

# Innovations

## **Application of Non-Dental Software Programs Using Smart Phone Devices in Dentistry**

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**Abstract:**

*Mobile health care applications facilitate effective and efficient communication as well as execution of various complex functionalities in health care sectors such as health education, promotion, health care delivery services and patient management. With easy access to smartphone devices and increased dependence of information technology mobile health application (mHealth Apps) remains one of the largest unexploited market in the context of health care services that benefits health professionals, and populations of remote regions by decreasing medical and travel expenses, eliminate chances of inappropriate diagnosis, and establishes a new business model and opportunities by assisting education and training, health promotion, clinical skill development, virtual consultation, supply chain and clinical administration, patient and customer relationship management in a user-friendly, simple and convenient way. Many dental apps have been developed over the years to exclusively assist dental consultation and administration however lack mobility solutions towards medical and pharmaceutical industry, health conscious, wellness and fitness sector, and customer relationship management that address mental, physical, social, environmental, or even spiritual factors associated with overall*

*health of an individual. The present review focus on the role of Non dental mobile software application in dentistry and emphasizes the need for utilization of medical or non-dental electronic resources, software applications by dental students and professionals along with acceptance of new technology in clinical setting at dental professional and oral health care delivery systems to provide advance healthcare delivery, better personal health tracking and enhance the overall quality of patient care.*

**Keywords:** *Dentistry, Digital practice, Health care professionals, Mobile health, Patient experience, Supply chain management.*

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### **Introduction:**

Smart phone devices have gained popularity over a decade owing to its combined functionality of a computer and portability, user-friendliness, wireless connectivity to internet resources, convenient access to software application and cost effectiveness over other information technology and communication devices (ICT) including computers. The term “Apps” refers to a software computer application that can be installed or already available (existing by default) for various information and communication purposes on the smart devices including Mobile, and Tablets<sup>[1-3]</sup>. Mobile Apps are computer programs specifically designed for designated purposes that run on smart devices capable of transferring information through various direct and indirect modalities that facilitate effective and efficient communication as well as execution of various complex functionalities. These Apps can be e-books, interactive reference materials, training modules, medical software devices, data collection tools, interactive patient handouts, etc<sup>[4-7]</sup>.

With advancement in communication, information technology and developing artificial intelligence (AI), the utilization of smart phone (Mobile and Tablets) apps that are currently available evolved as an important tool in medical industry and health care sectors<sup>[8, 9]</sup>. The term telehealth, e-health, m-health, and digital health are currently used unanimously to refer a broad spectrum of cost-effective and secured use of Information and communication technologies (ICT) in support of health and health related fields<sup>[10, 11]</sup>.

The “Health app” is categorized as mobile software that diagnoses, tracks, or treats disease while wellness app enhances or checks the overall health status of the user. These apps can address mental, physical, social, environmental, or even spiritual factors that relate to overall health of an individual<sup>[12, 13]</sup>. On the contrary, medical app are professional-based applications used to deliver information, training and access to health-related services including public health education and telehealth, chronic disease monitoring, medication and treatment adherence, patient-provider communication and behavior change interventions<sup>[14, 15]</sup>.

Over the years, with the evolution in digital dentistry using computer aided technology, mHealth in dental practice led clinicians to deliver precise

information to the patients as well as customers/subordinates by its wider application ranging from day-to-day communication, administrative process in clinical setup, practice promotion, convenient ordering of required materials and supplements, educating and assisting the patients to ensure successful treatment outcome expectations. Evidence based studies on utilization of advanced mobile Apps have shown significant increase in the promotion of dental health education, enhanced oral hygiene practices, reduced anxiety and fear towards dental treatment with positive treatment outcomes at the individual and community level. On the other hand, these applications also help the dentist to reduce the burden of keeping large manual clinical records, gain knowledge and keep abreast on the latest trends in the field of dentistry and medicine<sup>[16-19]</sup>.

**Discussion:**

Initially dental mobile and smart applications compatible with both iOS and Android operating systems have been developed focusing only on academic and clinical or practical perspective. Most of these apps are desired either for self-education or for clinicians to encourage their patients for oral hygiene practice guidance and health promotion. However, with incorporation of AI and Machine learning/Deep learning (ML/DL) technologies over the years many non-dental software applications were also introduced for various purposes that includes supply chain management, virtual training and consultations thus ensuring easier and cost-effective dental practice.

It is evident that most of the apps were specifically designed either for the patient or the clinician; there was no integration of the two. Moreover, most of the information contained within any app on the app store is often not independent and even more often not validated. The clinician must guide the patient to use the app that is best suited to the latter's needs and should ensure that the information being provided is genuine.

**Table 1: Table showing the working categorization of Non dental mobile software application based on its purpose/application:**

Category	Purpose/Uses	Software Application (Apps)
Education and Training	Dental Academics and Health Education Apps	Medscape, Lecturio, Osmosis Med Videos, Dentaltown, Radiology Rounds, Anatomy Learning
	Oral Care and Health Promotion Apps	Instant Aid, WebMD Symptom checker, CarePassport, Nutrition and Fitness goals, Nike Running, Nutrimeddy
	Clinical Demonstration and Clinical Skill	Mobile MIM Radiology, PEPID, Clinical Skills, Prognosis

	development Apps	
Consultation (VC) and Clinical Practice (CP)	Virtual Consultation Apps	Lybrate, Rhinogram, GYANT App, Hi-Doc/Teladoc-24/7, Mfine,
	Clinical Practice Apps	
Clinical Administrative (CA) and Practice Management	Clinical Administrative (CA)	Appointik, MEDICALID, MConsent, Docterz, Folda patient management, VisualDx, Practo
	Practice Management Apps	
Supply Chain Management	Supply Chain Apps	Sowingo, Zensupplies, SurgiCare, Mymediset, MedDeal
Customer Support and Relationship Management (CRM) apps:	Customer Support Apps	DynaMed, Crelio CRM, TrayMinder, InfluxMD, PlayMaker Health
	Customer Relationship Apps	

**1) Education and Training Purpose Apps<sup>[8-14]</sup>:**

**a) Dental Academics and Health Education:**

Dental academics apps serves as a useful dental library and teaching resources that carry treatment related information, important dental conditions, laboratory and diagnostic procedure information, drug information, dental emergency procedures and patient guidance materials. Clinicians can access publications, dental news, and magazines online from leading journals as “e-journals” “e-magazines” to update their knowledge of latest procedures, case studies and products. Health education apps were specifically designed to educate patients at the individual and community level about various procedures performed in dental practice, importance of oral hygiene and oral health, and role of dentist in enhancing the quality of life.

**Medscape<sup>TM</sup>**- Medscape<sup>TM</sup> is the leading online comprehensive destination that provides a personalized experience on the latest medical news, expert reviews, professional perspectives, essential point-of-care drug and disease information, relevant professional education through CME/CE activities and access to various medical resources for the physicians and healthcare professionals worldwide.

**Lecturio**- Lecturioprovides affordable, adaptive and personalized learning science experience with best education tools to master the basic science, high quality digital medical education resources with combined art of learning technology, comprehensive monitoring and assessment features.

**Osmosis Med videos-** Osmosis makes teaching medical and dental concepts more effective and efficient through bite-sized, illustrated videos and learning assessment tools available on demand. It helps us to address some of the challenges in teaching and learning by incorporating animations, videos, preclinical flashcards, study notes and basics and clinical questions.

**Dentaltown-** Dentaltown is a community based apps for dentists and other health care professionals with features includes magazine, update and latest trends in oral health care and online CE/CDE education programs. Dentaltown ensure professional solution, offering competitive and demographic data information in collaboration with LOCATE™

**Radiology Rounds-** Radiology rounds is an exclusive application for radiologists and practitioners to gain expertise in radiographic imaging and diagnosis, and also to share personal experiences including special cases among radiologists community. It also includes comprehensive drug database, guidelines, collection of journals, quick references, case scenarios and discussion forum to update their clinical skills and knowledge.

**Anatomy Learning-** Anatomy learning is a guided learning system for health care professionals that uses 3D models, demonstrations for studying human anatomical structures built on an advanced interactive 3D touch interface. It allows professionals to visualize in real 3D dimension of all the anatomical structures including muscles, nerves, bones and other vital organs.

#### **b) Oral Care and Health Promotion:**

Oral Care and Health Promotion apps provides unlimited access to oral health care services with a community-based approach suitable to a wide range of individuals that includes healthcare workers, public health practitioners, pre-med or pre-dental students, dental hygienists, social workers, future health care providers, health care workers/professionals, health administrators or educators, communicators, policy makers, and advocates with interest on Community Oral Health.

In addition “Health care apps” also illustrates the clinical symptoms and effects of most frequent dental conditions such as tooth decay, gingival and periodontal problems, tooth sensitivity, pain and tooth fractures.mHealth apps can be broadly categorized as remote monitoring apps, clinical and diagnostic apps, healthy living apps, reference and productivity apps.

**Instant Aid-** Instant Aid is primarily a voice assistant application that guides instinctive and clear operation of the first aid guidelines, emergency measures and protocols in a stressful emergency state or conditions. It serves as a valuable

tool by providing step-by-step instruction in case of emergency, accurate diagnosis possible, makes an emergency call and aid in interactive follow up.

**WebMD Symptom Checker** - WebMD is the largest provider of health information services, serving consumers, physicians, healthcare professionals, employers, and health plans. WebMD Health symptom checker is a mHealth app that provides information of symptoms, health related conditions and drugs, drug compatibility, diagnosis and treatment options, creates medication reminders, allergic alerts, locate the nearest doctors and specialists, customization and functionality on personal health related information, quick access articles about medical conditions and provide health news and updates.

**CarePassport**- CarePassport proves to be a beneficial medical app which they can use to gather and check medical data. This data includes dental records, medical images, lab results, and many others coming from hospitals and clinics. Patients can use this app to store in their records from any provider which includes PDF documents or any records which have been self-reported.

**Nutrition and fitness goals**- Nutrition Apps focuses on the food chart, lifestyle modifications, metabolism and health related conditions. Fitness and nutrition are closely interrelated factors to body consumption, muscular capability, respiratory and cardiovascular capacity. These apps assist calorie measurement, weight loss and fitness goals by aiding in better food habits and adopting a healthier lifestyle.

**Healthifyme** is a comprehensive database of variety of Indian foods and its calorie values. It also provides on-demand fitness trainer, yoga instructor and dietician. Majority of these apps helps to improve workout session, suggest better food alternative, reminders to drink water, and better exercise information to achieve personal health goals.

**Nutrimed**y- Nutrimed provides health care information widely used as remote location consultation services. It delivers health care system for clinical nutrition using telehealth enabled mobile platform to incorporate personalized care outside hospital in least accessible regions.

### **c) Clinical Demonstration and Clinical Skill development App:**

Clinical Skill or Demonstration apps guide the clinicians through self-explanatory videos, help visualize planned procedures and their potential outcomes through 3-dimensional virtual demonstration and also reduce the workload by influencing the pre-treatment preparation. Imaging apps are designed to display all the patient related images that can be useful for education, consultation, predict treatment outcomes and also for future communication reference by image sharing with smart devices as required.

**Mobile MIM Radiology App-** MIM Radiology interface is the first FDA-approved radiology imaging app to aid the imaging professionals towards practical imaging solutions in the fields of radiation oncology, radiology, nuclear medicine, neuroimaging, and cardiac imaging. by rendering portable access to medical images, such as MRI, SPECT, X-ray, PET, CT, and Ultrasound. This app allows the medical experts to use cloud technology to save diagnostic-quality X-rays and then spot different areas of it for further investigation. A secure network transfer is used to securely transfer the images to the app from a hospital or physician's office.

**PEPID-** PEPID is used commonly by students and interns as a clinical demonstration and education tool for paramedics, medical and dental students. The app help the health care professionals to diagnose faster based on symptoms provided at the emergency room. It provides access to information about possible conditions, treatments, drug allergy, drug interaction checker.

**Clinical Skills-** Clinical Skills is the best examination, demonstration and practice app that allows quick analysing and keep an accurate track on clinical skills and interventions. This app creates awareness for the proper professional patient care practice and manages an individual's clinical competencies, access future learning and keep a personal record on skill report in a simple, customizable and intuitive mobile app. Clinical Skills supports the clinician and allow access to clinical cases and learning opportunities that includes airway interventions, vital sign assessment, wound management or drug administrations to encourage enhanced professional practice depending on one's own clinical scope.

**Prognosis-** Prognosis is a skill development app for physicians, medical and dental students, nursing and other health care professionals that aids in increasing the ability to diagnose and manage key clinical presentations associated with the disease. This app provides access to various relevant facts, brief about underlying diagnostic and management rationale based on literature evidences and related studies across the world.

## **2) Virtual Consultation (VC) and Clinical Practice Apps:**

VC or telemedicine apps eliminate the paperless patient management by electronic dental forms, e-prescribe integration, online appointment portal and provides smart consultation services. VC apps can help improve the quality of dental services rendered and make communication with patients more effectively.

**Lybrate-** Lybrate is one of the best online consultation forum in India that provides premium health care services and immediate online doctor consultation through mobile phone, desktops, or laptops using Chat, Video, and Audio call access through the network of expert and certified health care professionals in a convenient, secure and approachable platform.

**Rhinogram-** Rhinogram is a patient engagement platform that provides well-structured virtual care solution. Various features includes sending texts or images, live video consults, communicate with patients through social media messages and enable patients to contact the practitioners website as and when required. It collects new patient information, medical records, consent, and other health data through customizable forms and e-signature capabilities.

**Hi-Doc/Teladoc-24/7- Hi-Doc/GYANT App-** GYANT offers benefits both to the patients and health care providers. Consumers or patients responds to a set of questionnaire to avail list of doctors available for assistance or self-health care tips depending on the data provided. AI-Based chatbot recreated human interactions and guides patients to choose telehealth option by getting an appointment online proceed further to visual consultations through video conference or visit the hospital-in-person as convenient as possible by scheduling. At the hospital, using the data provided already, patients spend less time during the appointment.

This one-on-one integration provides easy and quick communication, enables benefactors to form a better diagnosis, prepare treatment plans, prescribe medications, and import the patient's most recent medical history/record details to proceed further management.

**Mfine-** Mfine is an online consultation application that give access to video consultation, call or online chat with medical experts instantly. Various other services includes health assessment, high safety standard laboratory test appointments, online reports, and convenient booking for diagnostic centres (MRI, CT Scans). At home health checks, sample collection, personalized doctor consultation from certified labs to ensure best hygiene and safety standards.

### **3) Clinical Administrative (CA) and Practice Management Apps [13-15]:**

Clinicians use these apps to lower the administrative cost, streamlining the process of administrative practice, promotion of their dental practice and provides dental office management news and resources to modernize their practices through comprehensive business advice and planning to solidify the relationship with the patients. CA apps are utilized for requesting a dental appointment, smart scheduling the dental treatment, manage patient's record, storage of pre and post-operative information, reputation management and even



guiding the clinic location access thus connecting, interacting, and transacting with patients in an effective and easier way.

**Appointik-** Appointik is a practice management app that help medical/dental professionals to deliver digitalization to patients, organize their work flow, access information about the patient, easily schedule appointments, update their availability, host consultations, prescribe medications online, sending consultation and other services bill details. Patients can view current appointments, real-time available status of doctors, schedule appointments, lab results visualization, health related information and billing details.

**Medicalid-** MedicalID is a comprehensive data management application personalized to create multiple medical profiles in smartphones. This mHealth app also shares the consumers/patients GPS location with emergency contacts and nearby health care emergency staffs/centres even after the app is closed.

**mConsent-**mConsent is an exclusive practice management app that serves as a digital platform to create stress free and paper free in-office environment in dental practice. This app provides comprehensive environment friendly front office, Past medical records and other necessary documents before the patient arrives at once to the doctors in real time practice.

**Docterz-** Docterz app is a new age clinic management app that provides unique ecosystem to establish convenient and easy clinical practice for doctors visiting multiple clinics or managing polyclinics. It assists and reorganize day-to-day concerns like administration and finances, adapts to each and every doctor's specific problems by providing display of comprehensive data of all clinics, schedule and sessions in one platform to ensure easy clinic management and patient care.

**Folda Patient Management app:** Folda is a patient management and cloud based practice manager archiving software for health care professionals that features patient's record system in a simple, affordable, and easy to use cloud-based application. The app keep track of patient health folder by organizing profile information, medical history, treatments history, payments, medications list, signature, prescriptions, diagnosis, case related photo albums with message reminder for their follow-up examinations.

**VisualDx-** VisualDx is a patient engagement and satisfaction management app that uses visual reference tool influencing AI technology and a comprehensive digital image atlas to improve medical decision-making worldwide among health care professionals. Clinician can build personalized profile of patient's history, recent travel, demographic data and allergies thus aid in identification of infectious diseases and travel-related illnesses with public health resources.

**Practo-** Practo is one of the leading clinical administrative and practice management app in India for doctors, clinics, hospitals and corporate clinical establishments. It provides video consultation services, expert surgical care, access to find and book appointment with available doctors, schedule follow up, message alerts, lab tests and checkup schedules, order medicines and obtain digital prescriptions similar to clinic experience without physical visit in an easy and convenient way. Practo offers clinical administration and digital manager guidance by assisting doctors/medical specialists practices in area by name, speciality, or clinical procedure, exploring patient stories, doctor's online profile, locations, fees and experiences with hassle-free online doctor appointment scheduling and follow up.

#### **4) Supply Chain Management (SCM) Apps<sup>[18, 19]</sup>:**

The SCM apps promote easier and quicker supplies utility by reducing the time, automated review of supplies, reminders, payment processing, reputation management and access all the services and products 24/7 as and when required.

**Sowingo-** Sowingo is a cloud based e-Commerce, clinical supply procurement and inventory management application used for efficient purchase of medical and dental supplies, monitor supply levels, and track all inventories by pairing marketplace with inventory systems and control features.

**Zensupplies-** Zensupplies is a supply chain management app that provides one-stop inventory management solution platform for dental office suppliers. The apps aids in ordering products from different vendors, compare prices of products across various suppliers, locate suppliers and track the duration of product delivery, provide price transparencies, reduce cost, product expenses, time and avoids product and budget deficiencies.

**Surgi Care-** SurgiCare is an advanced mobile inventory application tool for material management systems designed to address complex needs of dental and medical health care facilities from small health care providers to large hospital facilities. The system runs on inbuilt barcode facility that assist tracking, purchasing, and surgical preference cards of inventories across single or multiple locations. SurgiCare's functionality provides various inventory information on tracking using barcode patterns, label generation, expiry date, lot numbers, item search, inventory control, custom fields and allows the user to add multiple product descriptions, order creation, required quantities, re-order, upgrade stocks, invoice matching and notification alerts.

**Mymediset-** Mymediset is a medical Inventory software that helps medical and dental offices secure and keep track of equipment, tools, and controlled

substances. It is basically an System application and product add-on software for managing medical and dental equipment's, loaned medical kits and accessories, aid in efficient consignment inventory using cloud based solution.

**Med Deal-** MedDeal is an online medical equipment store application that provides medical and hospital supplies, surgical instruments for personal care, in-house, and hospitals inventories across India. The app provides comprehensive list of hospital equipment, surgical instruments, laboratory equipment, diagnostics equipment's, and rehabilitation aids used for many invasive and non-invasive procedures.

### **5) Customer Support and Relationship Management (CRM) apps:**

CRM apps are effective patient care review services that are vital to maintain patient-doctor relationship and prevents loss of patient's service by incorporating positive attitude towards one's practice and follow up information needs. Healthcare CRM software helps professionals in hospitals and private practices attract new patients and improve communication with existing patients. These apps helps clinicians to organize all patient information and plan routine visits, follow-ups that strengthens dental practice by creating automated call reminders, automated appointment reminders, online scheduling of appointments, post procedural follow up, review requests and feedback systems thus providing an opportunity of gaining insights on the patients experience.

**DynaMed™-** DynaMed™ is a clinical decision support (CDS) system tool that combines quality evidence based information, literature guided patient care, expert guidance and real time updates to the health care professionals and clinicians to deliver accurate, simple and quick answers to their customers/patients at the point of care.

**Crelio CRM-** Crelio CRM is an end-to-end process application that includes patient engagement, patient management, digitally transform their medical experiences, provide feedback recommendations to redesign the patient experiences and also aids in online promotions of best healthcare packages. This app keeps the track of appointment management, automated scheduling, patient's feedback, recommendations, treatment satisfaction, communication management through calls, messages, email alerts, notification alerts, process e-forms, marketing automation, medical history records and management, statistical reports and social media integration.

**Tray Minder ® Aligner Tracker-** Tray Minder ® aligner tracker is created by experienced dental care specialist (orthodontist) to help the busy patients stay on track with clear aligners (Invisalign®, Clear Correct®, Clarity® ) along the course of orthodontic treatment and get the best promising results.

**InfluxMD-** InfluxMD provides health care marketing experiences ranging from small practice clinics to large hospitals. It assists sales and marketing services designed specifically for clinicians, simplifies the lead acquisition, promotes conversion process efficiently without changing clinical workflows, and combines SCM with CRM, lead management, marketing automation and online engagement facilities with AI, ML, and DL algorithms to recognize marketing strategies, needs, prospects and opportunities.

**Play Maker Health:** PlayMaker Health CRM is a cloud-based customer management application designed specifically to provide post-acute care takers/suppliers. This app offers relevant market data related to home care services, hospital ranking, patient's disease category, location of services, readmission rates to the health care professionals and aids in educating the benefits of such services and build a positive relationship between the patients and hospital centers. This application features tools for monitoring referral activities, cases as well as the overall impact of your referral and outbound communication activities.

#### **Advantages and Limitations:**

mHealth applications provide wide range of advantages to the practitioners and consumers/patients by offering new and fastest way of collecting community and clinical health data, easy and quick delivery of health-related information to the practitioners and researchers, generate cost effectiveness and improve the capacity of health systems, strengthening health care delivery and provide quality, convenient access of health care services with real time monitoring of patients. The mHealth also keeps a track record of our day to day health condition, related medical condition on a daily routine basis. This therefore, helps practitioners to induce more conscious and mindful dietary habits, exercise and health among their consumers/patients. These apps work very effectively, encourage and foster a healthy behaviour and even a healthy life. mHealth also guides health care professionals to acquire clinical skills, update or upgrade medical knowledge, enhanced communication with patients, and manage clinical practice effectively and efficiently.

Over the years, these apps have shown good assistance for dental professionals by its active participation in oral health promotion, health education delivery, clinical practice and supply chain management and enhancing customer relationship. Despite several benefits, there are some limitations and drawbacks that creates dilemma in the minds of health care professionals towards its use such as accessibility to mHealth, complex computer languages, data privacy, data security, inaccurate content, lack of information control/evidences, and expert involvement during application development, prone for virus attacks and lack of regulatory guidelines for formulation of such health care applications.

**Conclusion:**

There exists a gap between utilization of medical or non-dental electronic resources, software applications and acceptance of new technology in clinical setting at dental professional and oral health care delivery systems. With the advancements in AI, introduction of ML, DL, cloud and augmented reality, the future of mHealthcare apps looks encouraging in the field of dentistry. It can be assured that there will be an increased number of dentists and dental students using medical apps in the near future to provide improved healthcare delivery, better personal health tracking and enhance the overall quality of patient care.

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