Chapter-4

Information Technology Assistance in Diabetes & Alzheimer's disease

4.1 Information Technology need to Diabetes & Alzheimer’s

Bioinformatics resources available for biotechnologists aiming by use the wealth of genomic data available today. The genomic data along with associated proteomic and functional data are often distributed across multiple databases, requiring a time-consuming search by the user. The explosion of information seen in molecular biology has created a veritable maze, through which careful navigation is required for research and innovation in biotechnology. (Adak, S., Srivastava, B., et al, 2002) Computational tools and algorithms for in silico genome annotation and, in particular, the Bioinformatics resources available for in silico gene prediction. Gene prediction requires a combination of algorithms with different types of biological databases and the author intends to provide the biologist or biotechnology researcher an insight into the use of these methods. (Adak, S., et al, 2003) Advances in computer technologies and the birth of the internet are also part of this revolution in biology. Online databases have given scientists and researchers across the world access to unimaginable volumes of biologically relevant data. Bioinformatics, a truly multidisciplinary science, aims to use the benefits of computer technologies in understanding the biology of life itself. (Adak, S., Srivastava, B., et al, 2002).
4.1.1 Diabetes Mellitus

Diabetes mellitus has been on the rise across the world affecting over 150 million people. Over 20% of diabetics in the world are Indians. At present, 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. By the year 2025, greater than 75% of people with diabetes will reside in developing countries. The countries with the largest number of people with diabetes are, and will be in the year 2025, India, China and U.S (King, H et al, 1998). Diabetes mellitus is a group of metabolic diseases characterized by high blood sugar (glucose) levels, which result from defects in insulin secretion, or action, or both New recommendations for the classification and diagnosis of diabetes mellitus include the preferred use of the terms 'type 1' and 'type 2' instead of 'IDDM' and 'NIDDM' to designate the two major types of diabetes mellitus; simplification of the diagnostic criteria for diabetes mellitus to two abnormal fasting plasma determinations; and a lower cutoff for fasting plasma glucose (126 mg per dL [7 mmol per L] or higher) to confirm the diagnosis of diabetes mellitus (Mayfield, J., et al, 1998).

Prospective studies have shown that hyperinsulinemia and insulin resistance preceded the development of IGT. Impaired Glucose Intolerance (IGT) represents the forerunner of NIDDM. Substantial evidence support that insulin resistance is the
inherited defect that initiates the diabetic event. Because of the insulin resistance, the pancreas produces excess insulin. As the resistance progresses the muscle glucose uptake becomes impaired. But, the insulin produced is sufficient to maintain the hepatic glucose uptake in the normal range. At this stage the time taken to achieve normoglycemia after the meal is the only defect noticed. Eventually the hyperglycemia becomes fasting blood glucose to normal level. The development of fasting and postprandial hyperglycemia stimulates the beta cell further. The resultant hyperinsulinemia leads to the down regulation of the receptor number and the post receptor events. This exacerbates the insulin resistance further and chronic hyperglycemia results; which is toxic to the beta cells and is responsible for the acquired defect of impaired insulin secretion (Seshiah V et al, 1977). Patients with diabetes have a two to forwarded increased risk in coronary artery disease and the risk of stroke and peripheral vascular disease is also substantially increased (Kasiska BL et al 1993)

The management of patients with Insulin dependent diabetes mellitus requires regular insulin injections and the monitoring of the patients metabolic status. One way to achieve the goals demonstrated by diabetes control and complications trial (DCCT) as well as implementing the requirements of the St. Vincent declaration (WHO report) in relative clinical practice is likely to be through the use of information technology.

Advanced in scientific knowledge have provided the medical community with information and disease management strategies designed to prevent the costly
debilitating complications of diabetes. These strategies include behavioral and pharmaceutical methods for maintaining tight glycemic control, reducing hypertension, and reducing plasma lipids, which can prevent or complications of the disease (Carolyn Schwartz et al., 2006). Because patient behavioral regimens can have a salient impact on disease course in diabetes, a patient-centered approach is particularly important. Patient reported outcome measures can be important tools and facilitate collaborations between clinicians and patients, and can provide clinicians with tools to elucidate how diabetes and its treatment are affecting their patient lives and ability to take control of their disease. Accordingly, there is emerging evidence in diabetes (Carolyn Schwartz et al., 2006).

4.1.2 Alzheimer’s disease

Alzheimer’s disease (AD) was first discovered in 1907 by German neurologist Alois Alzheimer (St. Georges et al, 2000). Alzheimer’s disease becomes one of the major hurdles for further survival of elders thereby a many number of people may suffer from AD in the next few decades. Molecular genetics reached human genetics about 1976, when the first human genes were cloned (Shine J et al,1977) Transgenic methods, ‘knock-outs’ and ‘knock-ins’ began in about 1986, and in about 1996, database searching became a fruitful way to do genomic research (Bassett DE Jr, et al,1997) The term ‘genome’ refers to an organism's complete set of genes and chromosomes. The term ‘genomics’ describes the scientific discipline of mapping, sequencing, and analysing genomes (McKusick et al, 1997)
Alzheimer's disease (AD) becomes one of the major hurdles for further survival of elders thereby a many number of people may suffer from AD in the next few decades.

The fact that most diseases do not follow a simple inheritance patterns has led to a significant challenge in the genetic dissection of the complex traits of diseases such hypertension, Alzheimer's disease, schizophrenia and diabetes. AD afflicts its patients with a dementia that increases in malignance over time: the older an AD patient is, the worse the dementia is. Dementia is a result of the loss of neurons in the brain that assist in engagement of intellectual activities. The loss of neurons specifically affects the hippocampus, which is a central region for memory operation, and the cerebral cortex. The cerebral cortex is also involved in memory functions, but also works to accomplish reasoning and language functions. A big difference between a normal brain and a brain afflicted with AD is the presence of protein clusters inside and between neurons (Hanuman Thota, et al., 2007).

Computer-aided system for the diagnosis of Alzheimer's disease. The system consists of: (1) extraction of the portions from MRI data, (2) measurement of the volumes of the portions and then displaying them, and (3) user interface for a medical doctor (Kobashi, S., et al., 1997). Memory loss is the most common and well known symptom for Alzheimer's disease. Other symptoms include loss of cognitive abilities, judgment, thinking and disorientation to place and time. Identification loss, depression, confusion, anxiety, fear, frustration, paranoia are also symptoms for
Alzheimer’s disease. The above symptoms may have different effects on different people. Currently medicines that are available for Alzheimer’s disease slow down its progression or help control the symptoms such as anxiety or sleeplessness. However, there is no available cure for Alzheimer’s disease. While the curative approach is certainly crucial to combating the effects of AD, one avenue we might consider looking down is a focus on supplemental measures (Hanuman Thota, et al,1997). ComputerLink is a specialized computer network designed to support caregivers of persons with Alzheimer's disease. ComputerLink delivers information, communication, and decision support, accessed through home terminals (Brennan, P.F., et al,1992)

Innovative information technologies can help reduce health disparities (Tarlow, B.J., Mahoney, D.F., et al, 2005). The development of new technologies that could help AD patients cope with loss of mental function might be appropriate, given the nature of the ailment. Developments in information technology could be offer assistance to AD patients in way that could supplement the loss of biological function with mechanical functions. For example, a computer could be used to keep records of family members to help remind the patient about his or her past. While a desktop PC seems somewhat impractical for this, a computer small enough to fit into someone’s eyeglasses, coupled with voice and image recognition technology, could provide AD patients with the kinds of information they need to continue to function. This, along with drugs to at least slow the process, could provide a treatment that could restore a quality of life to the patient in a way that is currently unavailable (Hanuman Thota, et
The Everyday Technologies for Alzheimer's Care (ETAC) initiative was launched by the Alzheimer's Association and Intel Corporation in 2003 to identify and fund promising research in the use of technology—especially information and communication technologies (ICTs)—for monitoring, diagnosing, and treating Alzheimer's disease (AD). Agilent Technologies joined the initiative in 2005. In October 2006, representatives of the three partners, together with ETAC award grantees, met to review the most recent research, and discuss how current and developing technologies can address growing needs in Alzheimer's care. (Dishman, E., Carrillo, M.C., et al., 2007).

4.2 Internet Role in Disease care and Management

The Internet's information capabilities and benefits to commerce have been proven but these results have an uncertain relationship to healthcare, managed care and disease management (Regan, M., 2001). Web-based applications have the potential to support the ongoing care needs of patients with chronic disease. At the University of Washington, a diabetes care module was developed, and the feasibility of allowing patients with type 2 diabetes to comanage their disease from home was pilot tested (Goldberg, H.I., et al., 2003). It is hoped that the Internet will go far beyond simply providing medical information and become the link between doctors, insurers and hospitals. Disease management is ideally structured to deal with the myriad of issues concerning patients, doctors and payors. Implementation of an Internet strategy in a disease management setting could provide the answer to improved quality of care,

Information technology based support groups fit into a broader effort to develop interventions that make use of social support concepts (King Sa and Moregg D, 1998) Thus for much of the literature on information technology support groups has elaborated on the reasons for their growth, their structure, and their advantages and disadvantages (D.Z Olds and Kitzman H.1993, N.Weinberg et al., 1995). Some studies have provided content analysis of the actual exchanges that took place between members of online support groups (D.A Salem et al1997, Winfebery A, 1997) those descriptive studies showed that the supportive statements made in computer mediated interactions are similar to those between support group members in face-to-face interactions. Cohen et al proposed that social support affects health and morality through a number of mechanisms that include (a) improved health behaviors (b) decreased negative effect and (c) improved immune system functioning (Health Psychology, et al, 1988). Recently Kim et al, (2007) evaluated an intervention using the SMS by personal cellular phone and internet would improve the levels of plasma glucose of obese type 2 diabetes at 3, 6, 9, and 12 months.
4.3 Information technology-Alzheimer’s disease and Diabetes Mellitus

Alzheimer’s disease

Information technology role on Alzheimer’s disease has already begun. In 2003, Intel entered into a consortium with the Alzheimer’s association, granting $1 million in Information technology research to be directed towards AD patients. Technology such as sensor networks is being used to study the habits of Alzheimer’s disease patient behavior in hopes of finding ways to learn more about AD and to make it more livable. This is an example of how Information technology can work for AD patients. Scientist Hans Moravec has suggested that someday, entire human brains and the consciousnesses they hold will be able to be downloaded into a computer. This would certainly avoid the problem of neuronal deterioration, but it’s possible that by the time, we have the technology to move minds into machines, we will know enough about AD to make it a livable or curable illness.

The early stage of AD primarily causes memory problems. At this stage a person can live independently and only requires assistance in remembering certain tasks. Cognitive prosthetics are helpful in aiding a person to remember such tasks. A pager was used to help a person remember the tasks during the early stage of AD. The Pager was able to record 80 letter alphanumeric message and then display the message at scheduled time. The person was able to perform the tasks independently within a
week by using the pager. The functional memory of the person had improved after using the pager for six months.

The majority of people with AD usually fit into the category of mild to moderate disease progression. At this stage it is common for patients with AD to move-in with a caregiver. During these stages, persons with AD are prone to forgetting their way home or wandering in the streets. The use of technology for people with AD provides hope that they can live on their own for longer period. Global Positioning System (GPS) is the technology that may prove to be very helpful in these stages. GPS is a tracking device that can be used to identify the location of the patients. A patient can wear a GPS unit and a caregiver can be notified when the patient wanders out of the designated area. Currently GPS devices used to locate Alzheimer’s patients are being used with personal locater devices. During the moderate to late stages of AD, behavioral disturbances need for more care. At this stage, motes can be programmed to inform caregiver of all the conditions of the patient. Sensors could be placed in the person’s bed to monitor weight loss. A combination of sensors placed in chairs and infrared tags detected by cameras could inform the caregiver, if the AD patient has fallen down or is sitting in the chair. Information technology can be used to help the caregivers with the responsibilities of monitoring the AD patients as well as informing the caregivers about AD and answering their questions. For example, a telephone-based intervention has been used to provide help and support to caregivers. The Project is known as REACH (Resource for Enhancing Caregiver Health) used an interactive voice response (IVR) to provide
support and answers to caregivers. It is necessary for the caregiver to receive the support they need in order to perform their job easily. The World Wide Web can easily solve the problem by providing knowledge and support to the caregivers. They can get the validity of online information from the online service called Alzonline.net. (R. L. Glueckauf and J. S. Loomis et al., 2003) Healthcare providers and caregivers are responsible for constantly monitoring the patient’s condition. It is not possible for many caregivers to constantly monitor the patient’s health because of lack of medical knowledge or equipment. (K. C. Buckwalter, et al., 2002) An important part of caregiving consists of taking the patients to the physician, this can add further stress to the caregiver and affect the accuracy of physician’s judgment about the patient’s condition. A healthcare provider might have a better idea regarding a patient’s condition if they could monitor the patient in a natural setting. A telehealth system could be used in order for the healthcare provider to monitor the patients in their home setting. Telehealth technology can be useful for rural caregivers. They need not drive long distances. Telehealth application can be used to monitor patients at home and eliminate unnecessary travel. A number of telehealth applications have been used to monitor the patients. Information technology can play a very important role to improve the condition of the people with Alzheimer’s disease. It can provide a caregiver with information and support. On the other hand it can engage the patients in many different activities to reduce the caregivers stress. A combination of telemedicine, telecommunication projects and technologies for daily living can help us with the aging of our elders the medical conditions they will face.
Diabetes Mellitus

There is renewed interest in the application of information technology (IT) based techniques for improving the day-to-day care of patients with diabetes mellitus, especially since the Diabetes Control and Complications Trial (DCCT) has demonstrated that intensive insulin therapy (IIT) can delay the onset and slow the progression of diabetic complications. The use of IT to achieve these goals, might help patients and physicians in the clinical practice and can help to contain costs (Chiarelli, F, 1998). Excellent diabetes care and self-management depends heavily on the flow of timely, accurate information to patients and providers. Recent developments in information technology (IT) may, therefore, hold great promise (Jackson, C.L. et al, 2006) DCCT (Diabetes Control and Complications Trial) study showed that tight metabolic control of diabetes mellitus can delay the onset and/or reduce the frequency of vascular complications. Telemedicine, i.e. telecommunications and information technologies in health care, is a useful tool to achieve the DCCT goals. Our European Community (EC) sponsored Telematic management of Insulin-Dependent Diabetes Mellitus (T-IDDM) project implements a telemedicine service through on a careful analysis of current medical practice. The system is based on two components: Patient Unit (PU) and Medical Unit (MU) connected by a Telecommunication system (TS). PU allows data collection and transmission from the patient's house to the hospital, assists self-monitoring activity and suggests insulin variations. PU communicates patient's current metabolic state the MU. MU assists the physician in periodic evaluation and suggests the prescriptions to communicate back defining a treatment
protocol. TS system is based on telephone lines, relying on the Intranet technology (D'Annunzio, G, et al, 2003). In the last Diabetes Information Technology & WebWatch column (Diabetes Technol Ther 2004;6:422-429) various hurdles to the implementation of computerised decision-support tools in clinical diabetes care were highlighted (Lehmann, E.D., et al, 2004). Previous Diabetes Information Technology & Web Watch columns have addressed the use of diabetes simulators, and, in particular, aspects of the AIDA software. AIDA is a freeware computer program, which simulates the interaction of carbohydrates and insulin administered in people with insulin-dependent (type 1) diabetes mellitus. The program is intended to be used as an educational support tool, and is available via the Internet without charge from www.2aida.org. (Reed, K., Lehmann, E.D., et al, 2005) This popular non-commercial Internet site provides free access to a downloadable PC version of AIDA, as well as access to a Web-based version of the simulator that can be run online (Reed, K., Lehmann, E.D., et al, 2005). The application of IT techniques to assist in the diagnosis and characterization of patients with diabetes mellitus is considered. The role of IT approaches for short-term glycaemic control is discussed and the utilization of computers for collecting, viewing and interpreting home monitoring blood glucose data is reviewed; both quantitative and qualitative techniques being considered. In the second paper the role of decision support tools for planning insulin therapy using clinical algorithms, hand-held devices, knowledge-based approaches, telemedicine techniques and interactive simulations is reviewed, and the validation and clinical evaluation of these tools is discussed. The likely impact of the routine clinical
application of implantable/non-invasive blood glucose monitoring devices is also considered (Lehmann, E.D., Deutsch, T., et al, 1995)

4.4 Automated Alerts for Disease Management

It has been suggested that automated disease management for chronic disease, like diabetes mellitus (DM), improves the quality of care and reduces inappropriate utilization of diagnostic and therapeutic measures (Fox, M.A. et al, 2002). Use of well-designed and implemented technology in diabetes management can potentially improve outcomes, increase efficiency and access to care, and reduce system errors. Empowering increasingly sophisticated patients with technology-based diabetes self-management tools can enhance their involvement in disease management. The success of integrated delivery systems (IDSs) depends on their ability to develop collaborative relationships with affiliated physician practice. As a long-term strategy, integrated delivery systems (IDSs) should develop sophisticated information systems that help their physician practices to effectively manage wellness and disease across the continuum of care. These information systems eventually should include a broad range of features, including systemwide access to communications technologies, such as e-mail and groupware, computer-based alerts and reminders to support wellness management, immediate access to hospital data from physician offices, and automated care guidelines. To address the immediate needs of affiliated physicians, however, IDSs should attempt to optimize the functionality of their existing communications systems, such as fax links and manual processes (Kilbridge, P.M. et al, 1998).
As noted earlier, there is discordance between targets recommended by guidelines and those achieved in clinical practice. Using computer-based algorithms and clinician prompting at the point of patient care could help bridge the difference between what is known and what is done. Electronic medication order entry systems, with automated clinical risk screening and online alerting capabilities, appear as particularly promising enabling tools in such settings. The Medical Office of the Twenty First Century (MOXXI-III) research group is currently utilizing such a system that integrates identification of dosing errors, adverse drug interactions, drug-disease and allergy contraindications and potential toxicity or contraindications based on patient age (Taylor, L.K., et al, 2005). Hyuk-Sang Kwon et al (2004) developed a blood glucose management system using the Internet and short message service (SMS), which can lessen the social economic burden and materialize an individualized diabetes mellitus management. Recently Lee et al (2007) developed patient-orientated diabetic education management system, which help patients control their glucose, HbA1c and total cholesterol levels to manage their diabetes, providing an easy and inexpensive way to extend hospital-based patient education services for community-based continuous patient education.

The Internet-based Home Automated Telemanagement (HAT) system has been designed to support a multi-disciplinary approach in patient self-management which includes regular patient assessment, disease-specific education, control of patient compliance with treatment plans, implementation of health behavior change models and social support both for patients and caregivers (Finkelstein, J. et al, 2003).
Prompts can be separated into passive, active, and patient-specific prompts. Reminders can also be active and passive. For example, a passive prompt, such as a wall poster listing clinical targets, can be effective as long as the doctor looks at it periodically. Active reminders mean that the doctor has responded to the prompt; for example, after performing the foot exam, the doctor puts a check by the foot exam. Finally, the patient-specific prompt is a recommendation for a given patient; for example, “Today you need to perform this patient’s annual microalbuminuria screen.” Automated telephone disease management (ATDM) with telephone nurse follow-up as a strategy for improving diabetes treatment processes and outcomes in Department of Veterans Affairs (VA) clinics (Piette, J.D. et al., 2001) impact of automated telephone disease management (ATDM) calls with telephone nurse follow-up as a strategy for improving outcomes such as mental health, self-efficacy, satisfaction with care, and health-related quality of life (HRQL) among low-income patients with diabetes mellitus (Piette, J.D. et al., 2000). Patients used the ATDM calls to report information about their health and self-care and to access self-care education. The nurse used patients’ ATDM reports to allocate her time according to their needs (Piette, J.D. et al., 2000). This intervention had several positive effects on patient-centered outcomes of care but no measurable effects on anxiety (Piette, J.D. et al., 2000).

The use of diabetes guideline recommendations printed on the patient encounter forms was compared to usual clinical practice in a randomized manner in a family practice setting in the United States over a 6-month period (Lobach DF 1997). In a clinic-based trial of 2 years’ duration, patient-specific reminders regarding tests
and physical examinations were compared with usual care over 2 year's periods in the United Kingdom. Routine diabetic clinic visits and physician reviews increased assessments of HbA1c, but there were no significant differences in HbA1c levels in either group during the studies.

4.5 Electronic Medical Records

Implementation of electronic medical record systems promises significant advances in patient care, because such systems enhance readability, availability, and data quality. Structured data entry (SDE) applications can prompt for completeness, provide greater accuracy and better ordering for searching and retrieval, and permit validity checks for data quality monitoring, research, and especially decision support (Roukema, J., et al., 2006). Implementation of an electronic medical record system in primary care can result in a positive financial return on investment to the health care organization. The magnitude of the return is sensitive to several key factors. (Wang, S.J., et al, 2003)
4.5.1 The Evolution of Electronic Medical Records

Many institutions are developing integrated clinical workstations, which provide a single point of entry for access to patient-related, administrative, and research information. At the heart of the evolving clinical workstation lies the medical record in a new incarnation: electronic, accessible, confidential, secure, acceptable to clinicians and patients, and integrated with other, non-patient-specific information (Shortliffe, E.H., et al., 1999). With advances in technology and the wider acceptance of computerization in physicians' offices, electronic medical records (EMRs) are now coming of age (Giannulli, T., et al., 1999). Standard interfaces and hardware platforms, with software products designed to meet a standardized market need, will become more prevalent. Multifunction workstations, voice recognition, and
other technological advancements will simplify the data-entry process for clinicians. Legal statutes that support automated records will be established and accepted by the courts, and optical disk image processing systems will take off as the storage medium of choice for the next generation. Because the EMR can provide the benefits outlined here, the health care industry must work together to ensure the success of this vision (Miller, C., et al., 1993).

4.5.2 The Next Generation Case Sheet

The main purpose of clinical care and research is to discern patterns and modify treatment according to changing parameters, be they weight, blood pressure, plasma glucose or serum lipids. Records on paper can be scanned and browsed easily but the data may not be recorded in a uniform fashion, papers may be lost, misplaced or become complex. The relevant paper records cannot easily be sorted and they cannot be accessed across different locations (Lusk R et al., 1998). Electronic medical records have advantages over paper records, viz: complete and comprehensive flexibility in storage and retrieval of data, which can be used for publication, presentation and research. Computerized guidelines can provide evidence-based recommendations by allowing access to references, showing errors and sending reminders (F. Sullivan and J. C. Wyatt., et al, 2005). Besides, interactive telemedicine support is possible. Information laws of the country can be expected to consider EMR as a legal document. They may be electronically signed and must be permanent. An identifier must be attached to any further modifications.
EMRs allow the capture, organization, and analysis of health care services including examination and laboratory results. They can facilitate direct patient care services by providing continually up-to-date problem lists, medication lists, and easily retrievable, readable, and problem-specific progress notes. Moreover, EMRs have many advantages over paper medical records, including less expensive, more secure chart storage and retrieval, remote access to patient information, and the ability to rapidly find specific information items. All the processes start from patient entry to hospital and end with his exit as shown in the figure 4.2.

Both registries and EMRs can support population management quality improvement initiatives that have been demonstrated to enhance diabetes care.

---

Figure 4.2: flow chart of Electronic Medical Records
4.5.3 The Medical Record and Clinical Trials

The use of electronic medical records offers many advantages for carrying out clinical research. Most obviously, it helps to eliminate the manual tasks of extracting data from charts or filling out specialized datasheets. The data needed for a study can be derived directly from the electronic record, making research-data collection a byproduct of routine clinical record keeping. But other advantages accrue as well. For example, the electronic record can help to identify patients who are eligible for a study, and can ensure adherence to a complex protocol whose logic depends on currently available data about that patient (Shortliffe, E.H., et al, 1999). Access to medical knowledge and literature databases that provide diagnostic and therapeutic decision support. IT can be applied to the clinical management of diabetes, considering both clinical information management and decision support (Sönksen, P., Carson, E., et al, 2002). Diabetes information systems have already evolved rapidly in recent years along a developmental pathway initiated by the St Vincent Declaration, fuelled by the rapid pace of IT development in the 1990s and now endorsed by the emerging NHS information strategy. They will be central to the delivery of 'patient-centred' care and essential to supporting and monitoring the diabetes national service framework implementation (Young, R.J., et al, 2002). Diabetes information systems are likely to be at the forefront of diabetes care delivery in the future, providing patients and professionals with timely and accurate data for the organization and delivery of care (Young, R.J., et al, 2002). Better information systems are needed if clinical
research is to become integrated in everyday clinical practice, for the benefit of both patients and clinicians (Iain Chalmers., et al, 2007).

Telemedicine systems have been proposed as a means of supporting people with diabetes in the self-management of their condition. Requirements for monitoring parameters of care, including glycaemic control, extent of analysis and interpretation of data, patient-clinician contacts, and involvement of a multidisciplinary care team with effective communication, can be addressed by telemedicine systems (Farmer, A. et al, 2005). The junction of telemedicine home monitoring with multifaceted disease management programs seems nowadays a promising direction to combine the need for an intensive approach to deal with diabetes and the pressure to contain the costs of the interventions. Several projects in the European Union and the United States are implementing information technology-based services for diabetes management using a comprehensive approach (Bellazzi, R. et al, 2004). Providing patient-specific reminders at the time of clinical encounters has the potential to improve this situation. A necessary prerequisite for providing such reminders, however, is to have an efficient means of acquiring patient information that can be matched to an underlying knowledge base (Hunt, D.L. et al, 1998). A telemedicine system may incorporate features that make it a suitable technological backbone for implementing a disease management program. The availability of data analysis tools, automated messaging system, and summary indicators of the effectiveness of the health care program may help in defining efficient clinical interventions (Bellazzi, R. et al, 2004).
One of the key components of a systems approach is a clinical information system. This can range from a patient registry containing patient demographic, diagnosis, laboratory, and medication information to a full-featured electronic medical records system (EMR). Recently Samson W. Tu et al (2007) describes the development and innovative features of the Standards-Based Active Guideline Environment Guideline Model and reports their experience encoding four guidelines. Innovations include methods for integrating guideline-based decision support with clinical workflow and employment of enterprise order sets. Within diabetes care, the majority of health decisions are in the hands of the patient. Therefore, the concepts of disease management and self-care represent inescapable challenges for both patient and healthcare professionals, entailing a considerable amount of learning. Thus, a computerised diabetes disease management systems (CDDM) is to be seen not merely as tools for the medical treatment, but also as pedagogical tools to enhance patient competence (Boisen, E., et al, 2003).

4.5.4 Medical Records and Access: The Scope of the Problem

The identification and authentication of monitors, partition of patient's information, and controlling the access rights at source document verification (SDV) are not properly conducted in all hospitals. Also 35 replies were obtained from the sponsors, and they are generally favorable to EMR because EMR can improve the reliability of data (Ishiyama, K., et al, 2007). While paper records and copying machines have never been particularly secure, computerized records introduce new
risks and new opportunities for abuse. At every stage of the process of collection and 
storage, dangers can arise, including entry errors, improper access, exploitation, and 
unauthorized disclosure information such as genetic blueprints from blood samples, 
data on communicable diseases such as AIDS and tuberculosis, various test results, 
health policy research, specific diseases such as cancer, and more. Regulating access 
to electronic health records has become a major social and technical challenge. 
Unfortunately, existing access control models fail in translating accurately basic law 
principles related to the safeguard of personal information (Finance, B., Medjdoub, S., 

Regulating access to electronic health records has become a major social and 
technical challenge. Unfortunately, existing access control models fail in translating 
accurately basic law principles related to the safeguard of personal information 
(Finance, B., et al, 2005). Electronic records can be accessed in combination with other 
databases, and in diverse geographic locations. The rapid and sophisticated ways that 
data can be updated, changed, and configured with few restrictions on dissemination 
and use, combined with the difficulties of getting rid of data that is obsolete or 
inaccurate, make privacy concerns for medical information appear virtually 
intractable. It is no surprise that people are becoming ever more distrustful of 
computerized medical databases. Given the many efforts currently under way to 
develop standards for electronic medical records, it is important to step back and re-

There are additional concerns compounding the privacy problems associated with medical data. The fundamental contention is that the requirements for a medical record must be grounded in its use for patient care. The basic requirement is that it be a faithful record of what clinicians have heard, seen, thought, and done. The other requirements for a medical record, e.g., that it be attributable and permanent, follow naturally from this view (Rector, A.L., Nowlan, W.A., Kay, S., et al, 1991). First, technological advances allowing easy access to such data make it difficult to determine who is the "owner" of the computer record. Many find it obvious that the patient owns his or her genetic record and should continue to be named as owner. Others urge, however, that in an electronic world, especially when some data is compiled anonymously, privacy protection is needed from wherever the data may flow, namely the source, without designation of an owner with privacy rights. Recently issued "clarifications" of the regulations reveal that they do not prevent unconsented access to sensitive medical information by marketers, health plans, health care clearinghouses, and law enforcement. These problems with the regulations constitute a serious breach of patient privacy, endangering the doctor-patient relationship and potentially driving up health care costs, and need to be addressed (Sobel, R., et al, 2002). To avoid the errors and to achieve goals of EMR we need to include. Some of these features are: (1) availability across a computer network so that
providers can access the record in a variety of settings, (2) simplicity of the user interface to ensure provider compliance with the system, (3) an intelligent system to encourage completeness of documentation in the medical record, (4) a problem-oriented obstetric chart so that no issue is overlooked and each is adequately addressed, and (5) administrative features to allow evaluation to ensure improved quality of care (Bernstein, P.S., Merkatz, I.R., et al, 2007).

4.5.5 e-prescription

Errors and inefficiencies related to the fulfillment of prescription medications are causes of significant morbidity, mortality, and cost within the health-care system. But what is being done to replace handwritten prescriptions with safer e-prescriptions systems (Ridinger, M.H.T., et al, 2007) Although e-prescribing may not change the extent to which patients and physicians discuss medication issues, patients of e-prescribing providers more frequently report provider verification of medication lists (Lapane, K.L., et al, 2007 ). Electronic prescribing offers a number of advantages over conventional prescribing, including generation of active medication lists for all authorized personnel and make it easy to identify potential drug interactions. A number of systems offer wire-less access via PDA, tablet, or laptop computer, electronic prescribing can dramatically reduce the time it takes to authorize refills and can reduce Potential medication errors (Miller Sr 2003). The smart cards are implemented to be portable repositories carrying up-to-date personal medical records and insurance information, providing doctors instant data access crucial to the process of diagnosis.
and prescription (Yang, Y., et al, 2004). It can also be cost effective if E-prescribing technology solutions may provide opportunities for earlier and enhanced communication between geriatric patients and their clinicians; geriatric patients may require more education to appreciate the value of e-prescribing (Lapane, K.L., et al., 2007). Within the overall context of protection of health care information, privacy of prescription data needs special treatment. First, the involvement of diverse parties, especially nonmedical parties in the process of drug prescription complicates the protection of prescription data. Second, both patients and doctors have privacy stakes in prescription, and their privacy should be equally protected. Third, the following facts determine that prescription should not be processed in a truly anonymous manner: certain involved parties conduct useful research on the basis of aggregation of prescription data that are linkable with respect to either the patients or the doctors; prescription data has to be identifiable in some extreme circumstances, e.g., under the court order for inspection and assign liability (Yang, Y., et al, 2004) E-prescribing technology solutions may provide opportunities for earlier and enhanced communication between geriatric patients and their clinicians; geriatric patients may require more education to appreciate the value of e-prescribing (Lapane, K.L., et al, 2007).

4.6 Biological databases

Bioinformatics is one of most active fields in life science. In recent years, various bioinformatics databases have appeared. The size of the database has grown
explosively, and the structure of database has been more complex. Now most databases are severed through the internet (Li, W.-Z., et al., 1999). The increasing volume of biological data collected in recent years has prompted increasing demand for bioinformatics tools for genomic and proteomic data analysis [Kitano H, 2002]. Web based bioinformatic application platforms have become one of the popular tools for biological data analysis among the bioscience community. However, these application platforms utilize different stand-alone bioinformatic applications and they use different data sources in different formats. Integrating different programs into a functional application platform would require new software components to be written for data exchange between different applications, since they use different formats for input and output. The lack of standards for data conversion between these programs further complicates the construction of application platforms. This adds extra time and cost to the software development process of these application platforms.

Primary Databases

The growing demands for the sequence information during 1980s, a lot of primary database projects were taken up and resulted in the creation of nucleic acid and Protein sequence databases. Some of the important DNA sequence databases are Gene Bank (USA), EMBL (Europe) and DDBJ (Japan). These databases exchange data on regular basis to ensure consistency of data.

The early 1960s witnessed the development of the Protein Sequence database at the National Biomedical Research Foundation (NBRF). Currently this database is
split into four distinct sections designated as PIR1 thru PIR4. They differ in terms of the quality of data and the level of annotation. Some of the important protein sequence databases are MIPS, SWISS – PORT etc., The primary databases suffer from the problem of proliferation which gives rise to a variety of problems. These problems are alleviated by the development of Composite Protein sequence databases that provide sequence searching more effective. NRDGB is such a database that contains comprehensive and up-to-date information.

Secondary Databases

Secondary Databases contain the results of analysis of the sequences in the Primary databases. Secondary Databases contain pattern data. As an example SWISS – PORT has emerged as a popular primary source for a number of secondary databases like PROSITE, profiles, Pfam etc,. A Tertiary Database is derived from the information stored in secondary databases. In addition to these databases Composite Protein pattern databases, Structure classification databases are also available. A Bibliographic database is a database that is used for collecting published articles, abstracts and full research papers with links to individual records. Researchers and scientists extensively use PubMed and Agricola for their studies.

4.7 Role of Bioinformatics- Type 2 Diabetes & Alzheimer’s Disease

Diabetes mellitus is defined as a syndrome characterized by chronic hyperglycemia associated with disturbances of carbohydrate, fat and protein
metabolism due to absolute or relative deficiency in insulin secretion and/or action. The most common symptoms of diabetes mellitus are polydipsia, polyuria, polyphagia, weight loss etc. Complications of diabetes mellitus are acute complications and chronic complications. Acute complications mainly include Ketoacidosis and Ketoacidotic coma. Chronic complications are further divided into microvascular and macrovascular complications. Microvascular complications are retinopathy, neuropathy, and nephropathy. Macrovascular complications are coronary artery disease, diabetic cardiomyopathy & peripheral vascular disease (Seshiah V and Ganesan V.S. Handbook, et al, 1977). Microarray technology is well established as a research tool, and now it is increasingly being used in clinical and diagnostic settings. Gregory Vlacich et al (2007) describes the principles behind microarrays, and details the current and potential applications in the search for biomarkers for diabetes, endocrine tumors and hormonal modulators of tumors

Diabetes mellitus has been on the rise across the world affecting over 150 million people. Over 20% of diabetics in the world are Indians. At present, 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. By the year 2025, greater than 75% of people with diabetes will reside in developing countries. The countries with the largest number of people with diabetes are, and will be in the year 2025, India, China and U.S. [King H. et al].
Alzheimer's Disease (AD), a devastating neurodegenerative condition associated with impaired memory and cognitive function. AD is characterized by two pathological hallmarks: senile plaques that are composed mainly of aggregated fibrillar insoluble beta-amyloid (Ab), and neurofibrillary tangles that include hyperphosphorylated tau protein, a microtubule binding protein important for physiological functions such as axonal transport and cellular communication. At the cellular level, AD pathology is also associated with a state of neurite dystrophy characterized by fragmented neurites, neurite retreat and degeneration, postsynaptic protein loss and eventual neuronal death.

Bioinformatics is the emerging field that deals with the application of computers the collection, organization, analysis, manipulation, presentation and sharing of biological data. Bioinformatics, therefore, provides the necessary data as to the gene expression and formulates further biological questions proteomics and metabolimics try to address. All of the above fields are heavily dependent on the experimental methods and instrumentation for the high-throughput data collection and analysis necessary to accomplish the ambitious goals of the analysis on a cell wide basis. Experimental methods such as microarray technology, liquid chromatography tandem mass spectrometry, and nuclear magnetic resonance profiling of metabolites make it feasible to address the biological questions of the “bioinformatics” era.

Bioinformatics research is in the midst of a transformation that is being driven by the massive increase for information and the development of bioinformatic analysis technologies exploits its use diabetes research for development of biomarker and new
drug therapies. Recently we have reported the analysis of genes causing hypertension, cardiovascular and diabetic diseases using composition alignment method in which a new approach has been developed for analyzing DNA sequences in order to detect regions with similar nucleotide composition (Allam Appa Rao et al. 2006). Bhramaramba et al reported analysis of species affected by diabetes, which will be useful for protein folding studies (R.Bharamaramba et al., 2007). Bases on the serum butyrylcholinesterase levels (Allam Appa Rao et al., 2005) or brain derived neurotrophic factor (Allam Appa Rao et al., 2007(a)), based on the cholinesterase levels we may identify the diabetes associated alzheimer’s disease (Allam Appa Rao et al., 2007(b)), these enzymes are expected to be useful as biomarkers for type 2 diabetes.

The bioinformatic technologies will not replace the other approaches of quantitative genetic evaluations of populations but will complement and add to already existing approaches. Our review briefly describes existing joint transcriptome-proteome analyses using bioinformatic tools and proposes an integrated - bioinformatic approach or so-called systems biology or systems genetics approach (Chassman M., et al, 2005) for biomarkers identification in type 2 diabetes associated complications. Consider ways to incorporate data on genetics, genomics, proteomics, and metabolomics into the already existing approaches of selection of proteins, which are accepted to be useful as biomarkers. Finally, possible uses of bioinformatics or systems genomics approaches in quantitative genetic/genomic analysis are discussed. Information technology playing the crucial role for diabetes disease management, data
collection online electronic medical records and disease progression. The relational view of the active, constitutive role of information technologies developing now interferes with some core tenets of diabetes research and disease management.

Diabetes is a chronic disease that causes a great deal of morbidity and poor quality of life for millions. Equally the incidence of the disease on the increase in on many areas of developing world, particularly as life style patterns, including those of diet, change, at the same time, diabetes has over the last two developments according the spectrum of information technology. As this centenary dreams to a close this trend continues as evidenced by the publications in reputed journals, which exemplify the use of information science and technology in relation to diabetes, decision support and clinical management.
References


18. Iain Chalmers; Otolaryngology - Head and Neck Surgery Better information systems are needed to help patients and clinicians integrate clinical research within everyday clinical practice, Volume 137, Issue 4, Supplement 1, October 2007, Pages S69-S71


28. Hyuk-Sang Kwon, Jae-Hyoung Cho, Hee-Soo Kim, Jin-Hee Lee, Bok-Re Song, Jung-Ah Oh, Je-Ho Han, Hee-Seung Kim, Bong-Yun Cha, Kwang-Woo Lee, Development of web-based diabetic patient management system using
29. Lee T, Yu-Ting Yeh, Chien-Tsai Liu and Ping-Ling Chen


45. Clark Cm Jr, Snyder Jw, Meek Rl, Et Al; A Systematic Approach To Risk Stratification And Intervention Within A Managed Care Environment Improves Diabetes Outcomes And Patient Satisfaction. Diabetes Care 24:1079-1086, 01

46. Graham G, Nugent, L, Stroucse K, Information Everywhere; How The Her Transformed Care At Vha, J Ahima


66. Lapane, K.L., Dubé, C.E., Schneider, K.L., Quilliam, B.J., Misperceptions of patients vs providers regarding medication-related communication issues, American Journal of Managed Care 13 (11), pp. 613-618, 2007


