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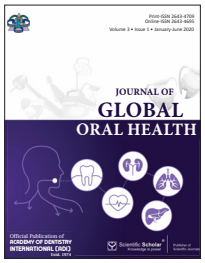

Review Article

Informatics in dental public health – A review

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ABSTRACT

In the recent times, when the world is taken over by the informatics and their usage in various fields, oral health is also much benefitted by this advancement. Public Health Dentistry has also been provided with its own share of the benefit. This specialty in dentistry deals with the communities, where the public health professionals need to be physically present there to collect the data, without which the analysis and interpretation cannot be commenced. Hence, for epidemiology and biostatistics to be established in a certain field of dentistry, the public health dentists, in the past, were required to visit from communities to communities, be it rural or urban. This not only consumed a major slot in their work schedule but also was very cumbersome. Hence, the development of informatics and its scope in public health has enabled the professionals in getting their work done not only efficiently but also effectively. This has also led to an increase in the pace with which they used to work and the quality of their outcomes. This article will review various modes of informatics being used in public health dentistry, their advantages, future prospects, and challenges faced by the specialist while utilizing it in their field and the scenario of informatics in India.

Keywords: Dental, Informatics, Public health

INTRODUCTION

The term, informatics, coined by the French in the 1960's as "Informatique" is the integration of information science, health science, and cognitive science.[1,2] It can be defined as an applied information science, which utilizes technology to design blueprints for organizing the complexities in the data systems to keep the privacy and confidentiality of the information intact in such a manner that it retains its usability and responsiveness to cater to the user's need. Toward the end of the 20th century, the developments in the field of microcircuitry and microprocessor have led to various phases of evolution in the zone of informatics and communication technology (ICT), which enabled the present-day world to gear up the usage of informatics for many important aspects, including health.[3] "Medical informatics" was coined in the mid-1970's.[2] Projects including e-health have been started by many countries to make the health care facilities reach the community in a jiffy. In the current scenario of the COVID-19 pandemic, informatics has been playing a crucial role in the health sector. Various national public health associations have been using this technology for upsurging their efforts in enabling the public to step closure to the integrated healthcare setup. Public health informatics takes the data pertaining to the population, into account. Its application includes multiple spheres of dental public health, such as surveillance, interception, alertness, and promotion of dental healthcare integrated with general health.[4] Among all these spheres, the prime space should be imparted to health promotion, the dental health being integrated with general health, wherein, along with health promotion, disease

prevention, and interception also should have a pivotal role to play. This can be achieved by altering the environment which poses as the key risk against diseases and injuries. These data are brought to the public by various agencies of territories and states, which, in turn, depend on informatics policies and principles.[1] To accomplish this provision, the system needs to be highly precise, punctual, and disciplined informatics service.[5]

Since the period that has witnessed the inception of the use of informatics in health-care system, electronic data reporting systems have played an immensely important role in the proper description of diseases and the prevention of their spread when the need was. This has led to improvement in health, and thereby, the quality of lives of the people and also in reduction of the stress that finance and diseases had on the community or the society in toto.[4] Now, available are various applications to meet the increasing demands for effective data collection techniques. For example, the Global Outbreak Alert and Response Network of the World Health Organization carries out daily surveillance using web-based information. Newer applications are in progress for carrying out data collection and surveillance. Mashups can serve as a tool for disease surveillance. HealthMap is also a recent advancement in this field, which provides an overview of the global status of the infectious disease threats worldwide and keeps the travelers alert and warns them before traveling to the concerned countries and cities.

USE OF BIG DATA IN HEALTH INFORMATICS

Big data is defined in many ways. One among them is "data approximating or exceeding a petabyte, that is, 10^{15} bytes." However, in healthcare, data of this size are rarely used. Hence, in this field of informatics, big data refers to data which can include a huge amount of information, that is, voluminous data. It is defined by 5 "V"s as Volume, Velocity, Variety, Veracity, and Value by Demchenko *et al*.[6] Volume refers to huge amounts of data. Velocity indicates the high speed with which a huge amount of data is generated. The complex feature of the data is referred to as the variety here. Veracity indicates the authenticity of the data. Value checks how superior the quality of the data is and whether it can be used to analyze the outcome which was intended to be. Health informatics data almost always qualify all these qualities. They have huge amounts of data collected from large patient records. New data get incorporated into the system at high speed. Many types of data in the form of independent and dependent variables from a varied number of sources are included. The complex nature of data makes detailed evaluation at many phases necessary. The high veracity of the data requires effective analysis. Hence, they can be termed as big data.[7]

DENTAL INFORMATICS AND ITS GOALS

The term "Dental informatics" was coined in 1986. It was first used in the publications indexed in MEDLINE. Funding in this field started in 1977.[2]

The goals of dental informatics are as follows:

1. Helping the health-care providers in the direction of improvement of patient outcomes
2. Ensuring proficient delivery of dental health care
3. Incorporation of evidence-based dentistry by the serving dental practitioners to arrive at the accurate diagnosis
4. Maintaining a continuity between researchers, practitioners, and dental care providers.[8]

INFORMATICS IN PUBLIC HEALTH PRACTICE

Public health practitioners need to have a crystal-clear knowledge regarding the details of informatics for being able to apply it in their field. Informatics has helped public health dentistry in a wide range of applications, such as biostatistics, health education for the community, geospatial information system (GIS), and teledentistry.[9,10]

Biostatistics is used by every public health dentist for recording their data and analyzing it and maintaining a track record of the diseases. The software used for carrying out these steps are Statistical Package for the Social Sciences, statistical analysis system, Microsoft EXCEL, EPI-INFO, and Epicollect. Epicollect is a recently developed software, which is being used by public health dentists for the collection and submitting the data which have been geotagged and, in turn, can be sent to a central website of the project for further steps. It is compatible with both Android and iPhone. It helps the public health dentists to analyze a large-scale data. The epidemiologists and ecologists have taken the advantage of the software in establishing a double-ended relationship between the workers in the field and their database in their laboratories. Epicollect,[11] which is a web application, located at www.spatialepidemiology.net uses both Google Maps (Or Google Earth) and Global positioning system for displaying and analyzing the data.[12] Yet, another application for recording oral health data is the mobile-assisted recording system.[13]

Informatics also has helped the sphere of health education in pacing with the present scenario. Not only has the dental health education been using application and software to educate people in clinical set-up but also in the field. These are being used for educating the patients about oral health improvisation and raising awareness among them for oral hygiene maintenance.

ORAPSHERE is a patient-educating software, which enables the dental professionals to educate the patients in community about the values of good oral health. It is a far-reaching collection of 3D, fully-described animations that carefully highlight and describe daily dental procedures, conditions,

and anatomy. It provides the professionals to coach the patients, which leads to increased case acceptance ratios and improved planning and organization. It even carries the advantage of being able to convince the patients to accept the policies of healthcare. It is also portable and can be carried from one to the other community set-up and can be easily stored in small storage slots. It also includes advanced applications for the patients' education.[14]

GIS is a framework for gathering, managing, and analyzing data. Dental services and access to it are often difficult in developing countries and especially in countries that are geographically complicated due to having difficult topography and landscape. The primary oral health disease (dental caries) in both developed and developing countries is a disease that follows the graph according to the socioeconomic status, that is, the poor class suffering more than the rich. Here, the glitch is that dental healthcare services are more easily made available to only the rich class. Hence, mapping and analysis of the distribution of dental services along with studying the population characteristics is more important.[15]

Combining science and geography, GIS integrates many types of data. It analyzes spatial location and organizes layers of information into visualizations using maps and 3D scenes. With this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations – helping users make smarter decisions. It also includes remote sensing and spatial remodeling of data.[3] All these data are viewed in one slot. GIS helps the public healthcare proceedings in all the spheres. It takes into account the data related to the demographics of the subjects, their social information, the geopositioned points of the subjects, and the healthcare institutions. It helps in creating and developing various maps related to health care. It can also create similar models of patterns of the spread of various diseases. Hence, it can be inferred that GIS provides an updated view of the data concerned.[16] It analyzes and highlights the shortcomings relating to the availability and access to health care in all geographic locations, taking their economic conditions into account.

Teledentistry combines effectively the fields of dentistry and telecommunication. It was developed in 1989 by the Westinghouse Electronics Systems Group in Baltimore.[17] It provides an effective way of communication between the remote areas and the dental professionals, leading to productive dental consultation and thereby treatment planning by the dental professionals.[18] Hence, it increases the ease of access of individuals to dental care. Its cost-effectiveness is an additional advantage to both, the public health professionals as well as the communities.[1] It aims at reducing the gap between the rural and urban communities and enabling the remotest corners of the world to easily access specialized healthcare. It has found its application in dentistry in two ways, self-instruction, and interactive video-conferencing. The self-instruction system is web-based and is stored in the system before the user uses it. It helps the users to learn the materials using their own time and can even access them several times.[19] The interactive video conferencing is carried out through plain old telephone service, satellite, integrated services digital network, Internet, or Intranet. It includes 2 systems – live interactive video conference and supportive information. The live video conference makes the use of a proper camera set-up, which transmits the information from the patients. The supportive information keeps the record of the patients' data, such as medical history and their radiographs. This information can be sent during the video conferencing or later. Here, an immediate feedback is received by the user.[19]

In India, the scope for telemedicine has progressed a considerable amount in making the healthcare facility available to the rural sections of the country. Since most of the people in India live in the rural communities, teledentistry can also help in achieving the demand-and-supply chain, even in these regions.[19]

CHALLENGES FACED BY THE PUBLIC HEALTH PROFESSIONALS IN APPLICATION OF INFORMATICS IN THE FIELD

1. To meet the financial need required for the development and establishment of the concept of e-health, and thereby the effective application of informatics in the field of dentistry, especially in the public health dentistry where the rural communities can be benefitted[1]
2. The requirement of trained and calibrated personnel, who would make the operation of the application effectively and carry out the oral hygiene maintenance in the rural communities.[1]

FUTURE PROSPECTIVE OF INFORMATICS IN DENTAL HEALTH CARE

Due to the continual advancements in the field of information and communication, the world is all set to experience an entire new set of changes in the healthcare too.[20] Hence, the difference between the demand and supply can be resolved effectively by undertaking few steps as follows:

1. The personnel employed for this operation should have sound knowledge in the field of computers and must be skilled in teaching[21]
2. A license is required in the respective states to enable smooth running of the application in each state[22]
3. Proper safety and confidentiality of the data has to be ensured by making the use of end-to-end encryption of data, protection of password, provision of proper logging in credentials of the users, etc.[23]
4. For the implementation of informatics in dental public health, there is dire need of a suitable surveillance
5. Applicable ICT education, training and support systems should be included in dental public health.

CONCLUSION

The public nowadays is using social media platforms and various applications that can be used as tools for supporting, in addition to the Public Health Information Network for disease surveillance. The fact that information technology keeps evolving, changing, and formatting itself and the thought of incorporating it into various prospects of healthcare has become an important requirement for the public health professionals. Patients, healthcare professionals, and dental public health personnel can all contribute to uplifting public health, including dental public health in the world of informatics by adapting themselves to new zone of informatics, the use of electronic methods for disease surveillance, and the remodeling of outdated methods.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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