# Dissertation Title

**"To Study the Basic Computer Awareness, Knowledge, Behavior, Attitude, towards Electronic Dental Records and current practices followed amongst Dentists"**

**A dissertation submitted in partial fulfillment of the requirements for the award of**

## Post-Graduate Diploma in Health and Hospital Management

**by**

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# ABSTRACT

Healthcare in India is in the middle of market transition. In terms of revenue & employment, it is one of the largest sectors. As per the Springboard Research, healthcare IT spending in India is expected to grow from $274.2 million in 2009 to $609.5 in 2013, growing at a Compounded Annual Growth Rate (CAGR) of 22 per cent from 2009-2013.

The advent of technology in Healthcare in India is making a tremendous impact on the current system of healthcare delivery. Recent advances in the field of information technology has improved the quality of the patient care and also reduced the related costs to a great extent. Though major focus has been laid on introduction of electronic records in the field of general medicine, dentistry has been not found to come out into the framework of electronic records.

Henceforth a study was carried out to analyze the introduction of technology in the field of dental records, an Electronic Dental Record is a specialized medical record created in an organization that delivers care, such as a hospital or a dental clinic. Electronic Dental Record (EDR) provides clinical charting for dentists and eliminates paper charts. The major function of a dental record is to document the patient's dental disease and treatment, which in turn ensures of better patient safety & care.

The study was aimed towards analyzing the knowledge, attitude and behaviour of the practicing dentists and interns towards use of electronic records in dentistry. The following results were obtained from the respondents; out of the 150 dentists, 81% of the survey populations were lying in the age group of 21-30 years. 67.3% never heard of the hospital or clinic management system. Despite of the availability of various software in the market, 88.3% dentists still today use the manual process for appointment scheduling & patient records. 64% of the dentists were not aware of the Electronic Medical Records or the Electronic Dental Records.

This study also shows that despite of having good attitude towards the use of IT applications, amongst the young dentists the knowledge of this group was inadequate & no practice was followed for the use of IT in Clinical Practice.

# ACKNOWLEDGEMENT

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# ABBREVIATIONS

**SOA:** Service Oriented Architecture

**WOA:** Web Oriented Architecture

**SODA:** Service Oriented Database Architecture

**ESB:** Enterprise Service Bus

**EHR:** Electronic Health Records

**MPI:** Master Patient Index

**CHR:** Clinical Health Record

**PHR:** Personal Health Record

**PMS:** Practice Management Software

**SRS:** Software Requirement Specifications

**ERD:** Entity Relationship Diagram

**GUI:** Graphical User Interface

**WBS:** Work Breakdown Structure

**CEO:** Chief Executive Officer

**CAGR:** Compounded Annual Growth Rate

**EDR:** Electronic Dental Record

**EPR:** Electronic Patient Record

**EMR:** Electronic Medical Record

**HIS:** Hospital Information System

**PACS:** Picture Archival & Communication Systems

**ICT:** Information & Communication Technology

**SPSS:** Statistical Package for Social Sciences

# PART – 1 INTERNSHIP REPORT

## Introduction to Organization

Fresco Informatics provides extensive range of enterprise computing solutions, consulting services and technology products for the ever-changing world of business. The goal is to exceed the expectations of every client by offering outstanding customer service, increased flexibility, and greater value, thus optimizing system functionality and improving operation efficiency.

Fresco Informatics associates are distinguished by their functional and technical expertise combined with their hands-on experience, thereby ensuring that the clients receive the most effective and professional service. Fresco Informatics brings in a fresh and innovative approach to software products and services. Software systems are agile and hence Requirements continue to evolve throughout the life of the software system. Need of the hour is an adaptive and collaborative approach to software development. Hence Fresco chooses to follow agile practices like scrum.

Fresco team experts in the Open source and closed source enterprise technologies and products build over Service Oriented Architecture (SOA), Web Oriented Architecture (WOA) and Service Oriented Database Architecture (SODA). The team has contributed significantly to various open source initiatives such as Project Mural, Open Enterprise Service Bus (ESB) and Glassfish Enterprise Service Bus (ESB).

Fresco Electronic Health Record (EHR) and Master Patient Index (MPI) a product suite empower and enables physician practices to provide effective and integrated care delivery. Fresco Informatics delivers the next generation of clinical care information systems solutions built upon best-of-breed and best-in-class healthcare software. The Fresco Informatics solution creates a foundation for heterogeneous communication amongst healthcare providers throughout the hospital as well as all caregivers within the Hospital Network.

The Internship Period was from 2$^{nd}$ January 2012 to 30$^{th}$ March 2012. During this Period, I worked as an intern in gathering & documenting the requirements for Fresco CHR Project.
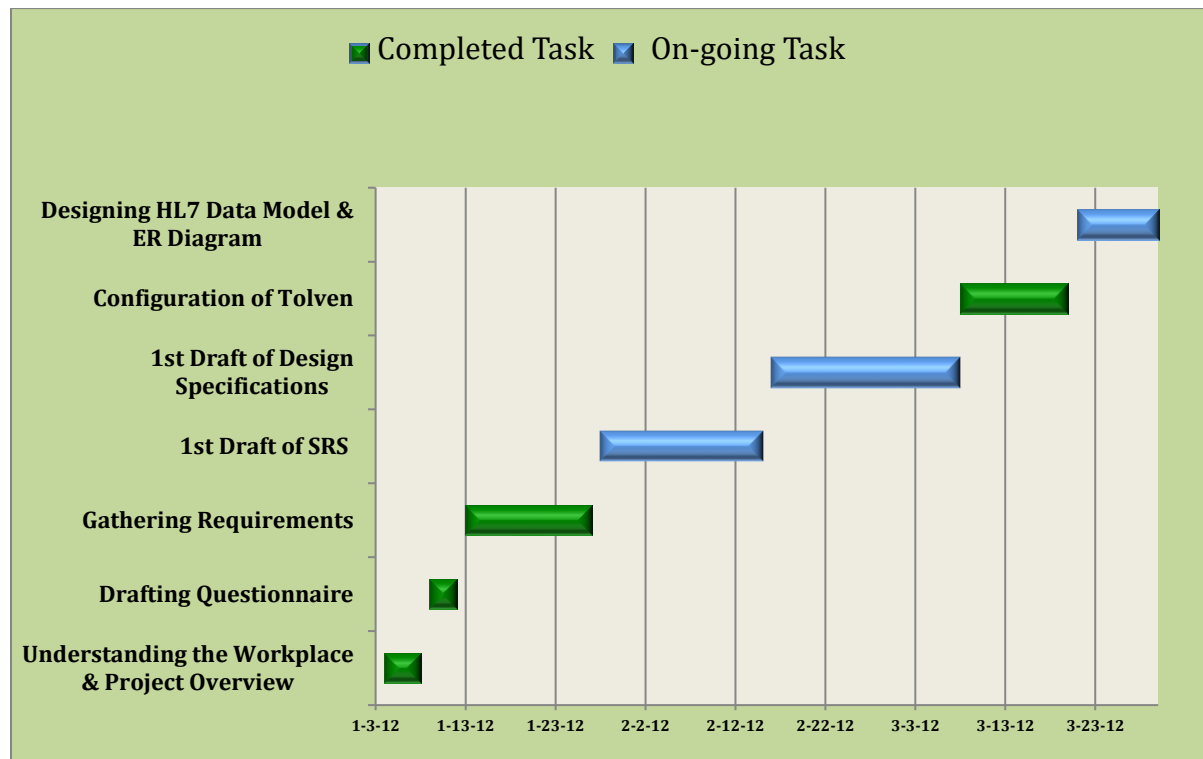


**Figure 1.** Gantt chart showing the tasks undertaken

## Fresco CHR Project Overview

Fresco Informatics delivers the next generation of clinical care information systems solutions in form of best-in-class healthcare software. The organization aims at providing a smart Practice management system apt for use at a Clinical Setup focusing on private practitioners who visit multiple clinics.

The Fresco Health practice management system comes with an Electronic Clinician Health Record, which enables authorized care professionals to capture information about their treatment plans and findings. Clinicians can securely share the information that they have collected about their patients with other care providers.

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The Fresco Informatics solution enables consumers to proactively ensure that their health providers have the latest information to guide them in their decision-making. The Fresco Personal Health Record (PHR) provides the consumer with an intuitive web-based application where the patient can update his health related information in few quick and easy steps.

The following are the modules & applications in the Fresco Clinical Health Record (CHR) Project: -

- Authentication Module
- Appointment & Patient Registration Application
- Preferences Module
- Dashboard Application
- Consultation Application
- Billing Application

During my Internship Period, I was involved in the requirements gathering part from the Internal as well as External Resources for the development of Fresco CHR. Initially for the first week, I read through various literatures provided by the organization for coming up with Ideas & understanding the functionality of the system. Demo Versions of various CHR & Practice Management System (PMS) available were studied & understood to get hold of the functionality of the system.

The various CHR reviewed: -

- Tolven CHR
- Vista EHR
- Practice Fusion
- Practo PMS
- EasyClinic Software
- Praxify

Once, the functionality & the objective of the project was understood, a structured questionnaire was drafted & requirements were gathered & validated from the private practitioners in Bangalore. A sample of 10 respondents were taken & validated with the requirements of the Internal Resources. Once the functional requirements were frozen for the first draft, Software Requirements Specification (SRS) was documented & sent for review to the Reporting Authority. A Collective SRS was drafted which was then broken into small modules & distributed amongst the Developing Team.

The format of the SRS Documented was as follows: -

- Introduction to the Organization & Product Profile
- Purpose of the Document
- Scope of the Document
- Major Stakeholders & their characteristics
- Product Features
- General Workflow of the Clinic
- Data Flow Diagram
- Functional Requirements
- Non-Functional Requirements
- Traceability Matrix
- System Architecture
- ER Diagram
- HL7 Data Structure/Data Model
- Use Cases & Use Case Description

First draft of SRS was completed by the end of first month, which is revised with small changes till date. After the SRS, System Design Specification with the data fields & characteristics were documented. Screens for the system were designed & the flow was presented in a PowerPoint presentation.

The tools used for all the documentation were: -

- MS Word
- MS PowerPoint
- MS Visio
- Lucidchart
- MockFlow

After the documentation, configuration of the existing CHR; that is Tolven was undertaken. This involved documentation of Implementation Specification for Indian Scenario. Various workflows involved according to the setup of the healthcare facility; that is; A Corporate Hospital, A Nursing Home & A Polyclinic were documented was implemented in the existing Tolven CHR. Theses workflows were designed on the basis of my work experience & past knowledge gathered from the summer training experience & the information gathered from certain doctors.  During this Period the developing team was also guided regarding the Graphical User Interface (GUI) & the design of the system for implementation of Tolven CHR.

## Managerial Task within the Organization

A project plan resource wise was made and is followed till date. The tool used for project management was Asana Project Management Tool. This tool helps to manage the entire project well with timeline. The project plan cycle consisted of the following stages: -

- Project Initiation
- Project Planning
- Project Execution
- Project Evaluation
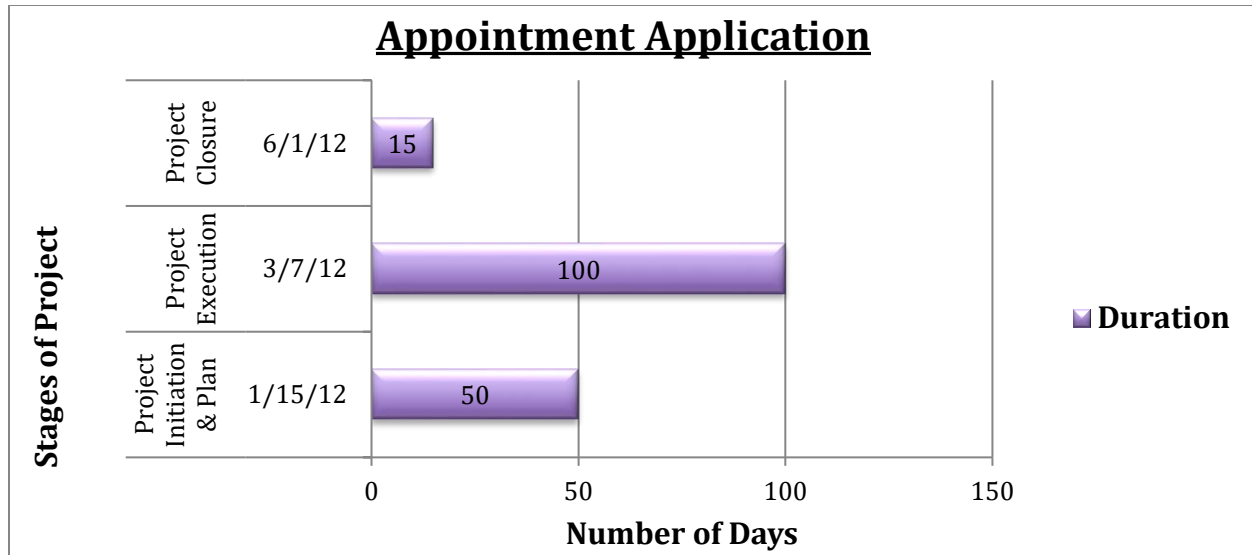
**Figure 2.** Start Date & Expected Number of days for completion of each phase

## Project Initiation

This stage started on 4th January 2012 and took 50 days almost to get completed. The following were the task done during this phase: -

- Identify and document the need/objectives that the project will address.
- Define the objective, approach and controls of the project.
- Ensure a clear and common understanding of the deliverables that will be produced.
- Specify what work needs to be completed in order to produce the deliverables.
- Determine the type of skills that will be needed to complete the project.
- Estimate how long it will take. (The work breakdown structure)
- Obtain appropriate management approval for effort.

## Project Planning

Once the project documentation was approved, effective project planning was critical to successful resourcing and execution of the project activities. This stage included development of the overall project structure, the activities and work plan/timeline that formed the basis of the project management process throughout the project lifecycle. This Process helped in setting out the procedures that will be used within the project for tracking progress, utilizing tools and methodologies, communicating with the project team members, users and other stakeholders, and resolving issues, problems and addressing change requests.

The whole Fresco CHR Project was divided into different modules or applications. The current application undertaken is the appointment application, which was executed from 6$^{th}$ March 2012 and is estimated to get completed by 1$^{st}$ June 2012.

The project schedule involved 2 major steps:

- Estimate the effort (person-months), including a work breakdown structure (WBS)
- Estimate the schedule (calendar-months)

The Appointment Application, currently working is an online application, which can be used by both the doctors & the patients. This application was divided into the following sub-tasks:

- Login & Registration Page
- Doctor's Landing Page
- Patient's Landing Page

These tasks are sub-divided into small tasks, but because of the Organization Policy, these are not to be disclosed.

**Project Status Report**

The project status report communicated the progress of the project across all the levels. This report was distributed to the CEO & the project team. The report was generated at the end of every week & also monthly. The report helped in the following ways:

- Reporting the progress of the project towards its objectives, as measured against the plan.
- Evaluating progress, weekly as well as monthly.
- Reporting issues to the authority and seek assistance through escalation, when and as necessary.

## AUTHENTICATION MODULE

| Task Number | Task Name | Start Date | End Date | Duration | % Complete | Assigned To | Status | Status Indicators |
|---|---|---|---|---|---|---|---|---|
| A | Authentication Module | 28 Mar 12 | 11 Apr 12 | 14 | 16% | Shankar Bannerjee | In Progress | ● |
| A1 | Doctor Sign-up / Registration Screen | 28 Mar 12 | 11 Apr 12 | 14 | 11% | Shankar Bannerjee | In Progress | ● |
| 1.1 | Defining Data Model | | | | 20% | Shankar Bannerjee | In Progress | ● |
| 1.2 | Design GUI & Defining Fields | | | | 2% | | | |
| 1.3 | Coding, Assemble & Deploy in Server | | | | - | | | |
| 1.4 | Module Testing | | | | - | | | |
| A2 | Login Screen | 28 Mar 12 | 11 Apr 12 | 14 | 25% | Shankar Bannerjee | In Progress | ● |
| 2.1 | Defining Data Model | | | | 20% | Shankar Bannerjee | In Progress | ● |
| 2.2 | Design GUI & Defining Fields | | | | 30% | | | |
| 2.3 | Coding, Assemble & Deploy in Server | | | | - | | | |
| 2.4 | Module Testing | | | | - | | | |
| A3 | Password Recovery Screen | 28 Mar 12 | 11 Apr 12 | 14 | 11% | Shankar Bannerjee | In Progress | ● |
| 3.1 | Defining Data Model | | | | 20% | Shankar Bannerjee | Facing Issues | ● |
| 3.2 | Design GUI & Defining Fields | | | | 2% | | | |
| 3.3 | Coding, Assemble & Deploy in Server | | | | - | | | |
| 3.4 | Module Testing | | | | - | | | |

**Figure 3.** Sample of Project Report generated

## Learning from the Internship Period

The Internship Period gave me the hands-on experience with the product development life cycle in the healthcare industry. The major learning gathered from this period are as follows:

- SRS Documentation
- Design Specifications according to the User Interface
- HL7 Data Model
- Creating the Project Plan & Execution
- Interaction with the various clients involved
- Building the Project Proposal

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## Chapter – 1 Introduction

# <u>Healthcare in India</u>

Healthcare in India is in the middle of market transition. In terms of revenue & employment, it is one of the largest sectors. During the 1990s, Indian healthcare grew at a compound annual rate of 16%. As per the Springboard Research, healthcare IT spending in India is expected to grow from $274.2 million in 2009 to $609.5 in 2013, growing at a Compounded Annual Growth Rate (CAGR) of 22 per cent from 2009-2013. Technology today in India is making a tremendous impact on the current system of healthcare delivery. Recent advances in the field of information technology has improved the quality of the patient care and also reduced the related costs to a great extent. The current healthcare infrastructure in India is inadequate, as the overall number of beds, physicians and nurses is low compared to other countries. The situation is worse in the case of tertiary beds and specialist physicians. The quality of provision too is poor due to the dominance of unqualified practitioners and sub-optimal size of facilities. Despite of all theses drawback the healthcare industry in India is expected to grow & is expected to become a great support for Indian Economy.
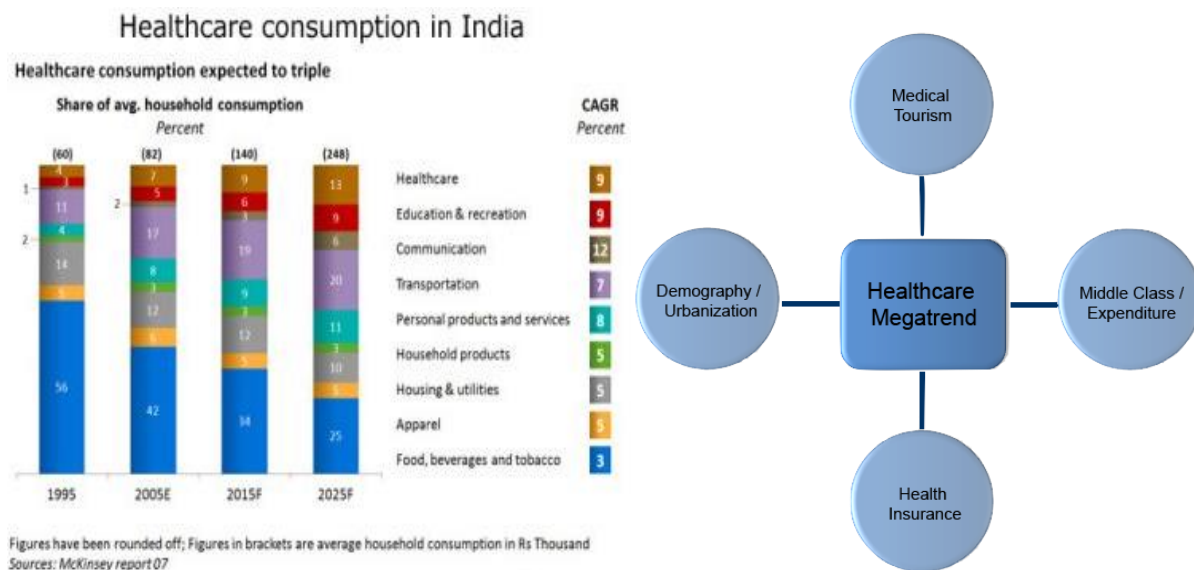


**Figure 4:** Healthcare in India & its trend

## Dentistry in India

Dentistry is a branch of medicine that is involved in the study, diagnosis, prevention, and treatment of diseases, disorders and conditions of the oral cavity, maxillofacial area and the adjacent and associated structures and their impact on the human body. Oral healthcare is an important aspect of the overall health of an individual. Diseases such as dental caries and oral cancers are major public health issues in India. Water fluoridation, fluoride toothpaste and a growing awareness of dental hygiene has led to improvements in the dental health of Indians over the past 25 years; further leading to greater demand for restorative dental treatment.

Indian Oral Infrastructure has shown marked improvement in the past 4-5 years but still needs to be improved; not only in rural areas but in urban areas as well. The Indian healthcare market, which includes medical and dental equipment and devices, currently ranks among the top ten markets in the world and is estimated to be in the region of US$ 1.4 billion a year.

According to Indian Dental Association, over 1,25,000 dental practitioners, 20,000 fresh graduates annually entering the workforce, which is expected to swell to 2 25 000 shortly, and with 290 dental colleges in India which is the largest number in the world, the market for dental equipment and material is estimated to be around US$ 38 million annually, an increase of 25 – 30%.

The advent of new technologies responsible for improving patient care requires a digital framework. An EDR walks the doctor through the process of treating a patient, providing a natural flow to both the office visit and the gathering and storing of data.

The electronic dental record can be the bridge between medicine and dentistry. The dental profession is coming to embrace it, and the specialty practice is the vehicle and the leader. As a dental surgeon, the role is pivotal in the implementation and perception of EDR in the dental community. EDR helps the practitioner manage data, streamline patients' visits and communicate with referring doctors.

# Electronic Dental Record

An **electronic dental record (EDR)** is a specialized medical record created in an organization that delivers care, such as a hospital or a dental clinic. EDR is a part of the health information system that allows storage, retrieval and modification of records. Electronic Dental Record (EDR) provides clinical charting for dentists and eliminates paper charts. The major function of a dental record is to document the patient's dental disease and treatment, which in turn ensures of better patient safety & care. A record that fulfills the above mentioned requirements provides the patient record in clear and understandable language. Apart from the record management, the EDR can also be used in research, epidemiology/public health, statistics, education, legal cases (used as evidence) and healthcare policy development.
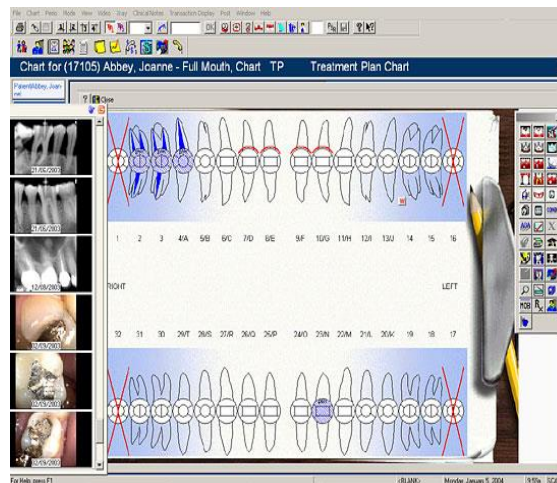


**Figure 5:** An Electronic Dental Record

**Core functions of EDR**

1. Patient medical & dental clinical profiles – This allows having immediate access to key information - such as patient's diagnosis, allergies, lab test results, and medications, as it would improve caregiver's ability to make sound clinical decisions in a timely manner.
2. Order management – The ability to enter and store orders for prescriptions, tests, and other services in a computer-based system should enhance legibility, reduce duplication, and improve the speed with which orders are executed.
3. Clinical Decision support – Using reminders, prompts, and alerts, computerized decision-support systems would help improve compliance with best clinical practices, ensuring

regular screenings and other preventive practices.

4. <u>Administrative processes</u> – Computerized administrative tools, such as scheduling systems, would greatly improve hospital and clinic's efficiency and provide more timely service to patients.

5. <u>Electronic Data Interchange</u> – Electronic data storage that employs uniform data standards will enable health care organizations to respond more quickly to federal, state, and private reporting requirements, including those that support patient safety and disease surveillance.

**Features of an adequate EDR**

- <u>Appointment Scheduling</u> – The system schedules appointments for all kinds of patients. This enables the staff to manage multiple patient appointments and streamline patient queue.

- <u>Registration</u> – The patient's demographic information such as Name, date of birth, age, gender, address, and telephone number are captured into system.

- <u>Dental Record</u> – This transforms the regular paper based record into an electronically based record. This begins with taking the Dental history, Patient Vitals, Allergies, Clinical oral examination to include an accurate charting, Diagnosis, Treatment plan, Documentation of informed consent, Medical history, Physical and emotional tolerance for procedures.

- <u>Prescription Generation</u> – An electronic prescription is generated using the fields filled during the dental record process.

- <u>Staff Management</u> – Define privileged access for staff – appointment, registration & billing.

- <u>Clinical Charting</u> – A smart charting feature of patient's dental findings. It allows easy representation and understanding of patient problems, examination & helps in prognosis, by comparing with the older visits.

- <u>Easy Payment & Billing</u> – An integrated & customizable medical billing template for all treatments.

**Benefits of EDR**

1. Improved Record Control - helps in creating single, sharable, up to date & accurate patient health record. An EDR helps in rapid retrieval of patient's data including the demographics as well as the clinical data.

2. Streamlines Clinical Workflow – electronic record helps in automating, structuring and streamlining clinical workflow.

3. Integrated Healthcare Entities – provides for integrated entities which help in monitoring, electronic prescribing, electronic referrals radiology, laboratory ordering and results display.

4. Public Health Reporting – electronic records maintain data and information trail that it is readily analyzed for medical audit, research, epidemiological monitoring & disease surveillance.

5. Provides functionality for Clinical Decision Support.

6. Provides means for avoiding potential drug and allergy interactions, thereby increasing the patient safety.

7. Continued Medical Education – supports for continuing medical education & helps the provider in keeping updated with the latest development in the field of medicine & dentistry.
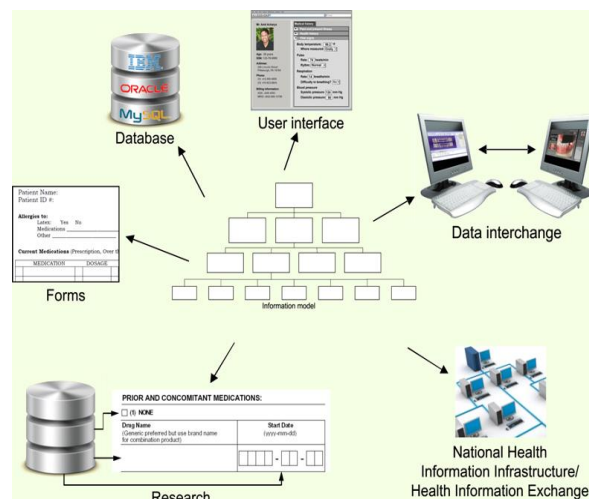


**Figure 6:** Uses of a Dental Information Model

## Problem

The healthcare industry including education, research, administration and patient care has become flooded with advances in information technology over the last decade. Of all the healthcare information technology (IT) in current use, the electronic medical record (EMR) has the most wide-ranging capabilities and thus the greatest potential for improving quality of patient care. With the increase in the number of Electronic Medical Records adoption, specialized Electronic Patient Records; such as EPR for Cardiology, Pediatrics or Electronic Dental Records is the next focus of advancement.

The Indian healthcare industry is seen to be growing at a rapid pace and is expected to become a US$280 billion industry by 2020. According to the investment commission of India; Healthcare sector has experienced phenomenal growth of 12 % per annum in the last four years. Rising income level and growing elderly population are all factors that are driving this growth.

Paper-based records have been in existence for centuries and their gradual replacement by computer-based records has been slowly undertaken. Information Technology has not achieved the same degree of penetration in healthcare as that seen in other sectors such as Finance, Transport, Banking and the Manufacturing and Retail Sectors. Also the deployment varies greatly from country to country and from specialty to specialty. It is essential for the dental fraternity to be a computer literate. The role of information technologies-including use of electronic dental records, retrieving computer-based knowledge resources, and understanding the basics of the Internet-is crucial for physicians.

The Indian government is one of the early adopters of healthcare IT among developing countries with the launching of "Development of Telemedicine Technology" project in 1997. Despite of being an early adopter, India is not completely utilizing the benefits of IT in healthcare. The key IT applications that are being implemented in the private healthcare sector include Hospital Information System (HIS), Picture Archival and Communication System (PACS), Telemedicine projects & now the advent of EMRs or EHRs. So far there are no or very few instances of EDRs adoption, in India. The use of EDR for improving quality of patient care & clinical decision-

making is not yet a priority. The EDR systems currently practiced have been used mainly for administrative purposes, due to which the true essence of EDR is missed. Without them other modern technologies such as clinical decision support systems cannot be effectively integrated into routine clinical workflow.

According to a study 25% of all general dentists in the United States use a computer in the clinical environment. But, only 1.8% actually maintains completely computer-based patient records (17). The paperless, interoperable, electronic dental record, which has been a goal for many researchers, healthcare professionals, administrators and politicians for the past few years, is however about to become reality in many western countries. The political commitment for the change in western countries has become stronger and stronger past few years.

In a study conducted in private dental institutions in India, it was observed that only 58.3% of the sample reported access to computers (7). This figure is lower than the 100% dental undergraduate students at college of Jordan and Chile followed by 95% undergraduate dental students in Oulu, Finland, 84% of undergraduate students in Glasgow, United Kingdom (UK), and 94% of medical students from Jeddah, Saudi Arabia.

Despite of many benefits, pointing towards the increase in the spread of ICT in healthcare, penetration of Electronic Records is still in question. There are several factors contributing to the resistance of EDR adoption rate. These include:
- Lack of awareness & Low computer literacy
- Absence of any government policy or initiative to promote HIT adoption.
- Technical issues – such as, functionality, ease of use.
- Cost Constraints
- Resources issues, training and re-training.
- Security, Privacy and Confidentiality issues
- Incompatibility between different systems

In 1997, the Dental Practice Board (DPB) carried out a survey of about 5,000 practices across the UK 59% of respondents had computing facilities. In a 1999 Glasgow study, 183 general dental practitioners (GDPs) were surveyed to assess attitudes towards integrated medical-dental patient records in primary care. A response rate of 83% for GDPs was obtained, out of which only 21% of GDPs, had practice computers.

## Rationale of the Study

Professional, ethical and legal responsibilities dictate that a complete chart and record documenting all aspects of each patient's dental care must be maintained. Good records facilitate the provision of effective clinical care and ensure the continuity and comprehensiveness of oral/dental health services.

According to a study, it is repeatedly stated that a graduate dentist, regardless of his priorities in research, public health, teaching or clinical care must be able to use ICT for the benefit of his personal and professional development (3).

According to College of Dental Surgeons of British Columbia, a dental record should incorporate details of the patient's general health & oral status. It should also include any of the patient's requests. It should include the proposed treatment plan and the treatment performed, as well as all the supporting documentation, such as any lab result in chronic cases or consent from a physician. Outcome of treatment should be documented and any deviations from expected outcomes should also be recorded on the patient chart, as this would help in better prognosis of the patient (12).

Though the paper based records include all the above mentioned criteria, but because of the constraints of this record system, the electronic records are much more reliable & accurate. The constraints of paper-based records include:

- Used by one person at a time.
- Data may be illegible or misinterpreted due to different handwriting of dental professionals.
- Most of the times, the previous records are either lost or misplaced by the patient or the

provider.

- The records are not well structured in terms of clinical data.
- Sharing of records is a big question when it comes to paper-based records.

Dentistry lags behind medicine in terms of the quality of record keeping. Medical doctors comply with stringent record keeping regulations, even on paper, because if data is improperly recorded and something goes wrong, a life is lost. Dental practitioners do not yet face this level of pressure to comply, as the probability of losing a life is minimal when compared with the field of medicine; although changes in this direction are just a matter of time. By mandating compliance for the dental community, we can improve the quality of care in the following ways:

- Improved treatment standards and quality of treatment.
- Complete records supporting better point-of-care decision-making.
- Smoother processing and filing of medical claims, which would lead to clear communication between doctor/patient/insurance providers.
- Reduction of administrative costs drastically.
- Improved security.
- Improved data access.
- Improved detection of data patterns & study outcomes.

While several researches have explored the use of computers and information technology by physicians & dentists, few of such studies are currently available in India. The aim of this study is to assess the computer literacy, current practices, knowledge, attitude & behavior amongst practicing dentists towards EDR.

## <span style="color:red">__Objective of the Study__</span>

- To Study the Basic Computer Awareness amongst Practicing Dentists.
- To study the current practices followed amongst Practicing Dentists.
- To study the Knowledge, Behavior & Attitude towards EDR amongst Practicing Dentists.

## <u>Hypothesis</u>

- Belief among end users that Knowledge of EDR will give competitive edge is co-related with age of end users.

- Belief among end users that knowledge of EDR will reduce duplication data entry is associated with the clinical experience of the end users.

- There is relationship between the attitude towards the use of IT application & the clinical experience of the end users.

## Research Design

The study is analytical by nature. The study employed quantitative approach to data gathering. The data collection sources for the study included both secondary and primary data sources.

**QUANTITATIVE APPROACH**

DATA COLLECTION & DATA ANALYSIS

**RESULTS INTERPRETED**
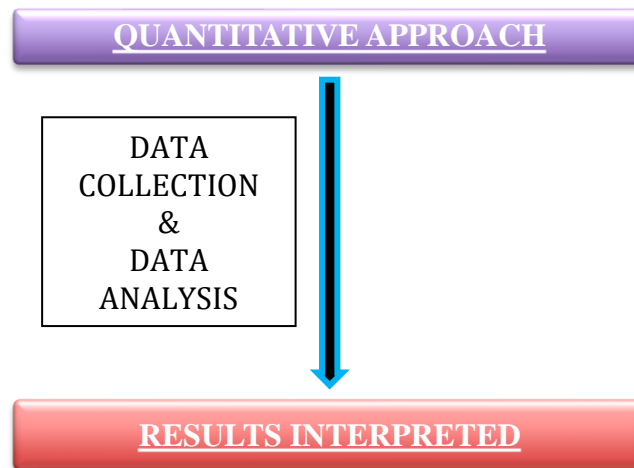
## Sample Design

- Sample Unit: Practicing Dentists from Delhi, NCR region were included.
- Sample Size: **150** Dentists.
- Sampling Technique: Simple Random Sampling
- Sampling Area: Delhi, NCR

## Data Collection

A self-structured questionnaire was drafted & the primary data was gathered by sending the questionnaire through e-mail & also by direct interviews.

## Data Analysis

Data was coded and analyzed in SPSS version 16.0 including the application of the following Statistical Analysis Techniques:

- Frequencies
- Cross-tabulation
- Chi square test

## Limitations of Study

- Gathering response from a large number of dentists under time constraints was difficult. Therefore, small sample size was one of the limitations for this study.

- Involving dentists from all the age group would have given a clearer picture & accurate analysis. But, this was not possible due to time constraints.

- Involving dentists from other parts of the country would have given a more meaningful and accurate analysis. But, this was not possible due to time constraints. This was another limitation of this study.

## Chapter – 3 Results & Findings

Analysis was done using SPSS version 16.0. Frequency table & Cross-tabulations were used to find the percentage of different entities. Chi-square test was applied to prove the hypothesis obtained from the objectives of the study.

## <u>Age Group Distribution of the Respondents</u>

Out of the 150 respondents, 121 were in the age group of 21-30 years, making it as 81% of the survey population.

| Age Group Distribution | | | |
|---|---|---|---|
| | | Frequency | Percent |
| Valid | 21-30 Years | 121 | 80.7 |
| | 31-40 Years | 24 | 16.0 |
| | 41-50 Years | 5 | 3.3 |
| | Total | 150 | 100.0 |

**Age Group Distribution**

- 21-30 Years
- 31-40 Years
- 41-50 Years

3%

16%

81%
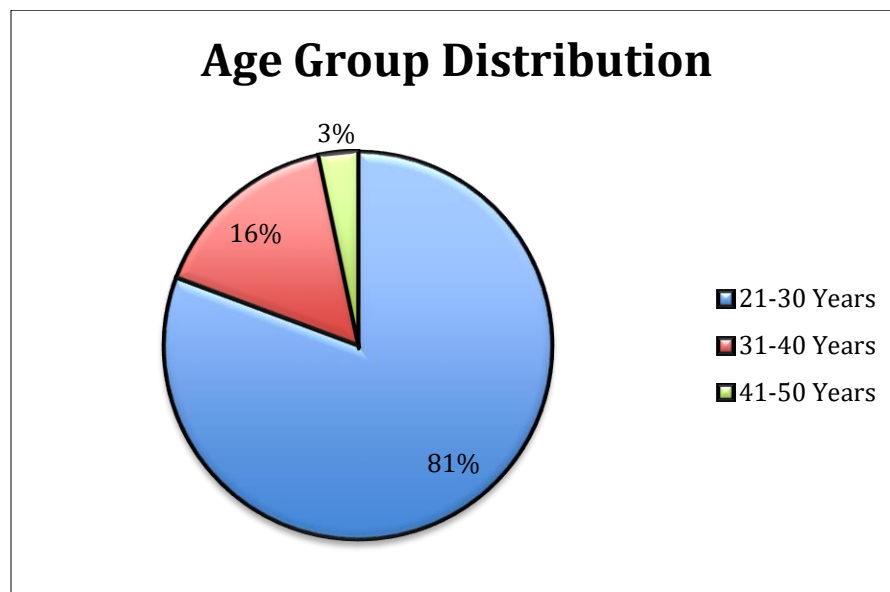
# Gender Distribution of the Respondents

Out of 150 respondents, 70 males & 80 females responded; that is, 53% females & 47% males.

| Gender Distribution | | | |
|---|---|---|---|
| | | Frequency | Percent |
| | Male | 70 | 46.7 |
| Valid | Female | 80 | 53.3 |
| | Total | 150 | 100.0 |
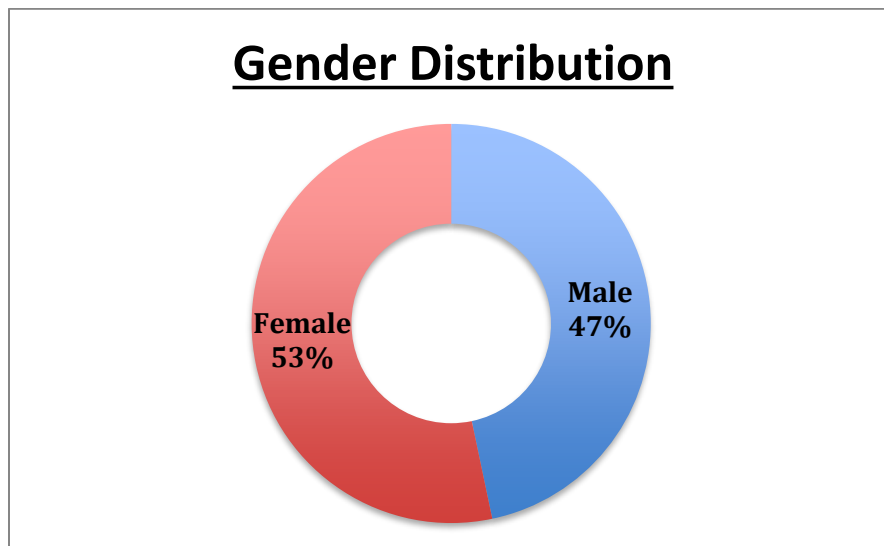
## Qualification Distribution of the Respondents

Out of 150 respondents, 57.3% dentists were graduates, 30.7% interns & the rest 12% were post-graduates.

| Qualification Distribution | | Frequency | Percent |
|---|---|---|---|
| | Intern | 46 | 30.7 |
| Valid | Graduate | 86 | 57.3 |
| | Post Graduate | 18 | 12.0 |
| | Total | 150 | 100.0 |

**Qualification Distribution**
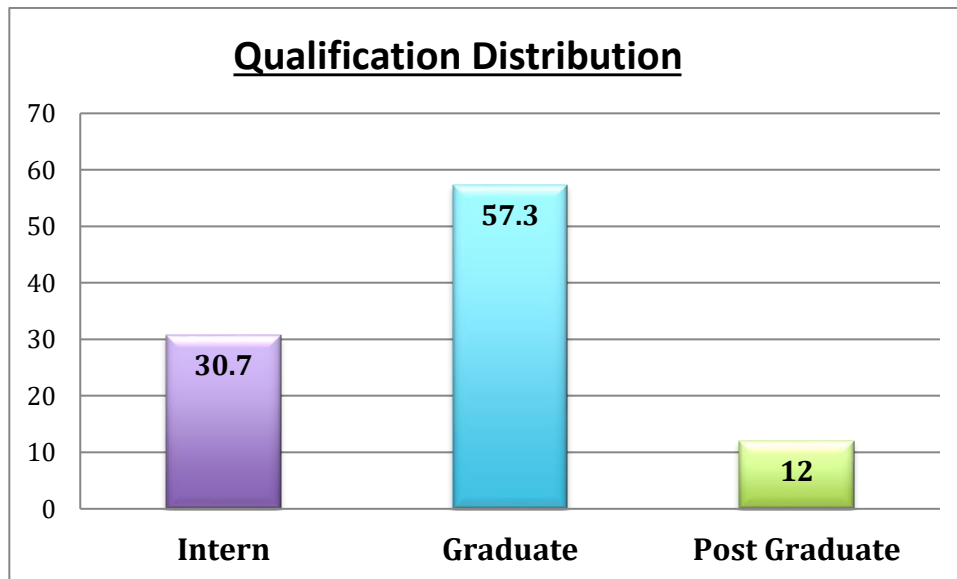
## Clinical Experience Distribution

| Clinical Experience | | Frequency | Percent |
|---|---|---|---|
| | Less than 1 Year | 68 | 45.3 |
| | 1 - 3 Years | 50 | 33.3 |
| | 3 - 5 Years | 12 | 8.0 |
| Valid | 5 - 7 Years | 7 | 4.7 |
| | 7 - 10 Years | 8 | 5.3 |
| | Above 10 Years | 5 | 3.3 |
| | Total | 150 | 100.0 |
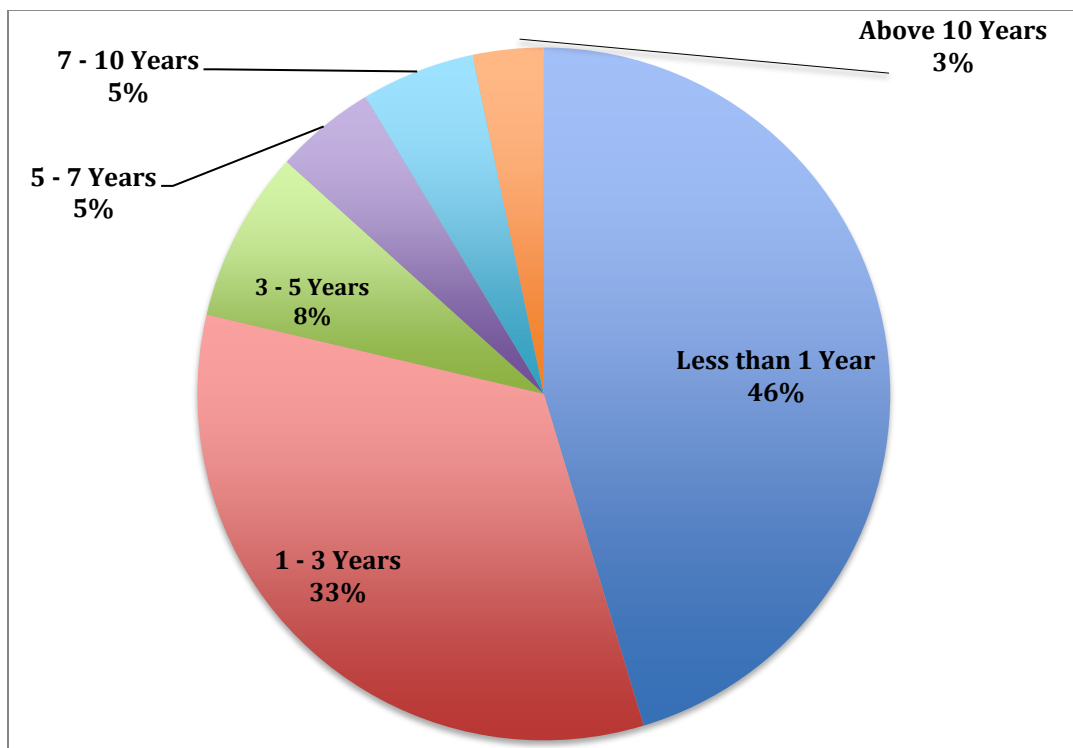
# Have you heard about Clinic/Hospital Management Software?

Of the 150 respondents, 67.3% of the dentists were not aware of the Hospital/Clinic Management Software.

| Heard of Clinic/ Hospital Management Software | | Frequency | Percent |
|---|---|---|---|
| | | Frequency | Percent |
| Valid | Yes | 49 | 32.7 |
| | No | 101 | 67.3 |
| | Total | 150 | 100.0 |



Awareness of Clinic/Hospital Management Software

## Current Practices followed

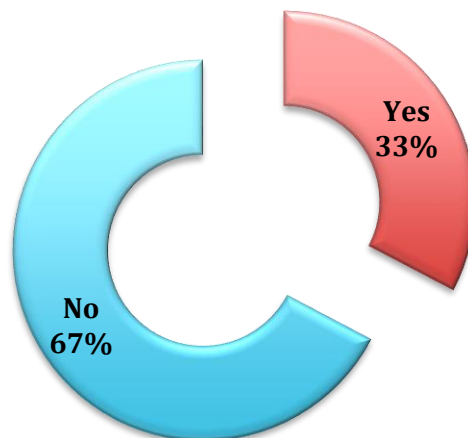1. Appointments & Scheduling done manually? **88.7%** of the respondents still follow manual practices for scheduling & appointment despite of various appointment applications in the market.

| Follow up cases appointment scheduling done manually | | | |
|---|---|---|---|
| | | Frequency | Percent |
| Valid | Yes | 133 | 88.7 |
| | No | 17 | 11.3 |
| | Total | 150 | 100.0 |

**Manual Practice Followed**
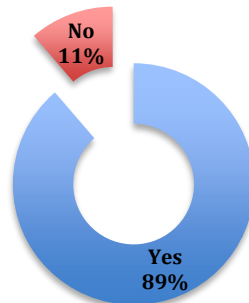


2. Any IT applications in Clinical Practice? **81.3%** dentists do not use any kind of IT applications in their Clinical Practice.

| Have IT applications in Clinic | | | |
|---|---|---|---|
| | | Frequency | Percent |
| Valid | Yes | 28 | 18.7 |
| | No | 122 | 81.3 |
| | Total | 150 | 100.0 |

**IT Applications in Clinical Practice**
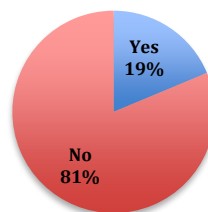
## Knowledge about Electronic Dental Records

**64%** of the dentists were not aware, that is they had no knowledge about EDR as it was never used as a part of their course curriculum.

| Use EDR as a part of Course Curriculum | | | |
|---|---|---|---|
| | | Frequency | Percent |
| Valid | Strongly Disagree | 37 | 24.7 |
| | Disagree | 96 | 64.0 |
| | Neutral | 17 | 11.3 |
| | Total | 150 | 100.0 |

### EDR as Course Curriculum

Neutral 11%

Strongly Disagree 25%

Disagree 64%
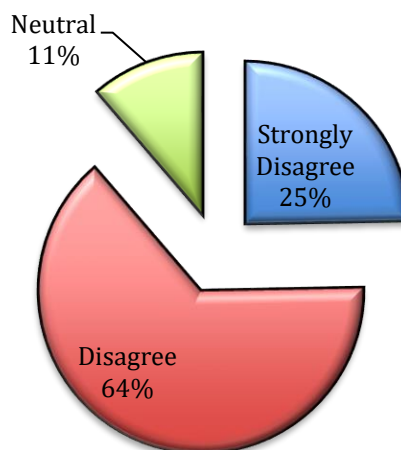
## Should IT application be a part of Course Curriculum?

When asked whether IT applications in clinical practice should be included in the course curriculum, almost **78%** of the dentists agreed.

| IT application in clinical practice has to be a part of course curriculum | | Frequency | Percent |
|---|---|---|---|
| Valid | Disagree | 3 | 2.0 |
| | Neutral | 30 | 20.0 |
| | Agree | 71 | 47.3 |
| | Strongly Agree | 46 | 30.7 |
| | Total | 150 | 100.0 |

### IT application part of course curriculum
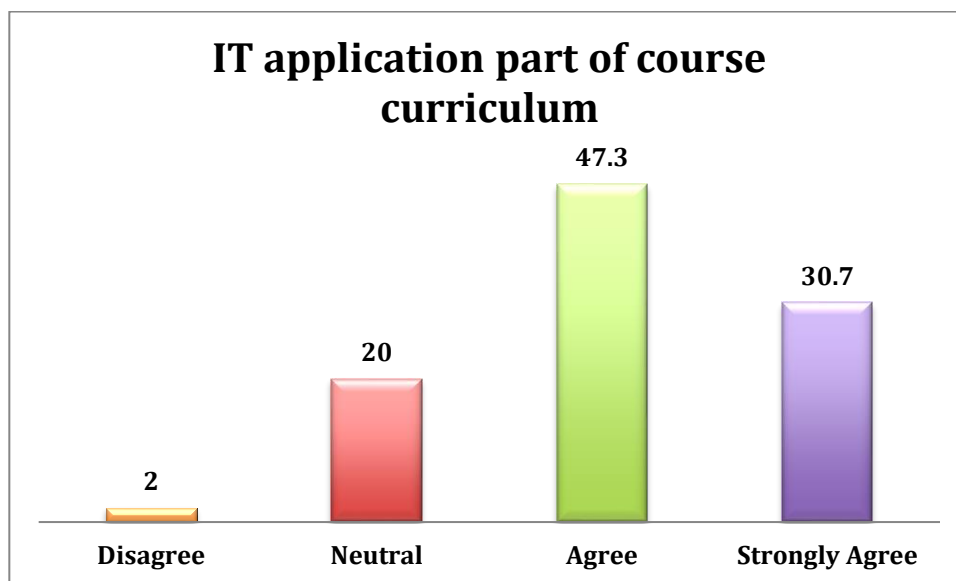
## Hypothesis Testing

**Hypothesis 1:** Belief among end users that Knowledge of EDR will give competitive edge is co-related with age of end users.

**Null Hypothesis:** Belief among end users that Knowledge of EDR will give competitive edge is not co-related with age of end users.

**Alternate Hypothesis:** Belief among end users that Knowledge of EDR will give competitive edge is co-related with age of end users.

**Computed chi-square ($\chi^2$) Test Statistics**

| Chi-Square Tests | | | |
|---|---|---|---|
| | Value | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | $1.590E2^a$ | 8 | .000 |
| Likelihood Ratio | 148.964 | 8 | .000 |
| Linear-by-Linear Association | 102.459 | 1 | .000 |
| N of Valid Cases | 150 | | |

**Computed $\chi^2$** = 159.0 (for df = 8 & p<0.001)

**Tabulated $\chi^2$** = 26.124 (for df = 8 & p<0.001)

Since, $|\chi^2| > \chi^2(\alpha)$ we reject the null hypothesis & accept the alternate hypothesis, that is; **Belief among end users that Knowledge of EDR will give competitive edge is co-related with age of end users.**

**Knowledge & Age Cross-Tabulation Analysis**

| Knowledge Question - EDR help to gain competitive edge * Age Group Cross-Tabulation Analysis | | | | | | |
|---|---|---|---|---|---|---|
| | | | Age Group | | | Total |
| | | | 21-30 Years | 31-40 Years | 41-50 Years | |
| EDR help to gain competitive edge | Strongly Disagree | Count | 40 | 0 | 0 | 40 |
| | | % of Total | 26.7% | 0.0% | 0.0% | 26.7% |
| | Disagree | Count | 69 | 0 | 0 | 69 |
| | | % of Total | 46.0% | 0.0% | 0.0% | 46.0% |
| | Neutral | Count | 12 | 0 | 0 | 12 |
| | | % of Total | 8.0% | 0.0% | 0.0% | 8.0% |
| | Agree | Count | 0 | 17 | 2 | 19 |
| | | % of Total | 0.0% | 11.3% | 1.3% | 12.7% |
| | Strongly Agree | Count | 0 | 7 | 3 | 10 |
| | | % of Total | 0.0% | 4.7% | 2.0% | 6.7% |
| Total | | Count | 121 | 24 | 5 | 150 |
| | | % of Total | 80.7% | 16.0% | 3.3% | 100.0% |



37
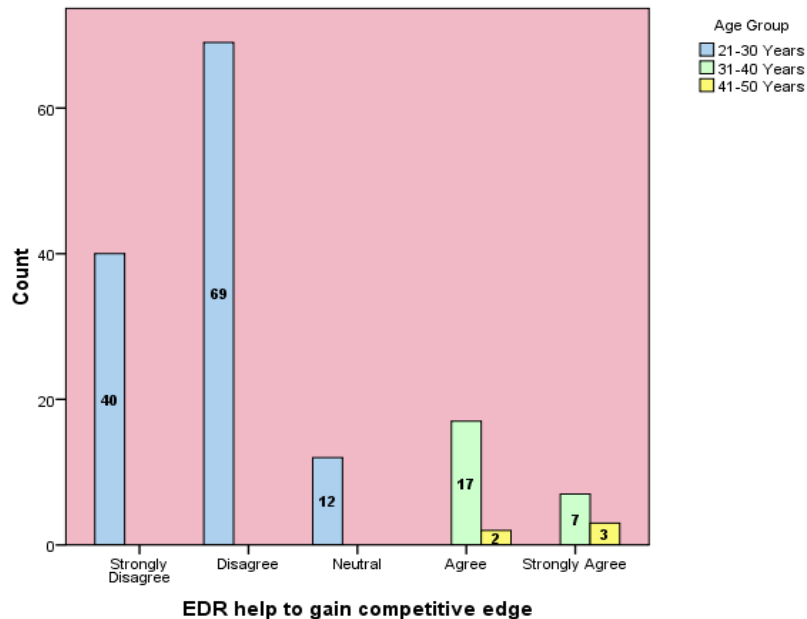
**Interpretation of Result** – This hypothesis shows that as the age group of an individual increases, the knowledge about EDR also increases. Therefore, we can say that Knowledge of an individual is influenced by the age of an individual. It was observed that the individuals in the age group 21-30 years, were mostly the interns or practicing dentists with 1 year of work experience, & as there is no subject involving the Electronic Dental Records in the course curriculum, therefore the dentists in this age group are not aware of EDR system. There is lack of awareness regarding the IT applications in Clinical Practice. Despite of having good attitude towards the use of IT applications, the knowledge of this age group was inadequate & no practice was followed for the use of IT in Clinical Practice.

As the age & the work experience of the dentist's increases, the knowledge of an individual also increases. This was mainly due to the exposure of dentists working in various different setups, such as corporate hospitals or big clinic's. This shows that the older generation, are aware of the various IT applications in Clinical Practice, including the EDR.

**Hypothesis 2:** Belief among end users that knowledge of EDR will reduce duplication data entry is associated with the clinical experience of the end users.

**Null Hypothesis:** Belief among end users that knowledge of EDR will reduce duplication data entry is not associated with the clinical experience of the end users.

**Alternate Hypothesis:** Belief among end users that knowledge of EDR will reduce duplication data entry is associated with the clinical experience of the end users.

### Computed chi-square ($\chi^2$) Test Statistics

|  | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 99.707[a] | 20 | .000 |
| Likelihood Ratio | 92.949 | 20 | .000 |
| Linear-by-Linear Association | 7.181 | 1 | .007 |
| N of Valid Cases | 150 |  |  |

**Computed $\chi^2$** = 99.707 (for df = 20 & p<0.001)

**Tabulated $\chi^2$** = 45.32 (for df = 8 & p<0.001)

Since, $|\chi^2| > \chi^2(\alpha)$ we reject the null hypothesis & accept the alternate hypothesis, that is; **Belief among end users that knowledge of EDR will reduce duplication data entry is associated with the clinical experience of the end users.**

## Knowledge & Clinical Experience Cross-Tabulation Analysis

| | | | EDR reduce duplicate data entries * Clinical Experience Cross-Tabulation | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Clinical Experience | | | | | | |
| | | | Less than 1 Year | 1 - 3 Years | 3 - 5 Years | 5 - 7 Years | 7 - 10 Years | Above 10 Years | Total |
| EDR reduce duplicate data entries | Strongly Disagree | Count | 2 | 2 | 0 | 0 | 0 | 0 | 4 |
| | | % of Total | 1.3% | 1.3% | .0% | .0% | .0% | .0% | 2.7% |
| | Disagree | Count | 5 | 7 | 2 | 0 | 0 | 0 | 14 |
| | | % of Total | 3.3% | 4.7% | 1.3% | .0% | .0% | .0% | 9.3% |
| | Neutral | Count | 41 | 29 | 5 | 0 | 0 | 0 | 75 |
| | | % of Total | 27.3% | 19.3% | 3.3% | .0% | .0% | .0% | 50.0% |
| | Agree | Count | 0 | 4 | 4 | 6 | 8 | 2 | 24 |
| | | % of Total | .0% | 2.7% | 2.7% | 4.0% | 5.3% | 1.3% | 16.0% |
| | Strongly Agree | Count | 20 | 8 | 1 | 1 | 0 | 3 | 33 |
| | | % of Total | 13.3% | 5.3% | .7% | .7% | .0% | 2.0% | 22.0% |
| Total | | Count | 68 | 50 | 12 | 7 | 8 | 5 | 150 |
| | | % of Total | 45.3% | 33.3% | 8.0% | 4.7% | 5.3% | 3.3% | 100.0% |

**Bar Chart**
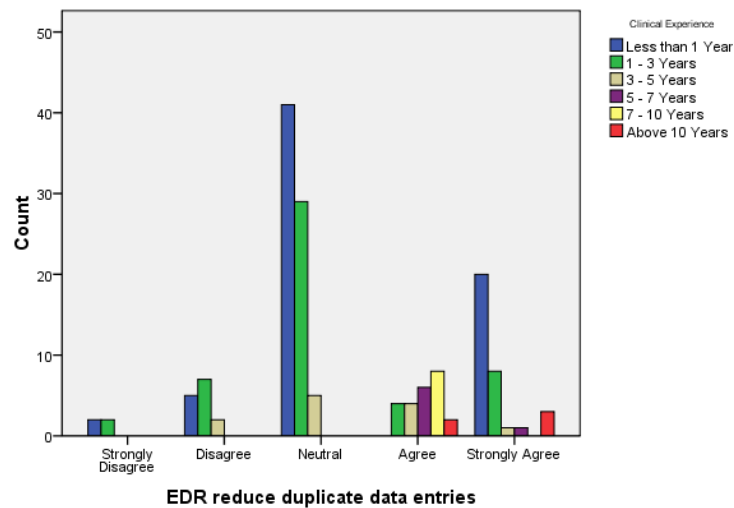
**Interpretation of result –** This hypothesis shows that as the clinical experience of an individual increases, the knowledge about EDR & its benefits also increases. Therefore, we can say that Knowledge of an individual is associated with the clinical experience of an individual. It was observed that as the individuals with the work experience of less than 1 year or 1-3 years, were mostly the interns or graduates, & as there is no subject & practice involving the Electronic Dental Records in the course curriculum, therefore the dentists in this group are not aware of EDR system & its benefits. There is lack of awareness regarding the IT applications in Clinical Practice.

As the work experience of the dentist's increases, the knowledge of an individual also increases. This was mainly due to the exposure of dentists working in various different setups, such as corporate hospitals or big clinic's. This shows that the older generation, are aware of the various IT applications in Clinical Practice, including the EDR.

**Hypothesis 3:** There is relationship between the attitude towards the use of IT application & the clinical experience of the end users.

**Null Hypothesis:** There is no relationship between the attitude towards the use of IT application & the clinical experience of the end users.

**Alternate Hypothesis:** There is relationship between the attitude towards the use of IT application & the clinical experience of the end users.

**Computed chi-square ($\chi^2$) Test Statistics**

| Chi-Square Tests | | | |
|---|---|---|---|
| | Value | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | 63.947[a] | 20 | .000 |
| Likelihood Ratio | 67.878 | 20 | .000 |
| Linear-by-Linear Association | 26.474 | 1 | .000 |
| N of Valid Cases | 150 | | |

**Computed $\chi^2$** = 63.947 (for df = 20 & p<0.001)

**Tabulated $\chi^2$** = 45.32 (for df = 20 & p<0.001)

Since, $|\chi^2| > \chi^2(\alpha)$ we reject the null hypothesis & accept the alternate hypothesis, that is; **there is relationship between the attitude towards the use of IT application & the clinical experience of the end users.**

Bar Chart
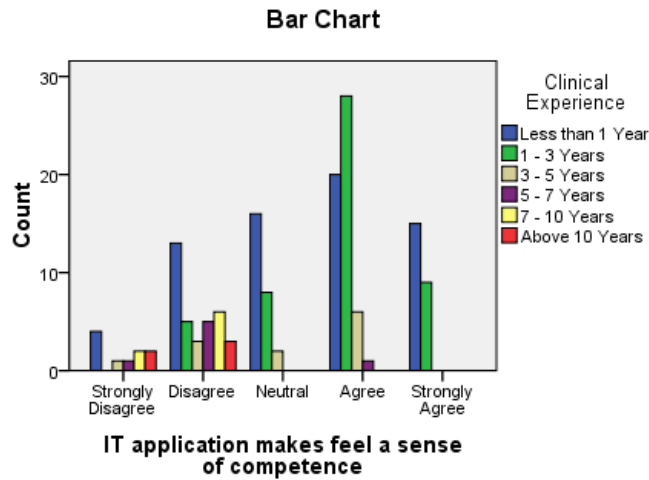
**Interpretation of Result –** This hypothesis shows that as the clinical experience of an individual increases, the attitude of an individual towards the use of IT applications is also affected. Therefore, we can say that Attitude of an individual is influenced by the experience of an individual. It was observed that the individuals with the work experience of less than 1 year or 1-3 years, were mostly the interns or graduates, & as the young generation today are more technology savvy, therefore their attitude towards use of IT applications is different from the individuals lying in the higher work experience group. It was noted that the individuals with the work experience of less than 1 year or 1-3 years felt a sense of competence with the use of IT applications, whereas the elder generation disagreed with the fact that the use of IT makes them feel a sense of competence.

The younger generation, despite of having good attitude towards the use of IT applications, the knowledge of this group was inadequate & no practice was followed for the use of IT in Clinical Practice (as proved earlier). The reason for this is mainly because of newer technologies coming into play, & the young generation getting adapt to it. But, as such very few technologies focus on the healthcare aspect, the awareness is not there & also despite of the adoption of EMRs or EDRs, in various healthcare facilities, it is still not a part of the formal education.

The elder generation, despite of having good knowledge about the IT applications in Clinical Practice, including the EMRs or EDRs, do not get adapted to the system is because of the attitude & they are reluctance to change.

## Chapter – 4 Conclusions

The result of the current study demonstrated that, out of the 150 dentists, 81% of the survey populations were lying in the age group of 21-30 years. 67.3% never heard of the hospital or clinic management system. Despite of the availability of various software in the market, 88.3% dentists still today use the manual process for appointment scheduling & patient records. 64% of the dentists were not aware of the Electronic Medical Records or the Electronic Dental Records.

The knowledge, attitude & the behavior of the individuals were designed on the 5. Likert scale as 1-5 with strongly agree & strongly disagree, the two end points. The study revealed that the attitude of the younger generation was much better than those individuals falling in the higher work experience. The study shows that the basic computer awareness is no longer an issue amongst the young generation. Of the 121 dentists in the age group 21-30, atleast 80 dentists were technology savvy & faced no hassles with the use of technology.

This study also shows that despite of having good attitude towards the use of IT applications, amongst the young dentists the knowledge of this group was inadequate & no practice was followed for the use of IT in Clinical Practice. The reason for this is mainly because: -

- Newer technologies are coming into play, & the young generation easily gets adapted to these technologies.
- There is lack of awareness.
- Despite of the adoption of EMRs or EDRs, in various healthcare facilities, it is still not a part of the formal education.
- Stressful & traditional practices, leaves no time for exploring the various advancements happening in the field of healthcare.

The elder generation, despite of having good knowledge about the IT applications in Clinical Practice, including the EMRs or EDRs, do not get adapted to the system is because of the following reasons: -

- Reluctance to change
- No proper formal education or training is provided.

During the entire duration of carrying out this study, there has been a lot of learning. Apart from that, the experience of the mentor has been very useful for knowledge transfer.

Some of the learning's during the entire study programme is as under:
- Practical issues involved in the each age group, regarding the knowledge, attitude & behavior of the individuals, which resulted in deviations depicted in the project.
- The basic workflow & the practices followed in a dental clinic.

**Recommendations**

To achieve the above mentioned benefits, following recommendations should be taken: -
- ✓ Instead of designing a standard system for all, the need of the end users should be identified and the EDRs should be customized as per their needs and requirements.
- ✓ Proper formal training should be given to both the dental students & dental educators.
- ✓ Introduce short refresher courses in computer applications & awareness about the IT applications used in Clinical Practice.
- ✓ The government should introduce certain incentives for implementing the Electronic Dental Records in their clinical practice.
- ✓ Instead of mandating the use of EDR, the dentist's perception about EDR should be understood first. This will allow for the development of targeted education to demonstrate the advantage of EDRs and to further improve their perception. This will lead to widespread adoption and successful implementation of EDRs.

With the above mentioned recommendations, the entire dental fraternity management would gain in the following areas: -

- Better management control
- Standardization of operations and functioning
- Reduce errors
- Better quality of service
- Higher growth prospects

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