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The Development of Dental Informatics as a Major Research Tool in Oral Pathology

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Abstract

Background Dental informatics is a relatively new field that has great potential to support clinical care. Most dentists are not aware of what dental informatics is, what its goals are, what it achieves and how they can get involved in it.

Methods The authors conducted a literature review and several roundtable discussions with dental informatics experts to discuss previous issues surrounding dental informatics.

Results Dental informatics is the application of computer and information sciences to improve dental practice, research, education, and management. Many applications have been developed that support clinical care, education, and research. Dental informatics is beginning to show the characteristics of a specialty: basic literature, trained specialists, and educational programs.

Conclusions Dental informatics offers potential solutions to many long-standing problems in dentistry, but it also faces significant obstacles and challenges. Its maturity will depend as much on the efforts of people as on the collective efforts of the profession.

Keywords: *Dental informatics, oral pathology.*

Introduction

Bioinformatics is a combination of biology and information technology. This discipline includes many computational tools and methods used to manage, analyze, and process large sets of biological data [1]. According to Hawa A. Lim, bioinformatics is the new subject concerned with collecting and analyzing genetic data and disseminating it to the research

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community [2]. The ultimate goal of this field is to facilitate new biological insights as well as create a global perspective from which unifying principles in biology can be discerned. Over the past few decades, enormous amounts of information have been generated by advances in biomedical research. Bioinformatics is important because it enables us to manage this data, sift through the data looking for useful coding gene segments, and use this information to make clinical decisions and develop new drugs and treatments more easily [3]. Biomedical informatics includes knowledge of health sciences (medicine, dentistry, pharmacy, nursing, and allied health sciences) with computer science, management and decision sciences, and biostatistics engineering and information technology. This involves the integrated use of many methods and techniques from these sciences to solve problems relevant to health care delivery, health sciences, pharmaceutical research, education, and clinical/medical decision making.

The primary goal of bioinformatics is to increase understanding of biological processes. However, what distinguishes bioinformatics from other approaches is its focus on developing and applying computationally intensive techniques (such as pattern recognition, data mining, machine learning algorithms, and visualization) to achieve this goal. Major research efforts in this area include sequence alignment, gene finding, genome assembly, drug design, drug discovery, protein structure alignment, protein structure prediction, prediction of gene expression and protein-protein interactions, genome-wide association studies, and gene modeling. Evolution [5].

Dental informatics

Dental informatics is the application of computer and information sciences to improve dental practice, research, education, and management [6]. Dental informatics, a relatively new field, can provide significant support to clinical care. As it develops, dental informatics has the potential to become a core discipline with a literature base to support it, experienced professionals in the field, and educational programs to teach it to a wide audience.

Dental professionals collect, present, and analyze data differently than their medical counterparts. While the general medical and medication history compiled by both medical and dental professionals share many common elements, dental history and oral health status have no equivalent in medicine. Thus, the development, implementation, and evaluation of computer-based dental records present challenges and opportunities for dental informatics

Dental informatics combines dentistry with several disciplines, such as computer science and communications. There are limited areas of overlap between IT and dental informatics. For example, a dental informatics team might envision a computerized way to organize patient history archives and then seek the technical expertise of the IT team to assist with software development.

Since dentistry is an information-intensive specialty, almost every aspect benefits from the application of computer and information science. The widespread availability of computer networks today signals a major change—dentistry is no longer an isolated field of health care [7]. Dentistry is now, more than ever, connected to a larger system of stakeholders, regulations, expectations, accountability, and risk.

The main goal of dental informatics is to improve patient outcomes. A secondary goal is to make the delivery of dental care more efficient, for example, by maintaining or improving cost-benefit ratios [8]. Dental informatics has many applications in dentistry and dental health, including dental education, record keeping, and computer-aided design. / Computer-aided manufacturing (CAD/CAM), computer video imaging, digital radiography, teledentistry, and research.

Dental informatics in public health practice:

Technologies used to maintain public health practices can be classified under the heading of public health informatics. Developing effective public health information systems requires an understanding of public health informatics (PHI), the systematic application of information, computer science, and technology in public health practice, research, and learning [13]. Key areas of application can be in: (a) biostatistics, (b) Dental Education, and (c) Teledentistry.

A brief note on various Software programs used in public health practices.

Research and Biostatistics:

Public health practice always involves collecting data from a large population. This data should be collected on a periodic basis to assess the prevalence and incidence of various diseases in the population as well as to track trends. Various programs such as SPSS (Statistical Package for the Social Sciences) [14] SAS (Statistical Analysis System),15 Microsoft EXCEL and EPI-INFO,[15]. have made the analysis of such comprehensive data simple and easy to calculate.

Dental Education

Computers can be used to augment, enhance, or replace traditional teaching strategies to provide new ways of learning. They can support individualized, personalized learning, anytime, anywhere, at any speed. It can place the student in a simulated clinical case, or in a simulated examination, and exercises the student's knowledge and decision-making abilities in a non-threatening environment [16]. They can be individual and interactive, keeping the student entertained, engaged and interested. There are many approaches to using computers and technology in education, whether medical or dental; Such as practice and practice tests, computer-based educational lectures, simulations, etc. In dentistry, computer-assisted learning packages have been developed in several dental specialties such as oral pathology, dental anatomy, and trauma, for general teaching and as interactive programs to provide students with the ability to develop their critical thinking and decision-making skills [17].

Immersive simulation environments, with physical simulation of the patient, have evolved into sophisticated educational environments. In dentistry specifically; The use of simulation has been widely used, especially since dentistry is a very hands-on profession that requires students to learn how to perform procedures such as cavity preparations, restorations, root canal treatment, crown preparation and others, at the pre-operative stage. A clinical course on dolls before performing them on patients. It has previously been performed on dentinal teeth or extracted teeth placed in a jaw model on a simulated head dummy to mimic clinical situations. Faculty instructors will evaluate the steps of procedures performed on these teeth. Currently, the modules are being developed as virtual reality simulators[17,18].

These units consist of a simulated patient or doll with a head and teeth, a dental handpiece and light, an infrared camera, and two computers. The manikin's head and fist contain infrared emitters that allow the infrared camera to detect its orientation in space. When a student prepares a tooth in the manikin's head, the computer can create a virtual image of the tooth being prepared in the computer [17].

Teledentistry

The roots of teledentistry lie in telemedicine. Telemedicine has been practiced since the late 1950s, and a large amount of money has been spent on research and demonstrations. The term "teledentistry" was first used in 1997, when Cook defined it as "the practice of using videoconferencing technologies to diagnose and advise on treatment at a distance." Teledentistry can deliver advanced patient care at an affordable cost through healthcare providers, as well as alleviating the shortage of specialist dental consultants and professional

isolation in rural areas [20]. Teledentistry can be an important tool for long-distance distance education programs. An interactive videoconferencing system will be more effective than a web-based system due to its ability to provide immediate and adequate feedback. Teledentistry in dental education can provide primary care professionals with easy access to effective consultations and case-based continuing education opportunities [21].

Some barriers still exist to practicing teledentistry, including legal, educational, and insurance issues. Most importantly, an experienced teacher is required to design protocols, guide students, and provide the necessary technical support. However, with thorough planning, teledentistry has a bright future.

Tools to search the database for similar sequences.

Searching a sequence database for sequences similar to the query sequence is the most common type of database similarity search. The first rapid search method was FASTA, which found short common patterns in query and database sequences and combined them into an alignment. The Basic Local Alignment Search Tool (BLAST) is similar to FASTA but is gaining popularity due to its ability to search for rarer and more important sequences. The PAM250 scoring matrix is a scoring matrix based on an evolutionary model that predicts the type of amino acid changes over a long period of time. PSI-BLAST and PHI-BLAST are iterative search methods that improve the detection rate of BLAST and FASTA. Pfam and the Simple Modular Architecture Research Tool (SMART) are used for protein domain family analysis. Phylogenetic analysis using parsimony (PAUP) and phylogenetic inference package (PHYIP) are software packages available for phylogenetic analysis of molecular sequences. RasMol is the most popular software for displaying macromolecular structures.[22]

Conclusion

During the last quarter of the twentieth century, the advent and rapid development of microprocessor technology enabled advances in information and communications technologies (ICTs) that ushered in the Information Age, which expanded and transformed economic and social activities around the world [23]. The governments of many developed countries have These technologies are already being used in healthcare, including dental sectors. In India, the need for an appropriate oral health information management system arises due to the stark disparities in equity and access to oral health care between urban and rural areas; The increasing burden of oral diseases; Difficulty in accessing health services, especially in the northern and northeastern states; Worrying situations such as disasters, famine floods, earthquakes, disease epidemics, etc. In 1988, the All India Institute of Medical Sciences (AIIMS) developed an open source software called Health Management Information System (HMIS). It is a process in which information is recorded (input), stored, retrieved and processed to make a decision (output) [24].This software is used in aspects such as planning, organizing and controlling health care at national, state and institutional levels. To date, such programs have not been developed for the oral health care sector in Saudi Arabia. The WHO Global Oral Data Bank online portal emerged from collecting information from surveys on the increasing burden of disease especially in industrialized countries.

An oral health information system is important in evaluating public health initiatives and programs and for evaluating the achievement of health goals. Over the past two decades, great achievements have been made in the field of oral health in Saudi Arabia, but establishing a monitoring and surveillance database remains a challenge. Software used in clinical dentistry will improve the quality of life related to oral health.

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