THE INTERNET: EMPOWERING PEOPLE WITH DIABETES

Johny Kannampilly, Ivana Pavlić-Renar, Željko Metelko

SUMMARY

The management of diabetes is becoming a crucial issue as the prevalence of diabetes is high and increasing, and its impact on health care expenditure in many countries is substantial. Innovative communication technologies like Internet have great potential for providing the needed support and services for patients with diabetes. Internet helps in access to expert information which has proven to be one of the most essential tools in the management of diabetes and its complications, particularly in enabling empowerment. The website www.diabetescliniconline.com empowers doctors and patients anywhere in the world to interact with each other through the Internet and helps patients consult their doctors for blood sugar management in the periods between their regular visits. Internet can help both in managing patients and measuring quality of care, and will also result in providing the highest quality care at the lowest cost for treating diabetes.

INTRODUCTION – ‘THE ROAD AHEAD’

In the era of supersonic air travel, satellite communications and Internet’s information superhighways, distance between countries and peoples has become relative. On the threshold of the third millennium, the world has shrunk into a global village, where all people are virtual neighbors.

In the last 7 years, the Internet has expanded into more than 30 percent of homes in the United States, a feat the telephone took 40 years to accomplish. Web fever has become a pandemic. Having spread explosively through the business world, it has now infected the health care industry, particularly over the past two years. The fever is transforming interactions among all of health care’s players, hospitals and insurers, physicians and patients, suppliers, pharmacies, and laboratories. Patients are sending e-mail to physicians and expecting responses, customers are purchasing health insurance online directly from the payer, physicians are demanding better electronic access to hospital data through Web-enabled connections, physicians and consumers are ordering prescription drugs online. Using the Internet and telemedicine video equipment to coordinate medical and health care will be commonplace in the near future. Already, physicians can assist and perform surgery in remote sites via robotics and review radiological films and pathology slides (1).

The management of diabetes is becoming a crucial issue as the prevalence of diabetes is high and increasing, and its impact on health care expenditure in many countries is substantial. Innovative communication technologies should now be included as new partners in the health care system.

Nowadays, the Internet and diabetology are no longer two separate concepts. Their mutual penetration and mutual influence are growing. So, what does the Inter-
net give to diabetology? Indeed, how can the new telecommunication technology contribute to the management of diabetes?

Only the Internet allows us to set up an independent global diabetological service, which can serve an unlimited number of people anywhere in the world with a medical consultation center. The only thing users would need is a computer and access to the Internet. This kind of service does not require large investments, does not imply high fees, and can easily be enriched with new information which immediately becomes available to the target group of users in any location. Internet-based health programs may improve compliance with treatment. Decision systems are available on the Net to help patients monitoring their diet and insulin doses. The use of electronic medical record shared on Internet may help both physicians and patients monitor on the longterm the effect of interventions. These technologies can help both in managing patients and measuring quality of care, and will also result in providing the highest quality care at the lowest cost for treating diabetes. This article is an overview of the possibilities that Internet can provide in the field of diabetes towards better care in a cost effective way.

THE INTERNET – AN ‘INFORMATION HIGHWAY’

What is the Internet?

The Internet is the linking of thousands of computer networks around the world. A computer network is a group of computers linked together so they can share data. When many computers linked on a wide area network allow quick access to many resources such as databases or electronic mail (E-mail), and programs, the network can be considered a “highway” of information (2,3).

History of the Internet

The Internet was originally created in the 1970s as a military network. Quickly, universities and companies involved with defense-related research were given access. In the late 1980s, the Internet became a de facto global network for most universities and many businesses around the world (4). Then arose the need for better graphics on the Internet which had been largely a text only system. The graphics capabilities implemented were called HTML and the transmission mechanism was called World Wide Web, or Web for short. The World Wide Web representing the latest in Internet technology, the Web blends the best of the textual information with graphic capabilities (5). In 1993, when commercial providers were first permitted to sell Internet connections to individuals, usage of the network exploded. Millions of new users came on-line within months, and a new era of computer communications began (3,4).

How it works and how to get started

The connection of a computer to the Internet can be through Dial Up Phone Lines, Fiber Optics, ISDN or Satellite Links (Fig. 1). Internet Service Provider (ISP) is a company through which the Internet is accessed. Data are sent from a computer in the form of a “package” and contain both a return and destination address. A special device called Router reads the destination address on the packages being sent by the computer and then forwards the package to the appropriate destination.

Computer A and Computer B which are at a nearly 3000-mile distance are connected using the Internet (Fig. 2). In effect, the link between Computer A and Computer B can take many paths. It can travel hundreds or even thousands of miles in order to reach the other computer (2).

Thus, by linking of computers around the world, Internet becomes a network of resources with international linking of tens of thousands of businesses, universities, and research organizations with millions of
individual users. The Internet provides users with an enormous amount of information on a wide variety of topics. In addition, the Internet provides the means to allow communications among computers and share computer programs, databases, manuscripts, and spreadsheets across the world (3).

**DIABETES AND ITS BURDEN – ‘CALL FOR INTERNATIONAL STRATEGY PLAN’**

Diabetes mellitus is described as a metabolic disorder of multiple etiology characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both (6).

The effects of diabetes mellitus include longterm damage, dysfunction and failure of various organs. Diabetes mellitus may present with characteristic symptoms such as thirst, polyuria, blurring of vision, and weight loss. In its most severe forms, ketoacidosis or a non-ketotic hyperosmolar state may develop and lead to stupor, coma and, in the absence of effective treatment, death. Often the symptoms are not severe or may be absent, and consequently hyperglycemia sufficient to cause pathological and functional changes may be present for a long time before the diagnosis is made. The longterm effects of diabetes mellitus include progressive development of the specific complications of retinopathy with potential blindness, nephropathy that may lead to renal failure, and/or neuropathy with the risk of foot ulcers, amputation, charcot joints, and features of autonomic dysfunction, including sexual dysfunction. People with diabetes are at an increased risk of cardiovascular, peripheral vascular and cerebrovascular diseases (6).

Several pathogenetic processes are involved in the development of diabetes. These include processes which destroy beta cells of the pancreas with consequential insulin deficiency, and others that result in resistance to insulin action. The abnormalities of carbohydrate, fat and protein metabolism are due to deficient action of insulin on target tissues resulting from insensitivity or lack of insulin (6).

**Epidemic**

Diabetes is a chronic disease that affects 30 million people worldwide and is the seventh leading cause of death in the United States (8,9). The prevalence of diabetes in adults worldwide was estimated to be 4.0% in 1995 and has been anticipated to rise to 5.4% by the year 2025. It is higher in developed than in developing countries. The number of adults with diabetes in the world will rise from 135 million in 1995 to 300 million in the year 2025. The major part of this numerical increase will occur in developing countries. There will be a 42% increase, from 51 to 72 million, in the developed countries, and a 170% increase, from 84 to 228 million, in the developing countries. Thus, by the year 2025, >75% of people with diabetes will reside in developing countries, as compared with 62% in 1995. The countries with the largest number of people with diabetes are, and will be in the year 2025, India, China, and the U.S. In developing countries, the majority of people with diabetes are in the age range of 45-64 years. In the developed countries, the majority of people with diabetes are aged ≥65 years. This pattern will be accentuated by the year 2025. There are more women than men with diabetes, especially in developed countries. In the future, diabetes will be increasingly concentrated in urban areas. Worldwide surveillance of diabetes is a necessary first step towards its prevention and control, which is now recognized as an urgent priority (10).

**Economic burden**

The prevalence of diabetes is high and increasing, and its impact on health care expenditure in many countries is substantial. In the USA, diabetes has been reported to account for approximately five to six percent of the total health care expenditure. The total annual economic cost of diabetes in 1997 was estimated to be 98 billion USD. This includes 44 billion USD in direct medical and treatment costs and 54 billion USD for indirect costs attributed to disability and humanity and a significant intrusion in the life of an individual (11).

In 1998, the CODE-2 study (The Cost of Diabetes in Europe – Type 2) involving Sweden, UK, Germany, the Netherlands, Belgium, Italy, Spain and France, and totalling more than 7000 people, was carried out to provide a reliable picture of the cost of diabetes in Europe. It was found that more than 10 million people in the eight countries had type 2 diabetes. The total direct medical cost for these people was estimated at nearly 26 billion USD. The average annual cost per individual with type 2 diabetes was therefore just over 2514 USD (12).

**Complications create huge costs**

Individuals with diabetes are susceptible to a number of complications including retinopathy, nephropathy and neuropathy (microvascular), cardiovascular disease
such as angina and myocardial infarction, and cerebrovascular disease such as stroke (macrovascular). In the CODE-2 study, direct medical costs for individuals with no complications and individuals with different types of complications were calculated separately. Figure 3 shows how the presence of complications affects costs. An average CODE-2 person without any complications had an annual direct medical cost of just over 1368 USD. For individuals with micro- or macrovascular complications, the annual cost was more than twofold (12).

Figure 3. Reference: Henriksson F. Diabetes Voice, December 2000; Volume 45 (Number 4): 39.

Hospital admissions take biggest slice
Hospital inpatient care accounted for the greatest proportion of direct medical costs – 55 percent or just over 14 billion USD. Outpatient care accounted for the smallest proportion of direct medical costs with an average of 18 percent or nearly 5 billion USD. In total, drugs accounted for about 27 percent of direct medical costs, meaning just over 7 billion USD. However, antidiabetic drugs, including peroral antidiabetic drugs and insulin, accounted for less than a quarter of the total cost of drugs. The cost of drugs was instead dominated by cardiovascular and lipid-lowering agents (12) (Fig. 4).

Prevention of complications a key to cost reduction
The CODE-2 study has shown that diabetes type 2 is a serious and expensive condition accounting for around 6 percent of total health care expenditure in Europe. In general, people with diabetes have excess direct medical costs two to three times higher than the general population. The diabetes-related complications are the main cost-drivers, mainly due to high inpatient hospital costs. Even if it is hazardous to draw conclusions about the cost-effectiveness of interventions from an observational study like CODE-2, the key to good diabetes care seems to be to address the diabetes-related complications at an early stage. This would most certainly reduce costs in the long run and also improve the quality of life of the individuals with the condition (12).

Results from the United Kingdom Prospective Diabetes Study have shown that both intensive glycemic control and blood pressure control are cost effective (13). However, further research is needed about the cost effectiveness of interventions aiming at reducing the incidence of late complications. Since the prevalence of diabetes is increasing rapidly worldwide, primary prevention actions aiming at stopping or delaying the onset of diabetes is crucial. Such programs will probably be a good societal investment, both in financial and quality-of-life respects, and this is an area where further research is highly demanded (10).

SUCCESSFUL SELF-CARE AND INTENSIVE THERAPY – "THE BEST SIGN OF EMPOWERMENT"

Diabetes differs from the majority of other illnesses in one very important respect, as the outcome depends almost solely on the ability of those affected to take care of themselves. The traditional model in which the doctor prescribes particular medication applies to
diabetes only in part. All the other essential aspects of effective treatment (diet, exercise, etc.) are the responsibility of the person with diabetes (14).

The elevated cost of diabetes can be seen as the result of all previous failures of treatment. Treating diabetes complications is by far more expensive than taking preventive measures. Future cost cutting, therefore, can only be achieved by improving the level of care, especially in the field of self-management. People with diabetes must be given the means to do it, which can only be attained by cost effective methods (14).

People with diabetes need to know what effect eating, exercising and even stress have on their blood sugar. Everything they do, or do not do, affects their metabolic outcomes. Therefore, it is of utmost importance that people with diabetes understand their condition so that they are able to treat themselves properly. Health care professionals, no matter how knowledgeable in the field of diabetes, can only give advice to a limited extent. People with diabetes, after being properly informed, must then be in the position to continue to carry out those instructions through self-care. Therefore, they must know how to self-monitor. Internet is the best way to empower people with diabetes towards good self-care (14).

The key elements for empowerment are diabetes awareness, education and training, and the support of health care providers which are partly or totally lacking in many developing and even in developed countries. We still have a long way to go but the process has clearly started and will reach both people with diabetes and health care providers (14).

The factors that produced most satisfaction in the relationship between people with diabetes and health care providers were friendly, professional support and co-operation, continuous patient-doctor relationships, time for discussion and interest shown by the professionals in care as a whole (not only HbA1c and blood glucose monitoring). Supplementing online consultation to the traditional care is the way towards this direction. In self-care, the biggest problems faced were inappropriate glycemic control, lack of motivation both in healthy eating and in self-monitoring, overweight, and the general lack of knowledge and skills in diabetes care (14).

The barriers for real empowerment still lie in basic factors, even in developed countries. However, studies show that there is a strong willingness among both health care providers and people with diabetes to change the world of traditional diabetes care (14).

Prevention of complications: main aim in diabetes care

Diabetes complications threaten the very lives of people with diabetes, and their treatment accounts for the highest costs. Complications come about due to longterm inadequate control of blood glucose. These complications, however, can be prevented with proper control of diabetes, which is frequently called ‘intensive treatment’.

The proven effect of intensive treatment

As just mentioned, the major reason for the high cost of diabetes are its complications. Over 90 percent of the true excess costs of diabetes are due to the treatment of its complications, and just under one third of people with diabetes have them. In other words, the other 70 percent, who have not developed the complications, need only less than 10 percent of the excess costs of treatment of diabetes (15).

Figure 5. Reference: Kanqas T. Diabetes Voice, September 2001; Volume 46 (Special Edition) 25-7.

Comparison of average excess annual cost (USD) of people with diabetes, with and without complications (Finland 1997)

The results of well-known studies have indicated that intensive treatment reduces complications as well as excess costs. The Diabetes Control and Complications Trial (DCCT) showed a 27 to 76 percent reduction of complications in people with type 1 diabetes, and the United Kingdom Prospective Diabetes Study (UKPDS) showed a 25 percent reduction of diabetes-related microvascular complications among people with
type 2 diabetes – for which the Kumamoto Study showed a 64 to 77 percent reduction (13,16). All these studies have proven the cost-effectiveness of preventing complications (17). The costs of type 2 complications are on an average 24 times higher and in case of type 1 diabetes 12 times higher than that of their peers without complications (15) (Fig. 5).

Cost of equipping people with diabetes

When the cost of treatment for people with established diabetes complications is compared to the cost of prevention by intensive treatment, the self-care group has always been shown to be the most cost-effective one. In Finland, for example, the cost of self-care equipment (including blood-glucose strips) was recently found to be only 2.8 percent of the total incremental costs of diabetes care (15).

It can be speculated that there is a real possibility of saving up to some 40 percent of the present incremental costs of diabetes care. To achieve such a result, much future investment in diabetes education and newer ways to manage it will be needed. The visible results of such investment, however, would manifest only after a period of about five years (17).

The major worry concerning diabetes at the moment is the predicted explosion in its prevalence, especially of type 2 diabetes (18). This makes total prevention of diabetes on a global scale an unrealistic goal, indeed. It is, therefore, of utmost importance, at least in economic terms, to prevent the complications of diabetes by every possible means. Empowerment and self-care have been shown to be among the most effective approaches to achieve this aim.

THE INTERNET AND ITS USE IN DIABETES CARE – CHANGING THE WAY WE MANAGE DIABETES

The management of patients with diabetes is a long-standing challenge for health care organizations. Patients are required to adopt lifelong exercise, diet, and drug regimens to maintain optimal health. To avoid the complications of the disease, patients must be monitored constantly (19).

A key issue for patients, providers, and health care systems is how to deliver personalized behavioral support in ways that are affordable and can reach most patients. The Internet offers several advantages in this regard because it is available 24 hours a day, low cost, and capable of reaching thousands of patients. Because of the often asymptomatic nature of diabetes and the long period between sustained hyperglycemia and observable complications, appropriate diabetes care relies on a longterm program of secondary prevention. Yet routine monitoring and screening among patients with diabetes is less than optimal. The Internet has great potential for providing the needed support and services for patients with diabetes.

In managing diabetes, success is measured by positive change in prognostic indicators and outcomes. Below is a list of measurement criteria used in diabetes management (20-22):

- greater patient self-efficacy
- greater satisfaction with care, continuity, provider, quality of health outcome
- decreased HbA1c and blood glucose levels
- improved diet and body weight control
- lowered cholesterol
- improved quality of life
- decreased incidence of diabetic complications

Primarily, diabetes must be managed by the patient because it requires adherence to stringent dietary, physical, and medical regimens (20). Internet-based diabetes management systems have the potential of reducing the burden of disease both to the patient and the health care system. A recent study found that a high proportion of patients were willing to use Internet resources in the management of their disease (21). The driving forces behind the proliferation of technology for disease management are the patients’ demands to get real-time help, get real-time information, and keep in contact with their physician (19). Not surprisingly, several diabetes-specific sites have recently appeared, including diabetesclinic online, my Diabetes and LifeMasters (22).

The requirements of an Internet-based diabetes management solution are Information, Personalization, Communication, Monitoring, and Technology.

Information

The Internet has always served as a source of health information; 70 million of the 110 million American Internet users searched the Web for health information in the past year. Currently they can choose among 20,000 health care sites with 1,500 more coming online each month (23). A successful Internet-based diabetes management system should be a source of quality information for the patients who use it. The quality of information on the Internet is a source of great debate. The low barriers to publication on the Internet result in the presence of vast amounts of low-
quality and inaccurate information. This misinformation or information that is out of date has the potential of misleading and even harming patients. Consequently, independent agencies such as the Health on the Net Foundation were created to certify the contents of medical information on the Internet (24).

There are numerous benefits to accessing diabetes information on the Internet. It provides the latest scientific information and guidelines, allowing users to overcome geographic barriers. The information is relatively inexpensive and easy to find, and is available seven days a week, 24 hours a day. Imagine having millions of pages of diabetes information at your fingertips whenever you need it, at any time, day or night. This was only a dream less than 10 years ago, but today the Internet can deliver this in seconds. For example, searching the term ‘diabetes’ on the Google.com search engine results in 3,720,000 page links.

The number one benefit of having access to this information is that it enables people to take charge of their own health by helping them stay informed and learn more about the disease and ways to manage it. Some may question the importance of looking for information on diabetes if they regularly see their doctor. Taking responsibility for one’s own health is important. This does not, in any way, suggest that the Internet or any other information source be used as a substitute but rather as a complement to regular visits to a health care professional.

Communication between health professional and patient

Most efforts in health care technology focus on assisting the doctor in diagnosing and treating a disease. This approach tends to omit a key component of the health care cycle: the patient. The new trend in medicine favors the inclusion of the patient as an integral part of the healing process. A review of 22 studies by Stewart et al. indicated a positive effect of communication on actual patient health outcome such as pain, recovery from symptoms, anxiety, functional status, and physiologic measures of blood pressure and blood glucose (25).

An Internet-based diabetes management system must be a channel of communication between patients and their health care providers. Access to expert information has proven to be one of the most essential tools in the prevention of diabetes and its complications, particularly in enabling empowerment. The Internet is playing an increasingly important role in this process. It provides the basis for making information and electronic communication accessible to its users.

The communication system can follow 3 models: synchronous, asynchronous, and indirect. Synchronous communication allows the patient and health care provider to communicate directly by using teleconferencing or videoconferencing. Traditionally, these services were in the realm of telemedicine where specific technical equipment was installed to allow for the communication to happen (26). However, the advent of multimedia on the Internet has enabled the creation and maintenance to become an integral part of any Internet-based management systems. The implementation can be in the form of synchronous chat rooms or of newsgroups where users communicate asynchronously by posting their comments. Further, experts can moderate chat rooms.

Monitoring

Several parameters can be monitored; some examples are blood glucose, weight, blood pressure, diet, foot care, smoking, and nutrition (27-29). Health care professionals should be able to designate which parameters they want to monitor and specify the ranges for each patient. The health care professional should be able to indicate which course of action the system should take if the readings are outside the ranges (e.g., notification). Effective patient monitoring is not limited to the collection of health data, it also requires a multidisciplinary approach, proactive outreach, and feedback.

Multidisciplinary approach

The management of diabetes spans multiple medical specialties as evidenced by the use of multidisciplinary diabetes management teams. For example, an endocrinologist will manage medications and glucose levels, a dietitian will design an appropriate diet, and a psychologist will manage the mental aspect of dealing with diabetes. Internet-based diabetes management programs should be based on a multidisciplinary teamwork. This element consistently appears in successful chronic disease management systems (30). Patients should have the ability to interact with multiple specialists to manage each facet of their disease, and the Internet can provide a communication channel to enhance this interaction. Successful evaluation tools have been created to effectively measure diabetes management outcomes along multiple dimensions (medical, social, psychological,
etc.). Some examples of these tools are the Diabetes Quality of Life Measure (DQOL) developed for use in the Diabetes Control and Complications Trial (DCCT) and the SF-36 (16,31).

Proactive outreach

Proactive outreach and patient tracking are critical success factors for an Internet-based diabetes management system. Proactive outreach consists of notifications sent to patients to take their medication, visit the health care professional, or simply exercise once a day. The benefit of a proactive approach is well documented in the management of other chronic diseases such as chronic heart failure, where increased compliance and monitoring resulted in a decrease in the number of hospitalizations for cardiovascular diagnoses and hospital days were reduced from 0.6 to 0.2 (p=0.09) per patient per year (32). Proactive outreach also applies to health care professionals. Reminders to physicians of routine testing for patients can be implemented in an Internet-based diabetes management system. One study has determined that the use of diabetes management system increases the likelihood of physician ordering lipid-profile testing (19%) and retinal exams for their patients (33).

Feedback

The role of the patient has become central in the management of chronic disease; therefore, monitoring must integrate the patient (33). A crucial aspect of patient integration is feedback. Patients must have the ability to review their medical data at anytime. On-line graphic tools can allow patients to visualize their medical information in much the same way a physician would. Feedback also provides a valuable motivational tool that improves compliance and system usage, both of which are linked to an improved outcome in diabetes management (19,34).

Personalization

The management of any chronic disease must be personalized to the individuals, as they are ultimately responsible for its success. Consequently, an Internet-based diabetes management system must allow patients to tailor the intervention to their specific needs. Patients benefit from a proactive approach to their management and gain a valuable insight into the management options that may be available to them (35). Patient involvement and contribution to disease management has demonstrated improved results and compliance (36). Glasgow and Bull have identified the strengths and limitations of interactive technologies such as the Internet for Self-Management Action Steps (35). Nonetheless, a successful implementation of an Internet-based diabetes management system should provide the patient with the ability to navigate through each action step towards the creation of a personal action plan.

Personal health records on the Internet

Internet-based personal health records have the potential to profoundly influence the delivery of health care in the 21st century by changing the loci and ownership of the record from one that is distributed among the various health care providers the patient has seen in his lifetime, to one with a single source that is accessible from anywhere in the world and under the shared ownership and control of the patient and his provider. Internet-based personal health records (PHRs) include any Internet-accessible application that enables the patient to review, annotate, create or maintain a record of any aspect of his health condition, medication, medical problems, allergies, vaccination history, visit history or communications with his health care providers. As the field matures and gains more experience, these applications will improve significantly in the ease of use and functionality (37).

Language and ethnicity

Piette et al. demonstrated that an Automated Telephone Disease Management (ATDM) system produced positive results with an ethnically-diverse diabetic-patient population (38). Internet-based diabetes systems can reach different ethnicities by offering their services in multiple languages. In some groups where language may be a barrier to medical care, such systems may provide substantial benefits. Inevitably, this opens the discussion of Internet demographics splitting patients between haves and have-nots. This is particularly relevant for type II diabetes where some minority groups are disproportionately affected and have limited access to the Internet. However, the report from the National Telecommunications and Information Administration indicates a rapid change in Internet demographics that is reflective of the general population of the United States (39).

Conclusion

The Internet will undoubtedly change the way we deliver health care services. As the possibilities of the Internet are growing endlessly, more and more
information on diabetes is appearing in the World Wide Web. The Internet does not only empower the person with diabetes, but it can also be an invaluable tool for diabetes organizations. There simply is no easier way of serving so many people by any other method of communication. Industry, national and international research centers as well as national and international diabetes associations have their own websites. Within IDF itself, various member associations and regions have developed or are developing impressive websites, each in their own language and reflecting their particular messages.

The World Wide Web is already an incredible tool and a great resource for people with diabetes, despite its being around for less than a decade. It will continue to grow, offer new and exciting opportunities for people with diabetes to help them manage their disease. It is now time to perform appropriate trials to determine, besides other interventions, the precise role of innovative communication technologies in diabetes management (40).

DIABETES CLINIC ONLINE.COM – ‘A NEW AND BETTER WAY TO MANAGE DIABETES’

In the face of rising diabetes prevalence and cost burden, empowerment of people with diabetes and access to information are especially needed for the control of diabetes and its complications. To this end, the KAN & PILLY INFOWORLD, INDIA has created a new website offering up-to-date and quality-assured information for people with diabetes and health care professionals alike. This worldwide diabetes Internet service, www.diabetescliniconline.com, was initiated by a team of diabetologists and web programmers in August 2000 (41).

www.diabetescliniconline.com (DCO) is the first portal of the kind that empowers doctors and patients anywhere in the world to interact with each other through the Internet. DCO is a breakthrough site developed to provide the right medical care and information, so that diabetic patients can manage their disease and lead a better life in a cost-effective way. Studies have proved that good control of diabetes lowers the risk of complications. Tight control of blood glucose level is only possible with constant interaction between the patient and the physician. Frequent visits to the doctor pose a lot of inconvenience and one tends to put off the visits. Realizing the importance of the patient-doctor interaction, the site has developed a unique and convenient system wherein patients can consult their doctor online. It is not an attempt to provide an alternative to the present system of clinical practice but to supplement it. The portal helps the patients consult their doctor for blood sugar management in the periods between their regular visits. This portal is different from other health care websites since the patients are consulting with the doctor whom they know and visit regularly (41). How does it work? The basic machinery of the site works as follows. To start up the doctor has to register with his details which are secure and protected by the username and password. The patient has a choice to decide on his consultant. The patient has to register under the selected doctor, preferably his treating physician, since this facility is mainly intended for consultation between regular visits. The doctor has the option to offer his services either free or at a fixed annual fee. The patient can put his queries, test results, complaints and other particulars regarding his diabetes directly to the consultant through the link of pages (Doctor home page and Patient home page). The physician is also alerted of these queries through e-mail or even mobile phones immediately, and he responds at the earliest.

Test Alert, a novel feature, is a reminder which alerts the physician and the patient regarding the test (e.g., annual ophthalmologic evaluation, microalbuminuria, quarterly HbA1c, etc.) that are due. This will help in early detection and prevention of long-term diabetic complications.

Messages Board is a unique, user-friendly and effective tool that is available for the doctor to communicate and educate all or an individual patient.

Data Profile, a comparative analysis of patient data, is portrayed graphically from time to time and thus offers a potential prospect in evaluating the progress of the patient in all aspects. This is available at all times to the registered doctor and his patients. This site offers a unique combination of facilities towards better patient knowledge, motivation and physician involvement towards better control of diabetes and its complications in a very cost-effective way.

Clinic

Here diabetics can consult their doctors online within the comforts of their home or offices and reduce the frequency of personal visits to the doctor, for good control of blood sugar. Patients can send their blood sugar results through convenient mail formats to their
doctor for advice. Patients can stay in touch with their doctors even when they are either away on business or holiday. Facilitating frequent interactions with the doctor, the portal will help patients achieve good blood sugar control and thereby reduce the risk of long-term complications. DCO is based on the philosophy that constant patient-physician interaction is necessary for balancing the blood glucose level, and that tight control of blood sugar can to a great extent reduce the risk of complications. This online consultation facility of the site is a breakthrough phenomenon that will give a new dimension to diabetic care worldwide. Physicians from all over the world can register to enable their patients to consult online for recommendations and advice and manage their diabetes in a better way (41).

Education
At DCO we try to educate people about diabetes, the risk factors, diagnosis and treatment. The information on the site is understandable and easy to navigate, and it also offers information controlled by experts in a style that a non-expert can easily and readily understand. The site is not only aimed for the people with diabetes but also for their families, friends and those others involved in the prevention of complications. It provides information about topics relevant to everyday life, integrating them more into the individual’s diabetes management. ‘About Diabetes’ includes information about the signs and symptoms of diabetes, its complications, different kinds of insulin, type I and type II diabetes, guidelines for hypoglycemia and hyperglycemia, and other general diabetes information (41).

All information on the site has specific target groups. Some sections are for health care professionals, with restricted access to the public, as they contain information intended only for doctors and researchers. Other sections are publicly available and are targeted at people with diabetes and their families.

It is noted that the source of diabetes news provided on this site is from the American Diabetes Association and is updated weekly. The front page is updated with links and reviews of diabetological Internet sources regularly, which would be of interest to visitors (41). The website presents a trustworthy source of information and includes daily breaking news, regular newsletters sent to the users by e-mail, and a question-and-answer area serviced by diabetes experts. Weekly news and research updates help keep the visitors informed on events in the diabetes world. Links to other websites with diabetes information are also included.

Discussion and chat forums
The website also includes an online discussion forum for people with diabetes and other interested parties to interact. It has been seen that once having been part of a chat session, most visitors come back on a regular basis.

Facilities
The site is essentially a collection of dynamically updated news, consultative sections, links to other sites, a chat section, a list of medications and pharmacies, addresses of diabetologists, an online magazine containing various articles, an educational section called ‘About diabetes I’, a billboard, job offers and forums. In addition, the site has sections that are of interest to everybody – healthy lifestyles tips, jokes, diabetic recipes, resort information, etc.

Nutrition section includes pages about the FDA Food Guide Pyramid, reading the food guide label, carbohydrate counting, and recipes with full nutritional information. Links to other food-related websites are also included.

A diabetes appointment calendar, updated daily, provides information on talks, seminars, workshops, TV shows and regional events held by self-help groups, and an address list of contacts. In the future, the site managers plan to have almost everyday at fixed hours diabetologists and dietitians on duty at the site and will be available to immediately answer medical questions posed by people all around the world. An analysis of
Web pages from Diabetes clinic online.com

Home page

Doctor's home page

Patient's home page

Mail format for test results

Patient's data profile

Graphic presentation of blood sugar results
collected data have shown that at first, the most frequent visitors were family members of people with diabetes. Now the number of hits is about the same for family members and people with diabetes, which together account for over half of all visitors. There are about 1000 people visiting the site daily and the majority are from the USA and Europe. In terms of the frequency of visits, people with diabetes are on the first place, followed by doctors, then researchers and finally business people (41).

**E-charity**

To help the less fortunate members of our society, we have the e-charity section, through which contributions are collected and provides free medical aid to those individuals who cannot afford even the basic treatment. The mission is to serve the poor diabetic patients and take every effort to make their life better (41).

**Conclusion**

According to independent experts, it is one of the best diabetes websites. More than 1000 people a day come repeatedly to receive the needed help. Certainly a lot has been done but much more remains to be done. Some sections are still in the experimental stage. Moreover, science and innovation do not stand still. New methods and technologies have to be constantly created and applied. Study of web page presentation and user interaction with the site as to what information raises greater interest, and among which groups, are constantly done. Analysis of the site statistics enables to upgrade the existing sections, create new ones, modify the presentation of information, adjust the information orientation, and improve user service.

DCO also plans to conduct a large-scale trial to compare the quality of life and health care outcomes of matched cohorts, some supported through DCO and others supported through conventional health care services, to provide evidence that Internet care leads to a clear diminution of longterm complications and improved quality of life at a reduced cost for diabetic patients.

The process of development of such a structure as a global diabetological service is rather demanding and probably endless. The contents, structure and organization of DCO.com has become a model for providing information controlled by experts for people with diabetes. Thus, the main direction in the future will be developing a worldwide network of diabetes information, each with its own national emphasis. The experiences of the website may be drawn upon in creating defined strategies towards this goal. One of the roles, which can be transposed to this website, is to facilitate communication between diabetologists around the world. Another is to be a gate to various kinds of information, scientific research, industry news, etc. It is therefore DCO’s aim to develop a powerful tool involving all, be they people with diabetes, associations, physicians, caregivers, industry or scientific organizations. But it certainly implies time, human resources and support. Nonetheless, DCO is certainly working towards the most effective use of this wonderful tool that the Internet represents (41).

**COST-EFFECTIVENESS IN DIABETES CARE – “POSITIVE OUTCOMES, LOWER COSTS”**

Outcome management, care management, and disease management are the terms used to describe the protocol of services that will result in providing the highest quality care at the lowest cost for treating diabetes. The field of care management itself is based on the collection and analysis of data and the development of multidisciplinary interventions. The challenge here is in caring for the patient while trying to save money and provide treatment in the lowest cost setting. One of the keys to ensure compliance with treatment regimens lies in communicating with the patient and their family. Recent developments in information technology have enhanced the care management process, helping health care providers communicate with - and therefore better manage - patients with chronic illnesses like diabetes. Disease management and care management systems provide practices with many key value components, including cost-effective approaches to managing large populations, reliable outcome assessment and management tools, centralized data management and retrieval, and patient follow-up and management. Technology-driven disease management helps care managers provide low-cost, proactive health care by freeing them from the burden of manually monitoring patients under their care. The end result, cost reduction and improved patient outcomes, are the primary goals of practice management.

**Evidence for cost-effectiveness**

Very few studies to evaluate the cost-effectiveness of home telecare have been published. A UK report, Technologies for telecare in the home, concluded that,
for a typical Community Health National Health Service Trust, 15% of home visits could be replaced with telecare, saving 1.26 million GBP per annum in the first year, after accounting for establishment and operating costs (42). A retrospective review of home nursing visits in the UK similarly suggested that 14%-16% of these visits could be replaced by telecare services; a similar and very comprehensive study in the US concluded that 46% of all activities carried out by on-site nursing could reasonably be replaced by telenursing (43,44). The Royal Commission on Long Term Care has reported that it costs 454 GBP a week on an average for full-time residential care, and 250 GBP a week for private home care (52). Therefore, there is strong economic justification for transferring resources from residential to home-based care. There is also substantial evidence that health care outcomes and quality of life improve when health care services are home based (45,46). Studies of the cost-effectiveness of home telecare are most compelling for chronic conditions. In 1988, a trial of telephone cardiac surveillance of post-infarction patients found that cardiac death or arrest was decreased by 29% in the monitored group when compared with the control group (47). In addition, control subjects were 2.4 times more likely to be clinically depressed, and they returned to work less quickly. A US study of patients with chronic disease demonstrated savings of over 8000 USD per patient arising from a reduction of costs from 100 USD for conventional visits to 15-40 USD for telecare services (48). In another study on cardiac rehabilitation for congestive heart failure in the home, a 74% reduction in readmission heart rates was demonstrated at 90 days (49). In recent years, Internet-based home telemonitoring systems have become available (50). These sites leverage the Internet to record, measure, monitor, manage, and deliver health care. These information-technology solutions are creating a link between patient and caregiver that enables patients to supply a steady stream of valuable health information to caregivers. Diabetics can report their blood glucose readings, thus creating a history of their glucose control, which caregivers can use to evaluate the impact of a therapy (e.g., short-acting insulin) or the need of a different one (19). Conversely, caregivers have the ability to provide their patients with crucial information and feedback on the management of their disease. For example, patients can be notified about screening appointments for the complications of diabetes. Therefore, patients benefit from an improved control and understanding of the disease; the ability to self-monitor from home reduces the burden of the disease. These solutions have resulted in dramatic improvements in disease management as measured by hospitalizations, and in an overall reduction in costs (19,51). Furthermore, patients report higher levels of satisfaction and better control of their conditions (27).

THE CHANGING ROLES OF DOCTORS, PATIENTS AND FAMILIES – ‘A CHANGING PARADIGM’

Consumers and the community expect better service

As the Internet spreads its electronic web across the world, doctors ever more often encounter patients who have done their own research into the disease they have. This is often seen as a nuisance by doctors, who are accustomed to a position of unquestioned superiority in knowledge. Access to the enormous amount of information on the Internet is having a major effect on the practice of medicine. Health care professionals can access valuable databases such as PubMed or OMIM, and rapidly communicate with colleagues via email or request opinions through specialized bulletin boards (52-54). The whole concept of telemedicine is also beginning to influence practice by the rapid transfer of diagnostic images, electrocardiograms and even remote psychiatric counseling (55). However, what presents doctors with a unique challenge is dealing with the ready availability of these electronic resources to non-professionals. In the past, it was relatively difficult for patients to have access to current medical information from public libraries, and the information ‘volunteered’ by doctors was often sanitized for the patient’s perceived benefit. Many patients now have the ability to access detailed and accurate medical information on the Internet, which may be more up to date or more comprehensive than their attending doctor’s knowledge. This exposure of an apparent gap in the doctor’s knowledge may alarm both parties and, in view of the potential disruption to the doctor-patient relationships, a new approach of trust and teamwork is required.

Managing information

Doctors can pre-empt potential problems with this approach by warning patients of the variable quality and integrity of the information accessible on the Internet, and offer them appointments to discuss the material that might cause concern or encourage the individual to consider potentially harmful self-management (56).
Dealing with the Internet-literate patients and their families

**Do**
- Try to react in positive manner to information from the Internet
- Warn about the variability in the quality and reliability of material from the Internet
- Warn about your time constraints regarding information overload
- Develop a strategy for dealing with Internet information from patients (e.g., get the patient to e-mail a summary before visiting)
- Accept patient and family contributions as part of the management team
- Accept that they may have valid information that you have not come across

**Do not**
- Be dismissive or paternalistic
- Be derogatory of comments made by others on the Internet
- Refuse to accept Internet material
- Try to one-up your patients and their families regarding the information
- Break normal rules of patient confidentiality via the Internet

A major problem for both doctor and patient is being able to distinguish good information from bad. Many patients may access medical information that is totally irrelevant to their own clinical situation. Some of these problems have been addressed in general practice, with some good electronic guides (56,57). But in relation to rare or unusual clinical conditions, patients may have to search further and often come upon individual reports, frequently written as testimonials. There are also many websites that offer quackery, often for exploitative commercial reasons (58). Again, consumers are demanding access to information and responsive online in nearly all aspects of their lives. Provider organization must offer such services if they are to retain patients in the future. Consumer encounters with provider organizations are typically unpleasant from beginning to end. Most hospitals feature bureaucratic, hospital rather than customer centric operations for registration, scheduling, and patient-flow management. Few environments have ever been so ripe for improved customer service! Using the Internet enables hospitals to improve the patient experience in a myriad ways. Online registration and scheduling can minimize the time spent on telephone or waiting in queues at the hospital. Preadmission information and virtual tours can reduce patient anxiety and help them prepare for hospitalization. The availability of online follow-up information can improve the patients’ experience after discharge and increase their compliance with treatment recommendations.

The shift to outpatient care

As new technologies, changes in reimbursement structure, and cost pressures combine to drive the shift from inpatient to outpatient settings, new information management and communications challenges arise. The Internet is ideally suited to provide the kind of 'asynchronous' communication between patients, physicians, other clinicians, and administrators that will best support the outpatient encounter of the future. Online registration, scheduling, and follow-up communications will become highly valuable in the eyes of the consumer; and asynchronous communications will ease the burden of the physician-to-patient contact.

The physician – observer or participant?

Medical colleagues may feel threatened by patients who gather information on the Internet and they may attempt to discourage the process. This attitude has the potential to undermine the doctor-to-patient relationship and drive patients and their families to seek alternative help or self-manage their medical problems. Many people who surf the net use it to retrieve information pertaining to personal health care, and the reality is that individuals will aggressively seek more information to help them understand and cope with medical conditions diagnosed in them or their families, particularly when they have a rare condition (57). By accepting this new trend to patient education via the Internet, a pattern of cooperation and teamwork can be developed with mutual benefit.

Offices transformed

Despite the physicians’ resistance to change, dozens of public and private companies are feverishly pursuing the goal of transforming medical office practice using Internet technologies. Internet-based medical offices are more cost-efficient and will therefore save the health care system up to one quarter of the current trillion-dollar annual US health care expenditures.

The Net effect

This new powerful economic force that ‘healthnet’ companies hold promises to shake the foundations on which health care delivery is built and the effects are
just starting to be felt. For office based physicians, the result will be binary: those who either ignore or do not understand the changes and their implications may suffer quickly and tremendously; those who do will benefit and grow.

INTERNET AND PRIVACY – ‘THE LEGAL PERSPECTIVE’

Need for quality assurance

Currently, there is a plethora of information on the Internet concerning diabetes. The information offered is of a varying quality. Experts working in clinical and research fields of diabetes must, therefore, play a key role in the contribution, control and quality assurance.

Technology

The complex network of human and machine relations involved in managing diabetes via an Internet-based system has strong implications for the design of such a service.

Data security

One of the main concerns with any medical informatics solution are security and privacy of the data. The success of any Internet-based diabetes management system is reliant on the user’s trust that the user’s data are secure, private, and confidential. This is possible with the recent availability of strong cryptographic tools used for two main purposes: authentication and encryption (34).

Authentication

Identification of users is a crucial step in gaining access to the system. Users are granted access to data based on their security profile. For example, only the treating physician can modify a specific patient’s blood glucose ranges. Therefore, authentication is both the identification of the user (usually with a combination of username and password) and the enforcement of the security profile. Naturally, user identification is required for more advanced functions like personalization as mentioned earlier.

Encryption

All data transmitted between a patient and the system must be secure. Several encryption algorithms exist, with different strengths and speeds. Generally speaking, most Web servers can establish secure communication links using Netscape’s Secure Socket Layer (SSL), which is de facto the Internet standard. Any transmission of patient data should be encrypted at the highest level.

Privacy

One of the fundamental problems in the adoption of electronic information systems in health care is balancing valuable uses of information with the protection of individual privacy. New technologies make it unprecedentedly easy and inexpensive to create, retain, process, and retrieve sensitive data, while the Internet and other lesser network systems make its distribution virtually frictionless. The accessibility and availability of data have been multiplied, and are continuing to be multiplied, to a degree our society has only begun to explore.

For people working with the new health information technologies, these developments are exhilarating and their promised benefits enticing. For many others, perhaps a majority in society, they may be frightening. The prospect of unknown individuals having access to sensitive personal information for unforeseen purposes is and probably should be deeply disturbing. If we fail to give proper attention to privacy concerns in implementing systems and using information, we risk a social and political backlash that could retard or even prevent the use of valuable technologies for legitimate purposes.

Some of the solution to this problem lie in better-informed public debate, and some of the solution may come about naturally as more and more people use the new technologies and become comfortable with them. But another, major part of the solution is legal: we need, and are beginning to develop laws and policies that, if well crafted, will create appropriate protections while allowing for valuable uses.

Finally, consumers, i.e. patients, are also beginning to want access to their own health care information. This is a recent trend and one that may take some time to extend beyond a technologically sophisticated elite. Nonetheless, as the Internet becomes an ever richer source of both general health care diagnostic and treatment information and data pertaining to specific plans and providers, more and more consumers will come to expect online access to their own information too. While some providers may resist, a competitive response to consumer demand is likely to require that patients be allowed information access if they want it. While this is entirely legal, it will need to be handled with care if only in the interest of good patient relations.
CONCLUSION

The Internet will substantially change not only the way medicine is practised, but also the relationship between doctors, patients, and other users of health care information. The Internet is a wonderful help in diabetes management because there is so much information and support and so many services offered. The Internet and other health care computing technologies will challenge us to look to the future for new ways to create partnerships with our patients. Online skills and technological literacy will not replace more traditional approaches to patient care, but they most likely will change the model of how care is provided. Technology is an adjunct that will serve us well if it is incorporated as part of a multidimensional patient care environment. Above all, we will need to continue to foster good interpersonal relationships with patients to encourage ongoing dialogues about information obtained from all resources (59).

Over the next 10 years, the health care system will change to focus more on preventive medicine and health care in the home. For clinicians to become significant participants and leaders in these changes, they will need to become fully integrated in a communications network based on Web and Internet technologies. Widespread implementation, however, may not be limited by the availability of technology, which is becoming less costly and more effective every year, but rather by inertia and resistance to change within the health care system.

With advancing sophistication of technology, patients will increasingly be able to compare and choose doctors using the Internet and to access information that allows them to monitor and regulate the quality of their own care. Further, technologies will likely be developed to allow patients to increasingly manage their own care with the advent of customized software to adjust drug dosages and other treatments that may even write prescriptions for them. Thoughtful analysis and policy development will be critical for ensuring that the benefits are maximized and potential harm minimized (60). Large-scale trials to compare quality of life and health care outcomes of matched cohorts, some supported through Internet and others supported through conventional health care services, are required to provide more evidence that internetcare leads to a clear diminution of longterm complications, improved quality of life at reduced cost for diabetic patients.

Internet is an incredible tool and a great resource for people with diabetes. It will continue to grow and offer new and exciting opportunities as more and more people use and realize its potential to manage their diabetes in a better and cost-effective way.

USEFUL DIABETIC WEBSITES – ‘TOWARDS BETTER DIABETES CARE’

1. The International Diabetes Federation is an umbrella organisation of 164 member associations in 130 countries headquarters in Brussels, Belgium. The URL is http://www.idf.org/

2. The American Diabetes Association (ADA) is far and away the leading organisation concerned with diabetes and its huge Web site reflects that position. Its URL is http://www.diabetes.org/

3. Vuk Vrhovac Institute WHO Collaborating Centre for Diabetes Zagreb, Croatia http://www.idb.hr/

4. The Web site of the "Joslin Diabetes Center" Joslin is an international leader in diabetes research, treatment, and patient and professional education established in 1898 in Boston, Massachusetts. The URL is http://www.joslin.org/

5. The web site of the Canadian Diabetes Association is one of the first sites that people with diabetes living in Canada should visit. Its URL is http://www.diabetes.ca/


7. The National Institute of Diabetes and Digestive and Kidney Disease of the National Institutes of Health (NIH) in Bethesda, Maryland, is the site for several important government documents on diabetes. Its documents include the Diabetes Control and Complications Trial (DCCT), the NIDDK’s landmark clinical study carried out between 1983 to 1993. The URL is http://www.niddk.nih.gov/health/diabetes/diabetes.htm
8. The Juvenile Diabetes Research Foundation International is a not-for-profit, voluntary health agency whose mission is to support and fund research to find a cure for diabetes and its complications. Web site at http://www.jdrf.org/


10. The European Association for the Study of Diabetes (EASD)* in Düsseldorf, Germany. Its official journal is Diabetologia. This site includes information about the annual meetings of the EASD. The URL is http://www.easd.org/

11. The "International Society for Paediatric and Adolescent Diabetes" is now on-line. The URL is http://www.ispad.org/

12. The National Diabetes Education Initiative (NDEI) Web site for healthcare professionals is an online resource for medical education programs on type 2 diabetes and insulin resistance. The URL is http://www.ndei.org/

13. The Diabetic Retinopathy Foundation is a not-for-profit organisation that supports research and public awareness on one of the world's major causes of blindness-diabetic retinopathy. The URL is http://www.retinopathy.org/


15. Diabetes Voice is the quarterly bulletin of the International Diabetes Federation, which publishes separate editions in English, French, and Spanish. The URL is http://www.diabetesvoice.com/diabetesvoice/

16. World Diabetes, a newsletter of the World Health Organisation, is online at http://www.who.int/ncd/dia/dia_publications.htm

17. Diabetic Lifestyle Online Magazine is now free. It offers hundreds of recipes developed specifically for the website, travel articles, a section that reviews medical journals and brings diabetes research into focus for the layman, plus hundreds of other interesting and informative articles on how to manage diabetes and live well. The URL is http://www.diabetic-lifestyle.com/

18. The Diabetic Gourmet is an e-zine designed to provide information and resources for diabetic living, with exciting recipes, feature articles, and useful resources. Its motto is "Diabetic Dining for the Global Gourmet." The URL is http://gourmetconnection.com/czinc/diabetic/


20. The Diabetes Institute for Immunology and Transplantation at the University of Minnesota was founded in 1994 to develop and implement cures for diabetes through the disciplines of transplantation and immunology. The URL is http://www.diabetesinstitute.org

21. The International Diabetes Center in Minneapolis is part of the Institute for Research and Education HealthSystem Minnesota. The Center is a leader in the development, evaluation, and implementation of education and treatment models designed to improve the health and lives of people with diabetes. The URL is http://www.idcdiabetes.org/

22. The University of Texas Health Science Center at San Antonio Department of Orthopaedics/Podiatric Service has an extensive information about foot care. The URL is http://www.diabeticfoot.org/

23. The Beth Israel Deaconess Medical Center's Division of Vascular Surgery in Boston is a leading center for the treatment of the vascular complications of diabetes, especially for problems of the diabetic foot. The URL is http://www.bidmc.harvard.edu/surgery/vascular
24. The Texas Diabetes Institute in San Antonio focuses on type 2 diabetes. Unlike any facilities found elsewhere in the United States, the facility will allow for a continuum of care, including early prevention, patient education, routine treatment, research, and state-wide professional and physician training. The URL is http://www.texasdiabetesinstitute.com/

25. The Diabetes Information Site is on a crusade to increase awareness for the need to increase federal funding for diabetes research. The URL is http://www.diabetesinfo.cc/

26. TalkOnDiabetes.net is an informational resource site about diabetes from many aspects Basic diabetes information, such as symptoms, treatments and warnings are located on the diabetes page. The URL is http://www.talkondiabetes.net

27. This Web site is a newsletter designed for people with diabetes living in the Arab world. What makes this site different is that it discusses specific issues for Arabs who have diabetes, such as fasting Ramadan and performing Hajj. It is a result of the Yahoo! group, diabetes-in-egypt. The URL is http://www.diabetes-eg.com/

28. Novartis Pharma AG provides the diabetesandhealth.com Web site to help people with type 2 diabetes manage this disease. The URL is http://www.diabetesandhealth.com/indexpub.htm

29. Diabetes India is the two-month old Web site of the Indian Diabetes Task Force, which consists of about 300 practising doctors who specialise in diabetes. The URL is http://www.diabetesindia.com

30. The Dia Bear Club is a Web site for kids with diabetes in South Africa. The URL is http://www.diabear.co.za

31. Reality Check is about young adults living with diabetes. This Australian site is colorful and attractive. It has lots of great content too. The Stories section has great anecdotes from people with diabetes. The Forum has active discussions. The URL is http://www.realitycheck.org.au/Reality_Check.htm

32. FocusOnDiabetes.com is sponsored by MedicineNet.com. It has lots of articles about diabetes, although its section of articles on diabetes medications, for one, is strangely incomplete. The URL is http://www.focusondiabetes.com/Script/Main/hp.asp

33. Lifetoolz, a toolbox for your diabetes, is a new Australian Web site with up-to-date articles about diabetes and a range of tools to make recording blood glucose readings convenient, simple, and worthwhile. Customized sites for visitors from the U.S., the U.K., and from Australia can be reached from a choice of three URLs: http://www.lifetoolz.com, http://www.lifetoolz.co.uk/, and http://www.lifetoolz.com.au/

34. Diabetesonestop.com is a new British expert resource for those living and working with diabetes. The site contains a broad range of clinical and scientific articles relating to diabetes and associated conditions, both published and especially commissioned, as well as conference abstracts and reports. Other features include directories of useful services, a conference calendar and educational material for both healthcare professionals and people with diabetes. The URL is http://www.diabetesonestop.com/Diabetes/Diabetes_Front_Door

35. The GeneticHealth Diabetes site includes news with expert commentary and special features about diabetes with an emphasis on genetics. The URL is http://www.genetichealth.com/Diabetes_Home.shtml

36. The DiabeticDigest.com in Ft. Lauderdale, Florida, provides its content in English, Spanish, and Portuguese—and soon will add Japanese, Hindi, French, German and Mandarin, according to e-mail from Executive Vice President Howard Storfer. The URL is http://www.thediabeticdigest.com/

37. Teenage Diabetes is the latest Web site for teenagers with diabetes and their caregivers. The URL is http://www.teenagediabetes.co.uk/

38. DiabetesWATCH.com is a comprehensive and attractively presented diabetes resource. Sponsored by Aventis Pharmaceuticals, The URL is http://www.diabeteswatch.com/diabeteswatch/about/public.asp
39. IDEA 2000 is an international group of people with insulin dependent diabetes committed to leading healthy and adventurous lives and helping people with diabetes in need. The URL is http://www.idea2000.org/

40. Black and Brown Sugar.com in Pasadena, California, bills itself as "The Center for Free Diabetes Information Regarding African American, Latino and Other Minority Populations." Lenore T. Coleman, Pharm.D., CDE, is the site's Webmaster. The URL is http://www.blackandbrownsugar.com/

41. SugarBytes isn't a commercial site trying to sell you sugar-free foods. They call it "easy to digest diabetes information for Canadians" and so it is. The URL is http://www.sugarbytes.com/

42. Diabetes123 builds on Children with Diabetes, but broadens the focus to include everyone with diabetes. The URL is http://www.diabetes123.com/index_d123.htm

43. Diabetes in Control is dedicated to helping practitioners help their patients. The URL is http://www.diabetesincontrol.com

44. GoodBloodSugar.com includes monthly columns and forums for users to exchange news and views. The URL is http://www.goodbloodsugar.com/

45. AlternativeDiabetes provides credible, complete, and current information about alternative approaches to diabetes treatment, including herbal, dietary, nutritional, and other strategies. The site is remarkably even-handed. The URL is http://www.alternativediabetes.com/

46. The Diabetes Learning Center is specifically for the family members and friends of people with diabetes. There are special sections for Spouses, Boyfriends & Girlfriends, Others Like You, Parents. The URL is http://members.aol.com/dmmteam/

47. Discover Insulin Resistance has lots of information about the underlying cause of diabetes, obesity, and other major cardiovascular diseases. The URL is http://www.ir-web.com/index.html

48. Treating Diabetes with Good Nutrition starts with the basics about diabetes, proceeds to food management tools like food exchanges and carb counting, and goes on to food management skills, including cooking in and eating out. The URL is http://www.cyberdiet.com/modules/diabetes/outline.html

49. The Diabetic Gourmet Magazine is an attractive-looking Web site. But it is an e-zine rather than a magazine. The URL is http://diabeticgourmet.com/

50. DiabeticNet is beautifully designed, but is new and at this point has little original content, except on its discussion forums and chat rooms. The URL is http://www.diabeticnet.com/

51. Diabetes Home has some free stuff for people with diabetes. The URL is http://www.diabeteshome.com/

52. MyDiabetes Among many exciting features of the site is a "Daily Diary" to record diet, exercise, medications and blood glucose. The URL is http://www.mydiabetes.com/

53. The Diabetes Monitor includes the Diabetes Mentor section, which is a large collection of pages on diabetes for patients and their families. The URL is http://www.diabetesmonitor.com/

54. Children with Diabetes has many resources for children with Type I diabetes, their families, and other adults with Type I diabetes. Children with Diabetes is http://www.childrenwithdiabetes.com

55. The Banting Museum & Education Center in London, Ontario, Canada, is certainly an appropriate Web site to include here. The site is a must-see for anyone interested in diabetes. The graphics are like wandering through an excellent museum, and the explanations are first-rate. The URL is http://www.diabetes.ca/about_diabetes/banting/index.html
56. Diabetes Insight, contains useful information related to blood glucose meters, injection devices, lancets, books, news items and other information & products that are available in the UK to assist in the management of diabetes. In addition there is a wide range of software available for downloading data from blood glucose meters, providing information on diet and nutrition and an interactive educational program for simulating the effects of changes in the insulin regime of people who are insulin dependent. 

The URL of Diabetes Insight is http://www.diabetic.org.uk

57. The Discovery of Insulin On-line Resource Center is a magnificent Web site not to be missed by anyone with diabetes, whether on insulin or not. Bob Banting, a great-nephew of the principal discoverer, Sir Frederick Banting, is the Webmaster. The URL is http://www.discoveryofinsulin.com/

58. Hundreds of "Diabetic Recipes" are available online http://godzilla.eecs.berkeley.edu/recipes/diabetic/

59. Part of Joanne Larsen's Ask the Dietitian site is a full page of questions and answers about diabetes. You can also check out a Weight/Calorie Calculator. The URL is http://www.dietitian.com/diabetes.html

60. Insulin Dependent Diabetes Trust is a charity registered in the UK, with a branch in the United States. The URL is http://diabetes.pair.com/


62. Diabetic Recipes includes hundreds of them plus a subcategory of Chinese diabetic recipes. It is searchable and is indeed a part of SOAR, the Searchable Online Archive of Recipes at UC Berkeley. The URL is http://soar.berkeley.edu/recipes/diabetic/ Insulin Pumper's Homepage is connected to the Insulin Pumper's mailing list linked on the first page of this FAQ. The URL is http://www.insulin-pumpers.org/

63. The “Diabetes Health Economics Study Group” seeks to enhance communication about economic issues in diabetes care and establish collaborative efforts in the reporting and dissemination of diabetes economics research. The URL for the Diabetes Health EconoStudy Group is http://www.pitt.edu/~tjs/diabecon.html

64. "Mimi's Cyber Kitchen" is a great collection of food and other links for people with diabetes. The URL is http://www.cyber-kitchen.com/index/

65. Courage" is the diabetic superhero cybercomic. The URL is http://www.thehumanelement.com/courage/default.htm

66. The Amputation Prevention Global Resource Center, a collaborative effort between Boehringer Mannheim and Eli Lilly and Company, provides foot care tips so that people with diabetes can reduce their chances of having foot problems like sores, cuts, and bruises that may lead to amputation. The URL is http://www.diabetesresource.com/

67. A landmark study shows that the risk of complications of diabetes can be reduced dramatically. The UK Prospective Diabetes Study (UKPDS), the largest clinical study of diabetes ever attempted, has shown for the first time that the life-threatening complications of non-insulin dependent diabetes, often regarded as inevitable, can be reduced by more intensive management using existing treatments. The URL is http://www.dtu.ox.ac.uk/index.html?maindoc=/ukpds/
Suggested Reading

   URL www.mdcomputing.com


3. Journal of Medical Internet Research.
   URL www.jmir.org

REFERENCES


57. Johnson C. Psychiatrist says counseling via e-mail may be another use for the Internet. Can Med Assoc J 1996; 155: 1606-1607.


