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Dental Provider's Guide to the Electronic Dental Record

A Technical Report prepared by the American Dental Association and registered with ANSI.

ADA American Dental Association®

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AMERICAN DENTAL ASSOCIATION TECHNICAL REPORT NO. 1030 FOR DENTAL PROVIDERS GUIDE TO THE ELECTRONIC DENTAL RECORD

The Council on Dental Practice of the American Dental Association has approved American Dental Association Technical Report No. 1030 for Dental Providers Guide to the Electronic Dental Record. Working Groups of the ADA Standards Committee on Dental Informatics (SCDI) formulate this and other specifications and technical reports for the application of information technology and other electronic technologies to dentistry's clinical and administrative operations. The ADA SCDI has representation from appropriate interests in the United States in the standardization of information technology and other electronic technologies used in dental practice. The ADA SCDI confirmed approval of ADA Technical Report No. 1030 on January 7, 2015.

Publication of this technical report that has been registered with ANSI has been approved by the American Dental Association, 211 E. Chicago Ave., Chicago, IL 60611. This document is registered as a technical report according to the *Procedures for the Registration of Technical Reports with ANSI.* This document is not an American National Standard and the material contained herein is not normative in nature. Comments on this document should be sent to the American Dental Association, 211 E. Chicago Ave., Chicago, IL 60611.

This technical report was prepared by SCDI Working Group 11.2 on Practitioner's Guide to the Electronic Dental Record. SCDI Working Group 11.2 prepared this report at the request of SCDI Subcommittee on Clinical Informatics (Mark Diehl, chairman).

The ADA SCDI thanks the members of Working Group 11.2 and the organizations with which they were affiliated at the time the specification was developed:
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FOREWORD

(This foreword does not form a part of American Dental Association Draft Technical Report No. 1030 for Dental Providers Guide to the Electronic Dental Record)

In 1992, there was interest in the standardization of clinical information systems related to electronic technology in the dental environment. After evaluating current informatics activities, a Task Group of the ANSI Accredited Standards Committee MD156 (ASC MD156) was created by the ADA to initiate the development of technical reports, guidelines, and standards on electronic technologies used in dental practice. In 1999 the ADA established the ADA Standards Committee on Dental Informatics (SCDI). The ADA SCDI is currently the group that reviews and approves proposed American National Standards (ANSI approved) and technical reports developed by the standards committee's working groups. The ADA became an ANSI accredited standards organization in 2000.

The scope of the ADA SCDI is:

> *"The ADA SCDI shall develop informatics standards, specifications, technical reports and guidelines and interact with other entities involved in the development of health informatics standards aimed at implementation across the dental profession."*

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AMERICAN DENTAL ASSOCIATION TECHNICAL REPORT NO. 1030 FOR DENTAL PROVIDERS GUIDE TO THE ELECTRONIC DENTAL RECORD

SCOPE

This technical report is intended to increase the awareness and knowledge of dentists and dental healthcare providers about key concepts of the Electronic Dental Record (EDR) and the standards development process. The document can serve as a primer on the subject and as a tool to help dental offices implement an EDR. This report is useful because the application of computer-based systems in the management of dental practices, both private and institutional, have proven to be a significant and necessary resource. Over the past 25 years computer based systems supporting patient care have evolved from accounting and administrative information systems to digitally based patient record systems.

This paper also serves as a primer for consumers, private and institutional, who will use and develop electronic dental records and/or components of these record systems, based on concepts of computer-based patient records and their application to dentistry. Perspectives related to the use of these systems in private practice, as well as institutional users such dental education and governmental organizations that provide dental care, are included as part of this technical report. The report is also intended to support the previously approved dental informatics standards: *ANSI/ADA Standard No. 1000, Standard Clinical Data Architecture and ANSI/ADA Standard No. 1027, Implementation Guide to ADA Standard No. 1000.* ANSI/ADA Standard No. 1000 is a model-based standard clinical data architecture that addresses the need for standardized electronic health data and provides a blueprint for developers of health information systems

Ultimately, the document's purpose is to improve an end-user's understanding of an EDR and its components as well provide an understanding of what can be done with computer-based systems that cannot be done with paper-based analog records. Additionally, this document will cover any implementation issues surrounding the computer-based oral health record.

To provide an adequate reference point, this document will provide users with a better understanding of the evolution of electronic records in dentistry. In recent years we have witnessed the migration from "clinical information systems and practice management systems" (PMS) utilized for business functions to "computer-based oral health records" that incorporate clinical point of care computing. With the vast majority of dental practices already "computerized," users of these systems need to become more knowledgeable about clinical data and patient record systems to become a more informed consumer.

Who Benefits from the Electronic Dental Record (EDR)?

Patient	Patient information is available at the "point of need"
Practitioner	Point of need access, decision support, effective patient management
Managers	Access to individual and aggregate information for effective management
Staff	Improve time management related to records management
Payers	Increase accuracy of information and efficiency of reimbursement process
Community	Improve health and manage of a population of patients

I. INTRODUCTION AND HISTORICAL PERSPECTIVE

How did we get here?

Going back to their initial training on a dental chart or dental record, dental providers and staff will recall that medical and dental records used to be cryptic notes intended only to aid the doctor in treating his/her patients with reminders such as what had been accomplished for the patient as a reference point for the patient's next visit. A significant driver to the change in records purpose for healthcare in general was the medical-legal aspect that transformed records from more than just cryptic provider notes to documentation and demonstrations of the quality and thoroughness of care. In comes the new adage "if it wasn't written down it didn't happen" and records became much more sophisticated and detailed in the information collected. This paradigm shift in documentation helped support initial steps for improving patient care, managing patients and supporting better patient outcomes.

It was 40 years ago or more when one observed the first electronic systems appearing in dental practices. Many of the initial efforts were completed by a team of dentists and computer programmers developing systems from a narrow perspective. These electronic systems were principally administrative and transactional in nature and their principal function was to be an accounting system. That is, they were in no way intended to replace the dental chart or record used in the operatory.

As some of systems gained more market penetration, additional features were added and these dentist-programmer teams became "vendors" of practice management systems (PMS). PMS increased functionality included in patient and professional communications as well as electronic transmission of information for payment for services provided, such as creating insurance claims. Let us not forget most systems initially were text based in terms of entry, retrieval, and display of the information in them. It wasn't really until the 1990s that graphical systems for dentistry matured to be viable in PMS. This lead the way toward the consideration of how these systems could be used more efficiently, as well as intuitively, and could now be considered for use at the dental chair.

Another significant effort over the past 20 years has been the transition from radiographic film to digital images. Over the past 15 years technology has evolved to integrate seamlessly multiple information systems. These have been done so that to users in dental offices they appear as one system centered around the patient. In addition to PMS and EDR vendors, companies developing specialized products for patient communications, digital imaging, dental laboratory support and patient education have programmed these systems to exchange or access/link from Electronic Patient Record systems. Prior to data exchange standards development, either through recognized standards processes or "de facto" standards based on market share, initial systems developed for use in dentistry were proprietary in nature. This obviously presented significant obstacles when providers needed to exchange data between proprietary systems or change systems and/or vendors.

II. The Electronic Dental Record

What is an electronic dental record and what's different about it than the paper-based record?

What is an electronic oral health record, also known as electronic dental record (EDR)? In the strictest sense it is the part of the record that has to do with the direct patient care interaction. This is in contrast to the things we do from a business perspective such as accounting for the charges for patients' care, the dates of their appointments, and the practice schedule. We need to look at what we have done in terms of collecting information about the patient, e.g., histories and physical examinations, documenting those findings, and maintaining the narrative of the patient's treatment.

In 1919, the American College of Surgeons specified the nature of the information comprising the patient's medical record as:

- patient identification data,
- the chief complaint,
- personal and family history,
- history of the present illness,
- results of the physical examination,
- results of consultations, radiographic examination and clinical laboratory,
- a provisional or working diagnosis,
- medical and surgical treatments provided,
- progress notes,
- histopathology – gross and microscopic findings,
- the final diagnosis,
- patient condition on completion of care,
- follow-up notes, and
- autopsy findings in the event of death.

In its 1919 Minimum Standards, the American College of Surgeons established that the information in the patient's health record be complete, accurate, and accessible. For most of the twentieth century, patient health and other clinical data were typically recorded and maintained as a paper record. In the last two decades, however, this media failed to keep pace with operational, regulatory, and technological advances. The advantages of automation over physical media in integrating and presenting patient health information, and the common body of professional knowledge for clinical care, are further reasons for applying information technology to clinical care. We also know that the record has been the collection point for diagnostic aids for the patient, the major component of which being imaging or radiography.

We are now in the "digital world," where information is in a computer readable format, providing benefits in terms of access to information, its retrieval, and sorting and leveraging when the collected information is aggregated. Now we have the ability to tie together administrative information and functionality, such as patient registration and financial transactions directly with the clinical aspect of patient care.

Many healthcare professionals originally thought about the initial approach of this change from paper to computer-based records more in terms of recreating what we did with paper charts in an electronic form. With that mindset, information from the dental record is a static representation, non-searchable or reportable, making it unusable for practice management and practice analysis, for example. Thus, an approach of codifying the information collected for the creation of databases was developed. This approach made the information retrievable and sortable so it could be used in a more meaningful way.

Today, we need to think in terms of modules of functions that form the EDR, fitting together in a matrix create we can think of the contemporary EDR in whole. It's actually much like a car manufacturer or a computer manufacturer who integrates components to build a useable product. From the perspective of understanding the EDR, we will discuss the separate components that form the whole of the record in this report.

These special features, or add-ons to technologies such as imaging, electronic claims, or electronic communications, often were supplied by different vendors that had separate systems that many times required duplicate entry of patient names in chart numbers, for example. But in recent years strides have been made toward achieving a vision of an

integrated record, wherein systems such as imaging, electronic record, administrative systems, and communication systems are able to exchange information with each other seamlessly.

To reduce the data redundancy necessary to run a dental practice today, we must think about how to leverage this information for such purposes as decision support, integration of evidence-based care, analyzing practice metrics to make our practices more efficient and effective, improving patient safety, and improving patient communications. This is why today we think of the electronic dental record as more than just the one practice management system, but again as a variety of components melded together to allow us to provide patient care, to document that care, and to use the information effectively to improve the quality of our patient care and our practices.

In sections ahead, we will discuss the components of the EDR, how they relate to the electronic medical record, and how they comprise a whole system in terms of patient care. We'll look at what is driving its implementation as well as some of the clear implementation issues. Additionally, we will look at how electronic records for the private practice are different than institutional settings, how this standards in dental informatics and dental computer technology play a role, and finally we will review some of the practical uses and benefits of the EDR today and where we will be going with them in the future.

III. The Paradigm Change

What's driving the use of information technology and electronic health records?

One of the answers is that "*the horse left the barn."* Our society has embraced the digital era. We have seen and recognized the benefits of this transfer and access to information. Now, there's actually become an expectation that all fields should be able to use technology and information systems for improvement in efficiency. There is now an expectation for the evaluation of the quality of care and for changes in strategy and direction to be made if problems are noted. We have seen a logarithmic growth in terms of capability and computing power at the point of care or the point of experience. We have also seen a tremendous reduction in the size of computing devices along with increased computing power and significant advances in the clarity of the visual display (screen resolution). We've also seen significant increases in networking capability, increasing how much and how fast data and electronic information can be transferred and retrieved. Furthermore, we have seen tremendous changes in operating systems that allow computers to handle much more complicated instruction sets. The government has intervened in terms of its concern for patient quality and safety – more recently manifested by the meaningful use criteria for certified electronic medical and dental records. Finally, we have seen a change in business-to-business strategy, where electronic technology has become a way of doing business. All these factors are impacting the dental practice and driving us to incorporate PMS/EDR systems into our practices.

IV. Adoption of the Electronic Dental Record

Why should we be interested in EDR; what are the benefits for the practice, the dental team and their patients?

Initially, the automated health record was only an electronic equivalent of the traditional paper or problem-oriented record. Computer-based patient record vendors limited their products to a change of media, with the computer screen and printout replacing the previous hand or typewritten text pages. While many electronic health record products continue to be automated versions of paper-based documents, experience has revealed that merely exchanging paper for electronic technology carries along many of the shortcomings of paper documents. In addition, when working with larger patient loads and increasing volumes of clinical data, many of the failings of paper documents are magnified by the efficiency which automation provides. Retaining the look and feel of paper-based health records directs attention to

the form of the record rather than the substance of its data content and how this data is best used by the individual clinician. It leads to a focus on the interaction with the user rather than how the information content can be best employed to enhance personal health, care delivery, documentation, and other critical uses.

The 1997 revision of the Institute of Medicine report *[#14)* on the computer-based patient record effectively summarizes the failings of the paper document among the reasons for automating patient records. Additionally, Murphy [*#15*] discusses the impact of technology on this collective body of patient and related clinical data to clinical care as well as summarizes the rationale for transforming the paper-based health record to an electronic health record.

There are many reasons for transitioning from the paper-based health record to an electronic one. But let us just mention a few. PMS/EDR systems allow practitioners to use information when and where we need it, including at the point of care, the front desk or at the doctor's home or wherever it may be helpful to have information available to discuss with the patient or enhance the patient care process. The systems help manage patients better from a scheduling perspective and make the administrative functionality of the dental office more efficient and effective. Electronic systems facilitate patient safety and patient satisfaction by guiding us, in terms of information collection, to an effective diagnosis treatment plan for our patients. This provides significant patient management capability and improves our communication with patients.

We are now in the era of electronic financial transactions and PMS have provided a means of collection of data at the "point of care" making the transactional component of dental care more efficient. Now, we are looking at venues for patients to access and update their own information by being able to tie systems together to enable patients to perform these tasks. The technology has allowed us to better engage patients in their care by their visualization of problems, represented either graphically or narratively. We now have entered an era where the dental record, histories, and financial transactions are tied together with imaging and communication systems. The use of electronic records has been determined to be necessary for improving patient safety reducing error rates, lowering administrative costs, as well as providing a "seamless" health care record.[citation needed?]

Now, governmental initiatives are in place to promote and incentivize providers to use electronic tools. Increased efficiency in the practice of dentistry can be realized through improved patient management that results from effective access to patient care related information when and where it is needed. With the use of databases and query tools, longitudinal "quality assurance and improvement" programs can be implemented. In addition, strategic planning for the dental practice, whether private, educational or governmental, must be supported by objective data derived from patient information systems. Society is demanding accountability for treatment outcomes and the rapid identification of epidemic problems, diagnostic or therapeutic. Computer-based systems are the only realistic way to support these efforts. As these solutions are taken to the point of care, interactive linkages to knowledge bases, such as drug information systems and practice guidelines, will further facilitate the quality of patient care. The ultimate goal is for those who need access to comprehensive electronic health records at the point of patient care to be given authority in secured and protected manner.

V. The Electronic Oral Health Record / Electronic Dental Record

What is an electronic dental record or an electronic oral health record?

As we discussed earlier, the EDR is actually a multitude of components. It consists of the electronic dental record application, an imaging system, a prescription system, a scheduler, and additional functions that will be described in the next sections of this document. To specify what needs to be in an EDR from a database standpoint, *American Dental Association/American National Standards Institute (ANSI*) *Standard No. 1000—Standard Clinical Data*

Architecture for the Structure and Content of an Electric Health Record: 2001 was developed. In 2010, the second edition of ANSI/ADA Standard No. 1000 was approved by ANSI as an American National Standard. Patient Electronic Dental Records modules should include:

Patient Registration and Patient Demographics

In an electronic record system and EDR the unique identity of patients is paramount. Their identity is normally captured at the time of registration, on or before the patient's first visit. EDRs allow almost limitless capture of patient characteristics. Identity, communication, date of birth, physical address, responsible party, and communication means (phone number, email or text contact) are collected. With the growing significance of third party payers for care, information about those entities is collected, such as insurance carriers. Administrative functions associated with these systems enable dental practices to collect much more information about patients that can be beneficial in patient and practice analysis and practice management. Examples could include financial class, office alerts, patient status, and patient preferences.

Patient Care Transactions

The fact that provider, patient, and procedure activities can be readily documented is related to the ability to codify and capture the information as data. One of the first universal coding schemes for dentistry was the backbone of recording this information, *CDT – Certified Dental Terminology* (Chicago: American Dental Association), which efficiently enables this part of the system. In the US, it has been a standard for capture of clinical transactions.

Secure Capture and Exchange of Insurance Data

The most frequently asked question in dentistry today is, "How does my dental insurance cover this procedure?" A patient's dental care should never be dictated by their insurance coverage. However, the faster and more accurately we answer this question the sooner we can focus the patient's attention on their needs rather than their insurance coverage.

Traditionally, this question often resulted in a long detour in discussing and delivering some very routine treatments such as sealants, necessary radiographs, and fluoride treatments as well as more extensive treatments such as prosthetic work. When it came to sealants and fluoride treatments, the variables for each insurance policy are so diverse that the only way to accurately determine these benefits was to send the insurance carrier a predetermination of benefits form for each procedure to be performed and wait months for a response. This process meant not scheduling or performing the needed procedure until the insurance company responded.

Today's technology allows the dental claims and predeterminations, including any necessary attachments, to be sent electronically via a modem, which greatly speeds up the process. The best use of today's technology in this situation is the use of a computer in the treatment room with dental insurance information database software. The software can be integrated with your dental management software and allows instant access to coverage information on tens of thousands of dental insurance policies.

The information it provides includes, in addition to coverage, age restriction, tooth restriction, and frequency periods for procedures such as prosthetic replacement, porcelain coverage, posterior composites, full mouth radiographs, fluoride treatments, and sealants. A standardized format for all policies allows for easy use with concise and precise answers. Additionally, monthly updates helps insure the software's accuracy and allows for new policies to be added on a regular basis. Having accurate insurance information at the time of the appointment allows the hygienist and clinical staff members to be proactive regarding the benefits of the dental care and how the patient's insurance can assist in

paying for the treatment rather than reactive concerning the information the patient receives from his or her dental insurance carrier.

Scheduling

We need to be able to schedule the patient for appointments and track their attendance through the scheduling component of the system. Scheduling with a PMS is customizable on the fly and allows a direct connection to the patient's clinical data. The EDR aids scheduling by making patient data readily accessible from the schedule, whether in the office or from a remote location. Electronic schedulers can provide a rapid way to access the patient's information by linking to the data from the schedule's graphic representation. An additional feature linked to the schedule that would be helpful to the provider and staff is a summary view that includes such items as medical alerts or a list of the procedures to be performed at the appointment. This feature provides a working framework for operatory preparation and time management issues related to clinical care.

Health and Medication Status and History

Today, a patient's health status and medication profile are increasingly complicated. It is common to find patients with various dental needs who are on multiple medications and whose compromised health status is being treated by several physicians at once. Traditionally, one would research several reference manuals and consult with the patient's physician to determine which dental therapies were appropriate for the particular patient.

The technology of clinical reference software allows us to input the patient's medical conditions, medication regime, and proposed course of treatment. Then, the software will analyze and output recommendations for treatment, possible side effects, and the complications of the present and proposed course of treatment. The data is then maintained in a database, which allows for easy access and updating as changes occur. Quality software of this type is available as Internet based programs or on DVD/CD-ROM and is updated on a routine basis to insure that it is current with the latest medical findings. Network versions of this software make it possible to have this type of information available at all workstations in the dental office and allows for accessing separate patients on different workstations at the same time.

Medications

Capturing a list of medications in the management of patients has been a standard for many years. However, related issues arose, including where that information is listed, how it is brought to the attention of the clinician providing care, and medication reconciliation both with the medications the patients is taking and those that will be prescribed and the relationship of the medication to the dental management of the patient. The EDR provides a standard location where medications can be listed and updated and displayed for the clinician. Once this can be integrated with an electronic prescription product, looking at drug interactions becomes a routine activity that in some instances can be automated into a decision-support system prompting clinicians to potential medication-related complications.

Medication reconciliation can help in decisions about which medications are active or need renewal and can help address over-the-counter and herbal medications, their interactions with other medications and their relationship to the patient's care. This function ultimately aids the clinician in providing better patient safety related to their medications. Electronic prescriptions can also aid in the prevention of medical errors, such as illegible handwriting for medications, dosage and use, as well as prevention of substance abuse. Additionally, electronic prescriptions can impact the transactions of the dental care process by supporting real time determination of whether formularies are covered by benefit plans.

Physical Exam – Extraoral and Oral Health Findings

There is increasing importance given to capturing general health physical findings, such as blood pressure, weight, height, and temperature, which have direct patient management implications. With the endorsement of meaningful use of electronic records, the government has incentivized health care providers to collect, track, and use medical information in patient care intervention to improve the systemic health of patients. Hypertension is one of the areas of focus.

Some conditions need “observation” and we need a mechanism to track considerations. For instance, “drop down” menus to note oral medicine type problems/conditions need to be created, similar to treatment planned and completed procedures. Mechanism for tracking oral medicine mucosal problems also need to be created. To help, these problems can be represented in text and/or graphics.

The clinical record itself is made up of diagnostic findings (which can be represented visually as an “Odontogram”); and other features such as medical and medication alerts and lists of those, our patient's history- both medical and dental- and the physical findings, including hard and soft tissue examinations, periodontal and endodontic examinations, plus progress notes about patient visits that incorporate narrative descriptions of the patient care process.

Periodontal Charting

Recording pocket depths on paper has always been a burdensome task, involving either a second staff person or an excessive amount of time recording the six pocket depths per tooth; of which only one view was available with limited patient education value after all that effort. Computerized voice recognition programs now allow for a single clinician to efficiently input the data into the patient record. Once this data has been computerized it can be viewed in several different formats (numeric, bar graph, line graph, change between recordings, etc.), with various color coding and other techniques to help educate the patient on problem areas and areas of improvement. Digital periodontal probes can provide another method to acquire periodontal data efficiently without an assistant.

Imaging – Digital Radiography and Photography

Conventional dental radiography involves placing the film, positioning the patient, exposing the film, and then waiting for the film to develop in a chemical processor. The process is time consuming, has many variables, and if any adjustments need to be made it usually means redoing the entire procedure. If the problem is due to film placement or positioning, any reference to the previous position will be lost. In the same vein, If the problem is due to exposure or developing problems, nothing can be done to save the image.

Direct digital radiography, both intraoral and panoramic, allows for almost instantaneous viewing of the image. If the positioning of the sensor or the patient needs to be changed, it can be noted before the patient, sensor or X-ray head has been moved. This allows the clinician to use these reference points when doing any necessary repositioning. If the image exposure is not correct, often times the image can be made acceptable by adjusting the display settings. This immediate viewing the of the image allows you to make any needed exposure adjustments before any subsequent exposures are taken, minimizing retakes and saving time and radiation exposure to the patient.

Digital photography and imaging allow accurate and instantaneous documentation of a patient condition. These images can be used in recording both hard and soft tissue findings as well as for patient identification.

Today, all images in a dental practice should be stored digitally, whether they are radiographic, photographic, schematic, or text. The images can be captured in several ways: by radiographic sensors, digital photographic cameras, intraoral cameras attached to video capture card, or by scanning film images with a scanner. These images are easily stored, duplicated, and transmitted allowing for real time consulting with specialist and insurance carriers.

Digital images are excellent for patient education and case presentations with the added benefit that they can be printed or shown on a computer screen at any time. This allows the hygienist to capture the images at one time and review them then or at another appointment, showing the patient the proposed treatment, how their treatment is progressing, or the changes that have occurred in their dental health.

A roadblock in the adoption of digital radiography was the inability to exchange images across proprietary vendor platforms that did not communicate with each other. This problem was solved with standards development work done by the medical informatics / hospital / physician/ vendor imaging systems community, which resulted in a standard for medical images called DICOM (Digital Imaging and Communication in Medicine). Digital imaging and practice management system vendors have adopted the DICOM standard to help ensure that their systems are capable of exchanging images with different vendors' systems.

Over 10 years ago, dentistry, through the ADA Standards Committee on Dental Informatics (SCDI), began to develop standards for digital imaging to provide a framework for acquiring, retrieving, displaying, and exchanging digital dental images. Since then, multiple guidelines (technical reports) have been developed by organizations developing standards for dental imaging (see Bibliography). There are now several systems that are completely DICOM – conformant, from image capture to image communication.

Dental Laboratory Support

With the advent of electronic patient records, the need to digitize many other dental processes became apparent. Digital systems facilitate communications between the dentist and the laboratory technician regarding prescriptions for prosthetic devices. Much like electronic prescriptions for medications, the dental laboratory needs to receive concise instructions on how to fabricate prostheses in a manner that keeps patient confidentiality at the forefront. The ADA SCDI has developed two technical reports related to dental laboratory electronic work prescriptions: *ADA Technical Report No. 1041, Content of Electronic Laboratory Prescriptions*; and *ADA Technical Report No. 1054, Electronic Dental Laboratory Prescriptions*. Electronic laboratory prescriptions aid in the storage and retrieval of those prescriptions at later dates, providing the data elements needed to evaluate outcomes of care when a prosthetic treatment was involved. In addition, once network communications with the laboratory is in place digital images can be part of the prescription process, which is particularly important for restorative color matching. This form of communication allows this information to be stored in the EDR for ready access and evaluation at future times. Data from the lab Rx that can be stored and retrieved can improve patient management and allow for aggregation to evaluate requests, which supports management of the entire practice as it relates to dental laboratory procedures.

Restorative dentistry is now supported by CAD-CAM type devices, which provide for the acquisition of information (digital impression) and fabrication of intraoral prosthetic devices. CAD/CAM files will not be directly stored in the EDR, however, integration of a CAD/CAM system to the EDR would provide rapid access to that information when and where it is needed.

Patient Education

In the past, patient education consisted of a few demonstration models. It included a flipbook with a few schematic

drawings in it and some brochures. Today, with 3D multimedia presentations designed specifically for either the treatment rooms or the reception area, the entire concept has gone through a major transformation. Presentations have been designed in such a way that some sections can now be used as an overview while others are designed to give great detail on specific procedures.

The treatment room sections have been created to assist the staff in giving the patient information about the details of their procedures and post care. Integration with the dental management system allows for documentation of presentations that have been viewed, helps the staff understand their patient's knowledge level, and supports patient informed consent on a particular treatment. For these reasons, multimedia clinical based patient education needs to be a part of every practice's technology program.

Patient Communications

The long-term success of dental practices is dependent on patient satisfaction. Good patient satisfaction is driven by excellent patient communication in redundant and varied formats. Electronic record systems can be tied to patient communication functions such as letters for follow-up, educating patients about services offered by the practice, follow-up procedures that might be necessary, or treatments that still needs to be rendered. EDR coupled with clinical information system functionality allow for both automation and customization of these types of communication. As dentistry is presented with new modalities and they become available in the clinical environment, patients will need to be educated as to the availability and the nature of these procedures.

In addition, e-correspondence becomes part of the EDR, further aiding the office staff in overall patient management. With the push toward meaningful use of technology in healthcare, the desired endpoint is to give patients ready access to pertinent information in their electronic health record and to allow them to be more participatory in their care. Today we see e-correspondence manifested in systems such as patient portals that provide access to their information and communications with their provider.

Patient Management

A combination of EDR with transactional functions such as patient scheduling will create tools for patient management, or what we used to call patient management systems. The blended information allows us to provide better patient care in a proactive way, such as reviewing patients who are overdue for care, targeting educational materials based on treatment plans, modifying care for patients based on systemic conditions and/or medications, as well as by providing financial management for individual patients. With insight, systems can be set up in manner with the end in mind….such as deciding what information is necessary to more effectively provide care. Systems can also be configured to provide data for analysis and quality improvement. It is facilitated by standard and ad hoc queries of the system and presented in an intuitive manner to the dental team to translate into action items. Moreover, systems with standard export of scheduling information can be interfaced with automated call systems for such necessary tasks as appointment reminders.

Data Analysis and Reporting

The "practice management" aspect of the EDR is leveraged via the aggregation of individual patient data to groups of patients or the entire patient – provider base. Data analysis starts with critically evaluating the questions or purpose for the queries and the reports the EDR needs to provide. Many times standard reports from vendors provide the tools for support of everyday tasks. However, the ability to do ad hoc ,or customized queries, improves the value of the system for the dental team. Taken further, the ability of dental practices to add unique data elements without changing the core

structure of a system would allow for targeted management based on the individual practice differences in terms of patient mix, procedures offered, location, new treatment modalities, and local regulations.

Clinical quality improvement has become an important issue in the health delivery system. It encompasses both patient effectiveness (longitudinal success and cost care) and patient safety (preventing adverse effects of care). The backbone of support for quality improvement is clinical data that most logically is captured as part of the EDR.

Quality improvement involves creating measureable outcomes to objectively determine the results of improvement efforts. Databases of clinical information that provide the storage and retrieval means for queries have individual data elements such as patient zip code; the thoughtful establishment of the individual data elements allows more meaningful use of the information as it translates to patient care.

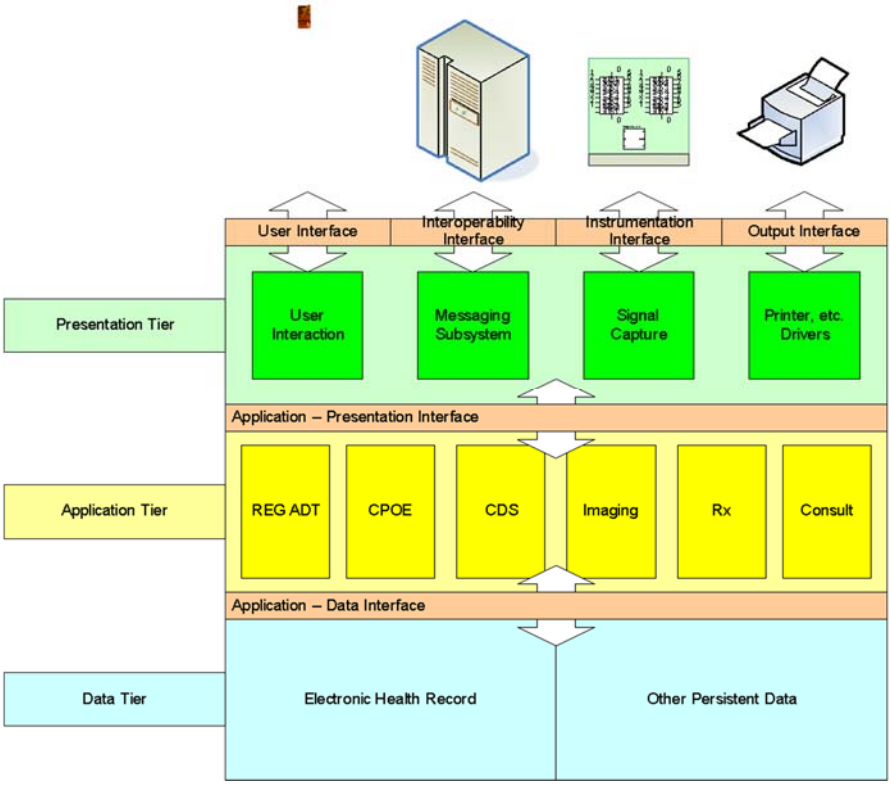
In dentistry as a profession, the design of these systems is best when there is standardization. That is because standardization provides vendors and users with better expectations for features and functionality that are needed. The ADA SCDI works with members of the profession and other informatics standards developing organizations (SDOs) for just this purpose. For more information about current SCDI Standards and Technical Reports used to guide the dental profession as computer technology is applied to patient care see the Bibliography section. The section below will also give you a brief example of “technical structure” standards that aid in the construction of systems used in today's environment with demands for easier patient and practice information, access, and exchange.

VI. What is an Electronic Dental Record and how are “standards” implemented?

Technologically, what is an electronic patient record?

The emerging *ASTM E31.19 standard for Standard Terminology for Health Information Systems* seeks to establish a consensus baseline to define such terms as computer-based patient record, electronic medical record, patient health record, etc. The physical architecture of the clinical information system proposed in the standard consists of three tiers (see Figure).

The type of application will either be a web-based or client server application. To decide which type of application will be implemented requires consideration of where the patient information/data is stored, secured, and protected from virtual and physical attack and its redundancy and process for retrieving if a hardware failure occurs. Today, there are web-based and web-hosted clinical information systems that the dentist purchases as a service. Once implemented, plans need to be in place to eliminate a single point of failure in EDR systems due to how critical they are to the practice As discussed previously, the EDR may comprise multiple systems and vendors, such as PMS/EDR/ digital radiography. So it is important to understand how these are tied together and the performance of the products coupled together.



EDR Tiers
Example of Clinical System Features by Architectural Component

In this illustration, the electronic health record, or computer-based patient record, resides at the data tier because it contains health data independent of use by the other tiers in the system architecture. Note that it is the system, rather than the patient record, that provides access to information, alerts and reminders, clinical decision support capability, etc. The EHR is one part of the data subsystem in such a clinical system. This is consistent with the views of both the ISO/TC 215 architecture and the definitions in other ASTM documents. In ASTM 1384 for example, the definition of the electronic health record is "a patient record that resides in a system specifically designed to support users by providing accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to scientific knowledge, and other aids."

VII. Implementing an Electronic Dental Record

What are the issues in implementing an EDR?

As one might guess, there are multiple infrastructure issues related to implementing an EDR. They are both hardware and software related for clinical applications and human factors, like understanding, motivation, training, and support. Other issues include peripheral devices, such as digital panoramic and sensor devices for radiography and cameras for image acquisitions. Another significant infrastructure issue is internal and external network capability and dependability.

Are people important to the success of implementation?

Of course this is a rhetorical question. To answer the question, one must first back up to the original decision to move

down the path toward implementing an EDR. Those in the decision-making seat need to understand what they want or expect a system like this to do. They cannot depend on a salesperson from a vendor to understand completely what the product does. Instead, dentists who make this decision need to become informed buyers. If they understand where they would like to be after implementation, in terms of what EDR does, how it works, how they will use it every day, and what they are going to do with the information that is collected, then they will be more satisfied in the long run.

Consider analyzing multiple vendors' products with common case scenarios with demonstrations from start to finish and note the intuitiveness, performance and output of the system. These professionals should consider the training, both initial and follow-up, vendor support for implementation and technical assistance ,and the long-term costs, including updates, refreshes, increases in storage space ,and addition of extra functions or system capability by the vendor. Practitioners should also consider training and staff motivation programs so that they learn to use the system effectively. Finally, the staff definitely should be involved in the implementation plan and process.

Effective training translated into a knowledgeable worker in the healthcare setting is paramount to effective use of computers in dentistry. Vendors should have follow-up support for the dentist and staff. They should also have a well thought-out and deployed support structure. Well-defined upgrade processes and responsibilities also are critical so that the responsibilities of both the vendor and dental practice are understood. Each office should be able to train new users effectively, usually following the train-the-trainer model, with a system expert. As new functionality is added the venue for training, whether face-to-face or online, should be in place.

What does the dental office need in order to utilize an EDR?

1. Technology Considerations

a. Software

One of the most foremost concepts that the practitioner needs to understand is the technological capability and requirements of the software he or she is about to purchase and deploy. A fully functional system is the sum of its parts. In this case these parts of the system are the EDR software, the hardware that supports it, the network that transmits it and redundancy that provides the ever-important backup. Effective utilization of EDRs is facilitated by thorough presentation of the software's capabilities and the practitioner’s, or employed consultant's, knowledge of system requirements when it comes to purchasing hardware to support the specific software application. This thorough understanding will also help them understand peripheral devices that need to be purchased for the system.

A "must-have" is very good vendor training, as indicated in the next section on human roles considerations. Keep in mind that the system is only as good as those trained to use it. Another consideration related to the software is the intuitiveness of the software in its use by providers and staff and how it appears to patients when patient education is involved using the EDR. Understanding both data input points and the outputs of reports, queries, and screens will help eliminate dissatisfaction with the system once deployed. Most software has customizable setup related to the individual practice and this should be reviewed and decided upon prior to its implementation to prevent unanticipated impacts on business processes and workflow. Software purchased also needs to be scalable to the particular environment it is deployed in, i.e., the number of dentists and hygienists accessing the system at any given time. Scalability is considered by the vendor in their selection of the database system the product is built on, such SQL, Access, or Oracle, for example. Practitioners must also know about any licensing issues and costs related to the underlying database.

b. System Migration and Data Conversion

As dentists begin to routinely incorporate these systems into dental practices, the need to be to transfer data in and out of multiple systems becomes apparent. The marketplace has continued to push developers to enhance products. With these enhancements and the growth in numbers of developers, dentists and dental institutions will be confronted with many choices as to systems that can be selected to support the management of patients and business of dentistry. The users of dental information systems need the ability to move data from one system to another as seamlessly as possible. Early systems written in proprietary format made it difficult if not impossible to transfer data transactions and files from one system to another, leading to a significant increase in workload and adding to the complexity of the migration from one system to another. As demand for electronic interface to payers of dental services grew, uniform standards for transactional accounting were implemented.

Additional considerations are other clinical support applications such as a drug information system or electronic Rx system. These systems may require additional software interfaces and could be add-ons to the primary EDR software. A good understanding of accessory software requirements and resources required is also important.

Moreover, data needs to be exported for a variety of reasons, including support for system migration. Many times export of data in spreadsheet readable format can also provide a mechanism for data analysis using standard office software.

c. Hardware – computer workstations and other digital devices

Once the software requirements are completely understood, then one can start looking at hardware requirements. Significant hardware investments will be made both at the data storage point, usually in the form of servers, or, in the case of a web-based version the vendor service supporting data storage; and the technical support for end point devices, clients or terminals to view and input the data. The typical configuration has been the client-server model, where processing is done both at the server, where the database of the information resides, and at the client in the operatory or office. Those systems that are client-server architecture will have requirements for the specific client machine. Technical requirements of client computers may be different at the clinical “point of care” than they are for administrative area computers.

One also has to consider the display of that information in regard to the size and the resolution of the computer display, particularly as it relates to the imaging component of providing care in a digital age. Over time, monitors or displays of electronic patient information have increased in size and resolution to support increased clarity or resolution of data display and enhanced visualization.

If the server is maintained by the dentist on-site, then procedures need to be place for redundancy related to drives and storage, power and power back-up, surge protection, and battery backup to name a few of the necessary components related to ownership of such a system. With total dependence on and an EDR, practitioners must pay more careful attention to redundancy and plan to achieve up to 99.9% uptime.

Another way to consider the data structure arrangement supported by hardware would be the thin client model in which all processing is done by the server computer and the machine, at the point of care or administrative area, is simply a display. Considerations previously expressed about monitors are important for thin clients. One should also consider whether a secondary monitor is necessary, e.g., those used for patient education. Many times this will be a much larger monitor that patients can view easily. Moreover, the benefit of a thin client is that it is less expense at the point of care or administrative functional area but with probable greater expense related to the server management side. Again a thorough understanding from the vendor related to the specifications of thin client and server would be paramount before the system is purchased and implemented.

A third type of deployment for electronic dental record is a web-based model known as ASP, where all data is maintained off-site and the client machine is a computer with appropriate browser. Most clients will use a web browser to access as well as input data. A significant investment here would be the external connection to maintain a constant uptime once there is complete dependence on EDR.

Another consideration related to hardware and EDR relates to peripheral devices connected to the system. First, one must consider any type of device used for data input, such as a keyboard and mouse, a magnetic card or smart card to access the system, a touchscreen computer, or a digital periodontal probe with voice activation. In the digital age, hard copies of information will still exist. That is why one must also consider scanners (single page and multipage) as a data entry device to EDR as well as a printer. These peripheral devices will present specifications or technical requirements necessary for such a system. Again, the vendor may have technical specifications related to the types of devices supported by their system. In the future, new interoperable standards may permit additional devices, such as blood pressure measurement, pulse oximeter and digital shade guides to have a direct interface to the electronic record system.

d. Network

All computer systems related to an EDR will depend on point of care technology. In order to have this point of care technology, a network or networks must be established to link the computers together, which requires a large bandwidth to support transmission of data within the office as well as outside the office.

An enterprise network is supported by routers to route network traffic to specific workstations. These routers have their own specifications and the vendor will indicate the desired data transmission speed. Another benefit of routers would be the ability to create firewalls to protect against unauthorized access to the internal network, making it more secure. Today's standard network transmission speeds have gone up to 1 GB per second and is expected to continue to increase based on continued upgrades in technology capabilities .

Dentists also must also understand what is required for privacy and security of data transmitted externally from their officer as well as within their internal network. Regulation requires the ability to electronically protect patient data using some type of encryption to prevent the information from being readable by unauthorized parties in transmission either to a specific site, such as sending a claims to a third party payer, or from remote access from outside systems. You can consider a couple of choices that many business now use including, a virtual private network (VPN) or secure web technology software to encrypt patient information.

e. Facility Design

Dental operatories must be designed today to accommodate “point of care” technology. Careful consideration needs to be made when selecting and installing custom dental furniture or millwork in a dental office so that it is ergonomically sound as well as functional. The location of network outlets, primary and secondary monitors/displays and CPU and the connection of electrical, network and audiovisual cables, and other peripheral devices, need to be laid out and planned for. They also must take into account infection control, equipment footprints, and other clinical issues. Non-clinical areas also should be planned with best practices principles for access and ergonomics.

What are the legal principles governing patient health records?

Several authors have examined the legal basis for treating the patient’s health record as a body of information that is regulated. Dennis [footnote] reviews the legal issues relevant to health information management, including electronic health records. Amatayakul reviewed the legal requirements for health records for the American Health Information

Management Association .[16] Roach presents a comprehensive overview of the medico-legal principles of paper based and computerized health records.[17] Tomes presented the legal foundation of the various types of records used by the health care industry and reviews federal and state legislation.[18] The fundamental concepts by Tomes [footnote] addressing the legal foundation of health information in an automated environment remains a current resource.

1. Federal Law and Electronic Health Records

Federal legal principles form the foundation of laws at all levels of government. The most important provisions of federal law are the treatment of records in the Uniform Rules of Evidence, the Privacy Act of 1974, and law addressing privacy and confidentiality of health information.

a. Uniform Rules of Evidence

While focusing on the requirements for business records to be accepted as evidence in federal court, the language of Rule 803 of the United States Uniform Rules of Evidence is appropriate to any record: "a memorandum, report, record, or data compilation, in any form, of acts, events, conditions, opinions, or diagnoses, made at or near the time by, or from information transmitted by a person with knowledge."

In addition to legal requirements, groups of trading partners may form an association where business practices are often regulated by agreed-upon provisions. The voluntary accreditation of healthcare organizations is an example of such an association. The basis of the voluntary consensus standards program in the United States is that individuals and organizations may collectively arrive at a consensus representing the best interests of all classes of participants, and that these organizations and individuals may elect to comply with the provisions of this consensus.

b. Federal Privacy Act

The federal Privacy Act of 1974, 5 U.S.C. § 552a, grants to people the right to find out what information has been collected about them, to correct and to amend that information, and to exercise limited control over the disclosure of that information. While the provisions of the Privacy Act apply to federally operated or contracted healthcare organizations and record systems, its provisions have been widely adopted at the state level and by private healthcare organizations operated pursuant to a contract with the federal government.

The Privacy Act defines the term "record" as any item, collection, or grouping of information about an individual. Since neither the Rules of Evidence nor the Privacy Act specify technology, these provisions apply equally to health information in both paper-based and electronic media. Huffman notes that this record constitutes "a compilation of pertinent facts of a patient's life and health history, including past and present illness(es) and treatment(s), written by the health professionals contributing to the patient's care."

c. HIPAA and other Privacy Requirements

Health records are a compilation of data gathered, maintained, and ultimately used for the benefit of the patient. These pieces of data are a necessary feature of routine business because these are essential for best decision-making practices in the delivery and management of health services. The patient health record is, therefore, considered to be a business document owned by the provider. Generally, under state law, the patient has a right to access the record and the right of confidentiality. On February 21, 1994, the Board of Governors of the American College of Healthcare Executives published a policy position that reads, "While the healthcare organization owns the health record, the information in that record remains the patient's personal property. Facilitating access by legitimate users to computerized patient health information opens new risks of a breach in privacy and confidentiality."

Since health information is considered confidential, Tomes notes that the law generally requires the person responsible for that information to treat it as such, regardless of whether physical or electronic technology is employed.

The federal government has established a uniform national requirement for privacy, security, and confidentiality provisions when handling protected health information. Tomes also prepared a guide to Department of Health and Human Services regulation and HIPAA compliance with portions relevant to electronic health information.

The HIPAA privacy rule requires adherence to certain standards when using protected health information, defining to whom and under what circumstances protected health information may requested, used, or disclosed. The HIPAA security rule establishes the administrative, physical, and technical safeguards required to protect electronic health information protected under its provisions.

In addition, the federal government has enacted legislation addressing use and disclosure of sensitive health service information. The 42 CFR Confidentiality of Alcohol and Drug Abuse Patient Records Regulation establishes uniform requirements across the states for the use and disclosure of information associated with drug abuse prevention services performed directly, contracted or supported by the federal government. This guidance forms the basis of many comparable state laws.

d. State Law and Electronic Health Records

In our constitutional republic form of government, regulation of healthcare, including defining and legislating health records, is one of the authorities of the states. Most states have laws covering the use, disclosure, and retention of business records and other materials that may be admitted into evidence. Electronic health information is often included in this category as a business record.

Tomes notes that many state statutes specifically include a "computer record" in the description of the nature or content of patient records. Tomes further finds that approximately two thirds of the states regard the medical record as "a collection of health care information, in “whatever form”. He concludes that though the various states and the federal government may define health care records differently, and may require different content, all share a common form as a compilation of relevant facts of a patient’s health history, illness and treatment. n essence, a paper based patient record is equivalent to a computer-based patient record in that both are merely vehicles for gathering, storing and using health data. State statutes often regulate the content and practices associated with administrative records, typically require that these records always contain patient identification data and frequently include demographic and financial data.

Many states also have laws or regulations that specifically define the circumstances under which patient health information may be used, disclosed, and retained. Likewise, many states also have special provisions covering access to, and disclosure of, sexually transmitted disease, drug or alcohol abuse, or mental health information. In the technical implementation of privacy and confidentiality provisions, Tomes notes some state statutes that allow the use of the CPR (computerized patient record) may not authorize a computer key for authentication of data entries. However, these standards recommend maintaining an entry unaltered or undeleted following authentication in a CPR system until destroyed at the end of its lifetime

VIII. Institutional Communities

How are the impacts of electronic dental records different depending on the settings?

a. What are the impacts of EDR in dental practice?

Introduction of operatory computers has been a popular trend led by applications such as digital X-ray systems and cosmetic imaging software. However, the EDR with respect to clinical charting is a more comprehensive application of software technology in operatories. A patient's complete electronic health record should have image data like digital X-rays, intra/extra oral camera stills, and scanned images appended to the clinical chart entries. Therefore, a properly configured charting program will be the hub for all clinical patient records. It will allow you to perform data entry and query from the same user interface. Many practice management software systems have charting packages that can integrate the available digital imaging technologies; therefore your best decision would be to introduce charting before imaging. The first step of introducing charting software will essentially provide the platform through which you will conduct all of your searches. If you introduce imaging, or digital X-rays, first, then you may have a problem bridging your existing image database with your new charting software.

Indeed, transitioning from paper records to electronic health records involves overcoming several technological, operational/workflow, and psychological barriers. From the perspective of the dentist and his staff, the technological barriers are easily overcome by selecting the practice management software with the most relevant features and system performance. Yet, operational and psychological barriers need more detailed discussion before the technology decisions are made.

Clinical records – automating the clinical workflow

Today, clinical records are sectioned into many different parts: health and medication status, radiographic records, photographic records, text progress notes, graphical representations such as standard periodontal chart, and proposed treatment recommendations. Traditionally, the written paper chart could only be organized in chronological order as care was administered or observed. Much of the information had to be re-entered several times to have all the necessary records and forms (insurance, accounts receivable etc.) completed and accessible when needed. Consistent detailed legible records were cumbersome and time consuming if not impossible to produce. As you can imagine, paper records are not sortable, can only be viewed in the order they were written, and are not suitable for any patient education purposes in their original format.

With a properly configured computer in the treatment areas, clinical records can be placed directly into the patient's electronic record. Single entry allows the treatment plan to be updated, insurance coverage to be calculated and filed, and account receivable information processed before the patient is out of the treatment room.

Predefined forms and variable note templates help facilitate recording of all necessary and desired information for every procedure performed. With a simple mouse click the entries are recorded in longhand text so that in years to come there will not be any guesswork on what an abbreviation stood for.

Notations that need to be made for special situations (such as specific patient taking pre-medication) are prompted automatically, ensuring that the appropriate treatments are performed and recordings are documented. In contrast, entries in a computerized patient record can be organized in many ways. For instance, they can be organized in traditional chronological order (entries show in the order that they were entered) or by area so that the practitioner can see the complete history of a tooth together (aids in diagnosis and proper treatment by seeing all the past history, pocket depths and proposed treatment at once).

Clinical workstations allow for the clinical staff to properly reappoint the patient for any needed follow up appointments for the appropriate amount of time and at the correct interval, without having to relay that information to another staff member who is not as familiar with the patient's case.

b. Government care-providing organizations : military, VA, public health – FQHC, prisons
What is the impact of EDR for government organizations?

The Department of Veterans Affairs (VA) manages the largest unified health care delivery system in the United States, with almost five million unique medical patients treated in Fiscal Year 2004. The VA medical care system is geographically dispersed, with locations in all fifty states as well as the District of Columbia, Puerto Rico, and many other U.S. territories. Treatment is rendered in a variety of health care settings, including hospitals, outpatient clinics, nursing homes and other long-term care facilities. VA also operates many training and education programs, including dental and medical postgraduate resident training programs. To effectively manage patient records in this complex environment, VA decided in the 1980s to move toward a paperless electronic health record. This migration to a fully digital patient record was gradually implemented at most of the over 200 VA dental treatment locations.

The VA electronic dental record is fully integrated, real-time, with the VA medical record, known as the VA Computerized Patient Record System (CPRS) and is an official component of this patient-centered record. The VA dental record, known as Dental Record Manager (DRM), has been fully implemented nationally since Fiscal Year 2002, with early test and implementation sites active since 1999.

DRM emphasizes those unique aspects of the patient's dental treatment that are not adequately dealt with in the medical record while using CPRS conventions for those aspects that are common to both the dental and medical records. DRM is not a dental record that parallels the medical record, but, rather, is a dental enhancement to the patient's electronic health record.

DRM has been developed and implemented in two iterations, DRM and DRM Plus. Both versions are transaction-based with completed transaction captures in DRM, and findings, planned, completed, and observation transactions added in DRM Plus. DRM use graphical user interface (GUI), which followed the provider workflow to record data on completed transactions, populate patient progress notes, and display data concerning historical patient treatment. The completed transactions data is automatically captured and stored in linked manner in a local database. Each completed transaction is based on a reported procedure code, either a CDT or CPT code, with all associated information, such as patient, provider, location, tooth number, surfaces, quadrant, and ICD code, linked together in the database. These transactions are then aggregated nationally and are available for static reporting as well as interactive analysis.

DRM Plus, which was fully implemented nationally by the end of Fiscal Year 2005, adds diagnostic findings, planning, head and neck lesion tracking, enhanced display graphics, enhanced automatic progress note creation, and broadened local static reporting. HL7 messages are used to automatically send local data to the national dental database. Additionally, DICOM standards requirements have been developed and implemented to allow the use of digital radiographic imaging as an integrated part of the VA electronic dental record. The use of national and international, standards has been emphasized throughout the development of the VA DRM.

c. What is the impact of EDR in dental schools?

Dental academia has many of the same issues as those previously discussed related to practice management. Dental schools are obviously in the business of teaching and learning, and electronic record systems will be used in a way that complements that process. Significant differences for dental academics relate to the scalability of the electronic record system. You see, academic settings such as dental schools have a significantly larger number of providers and

patients compared to a solo general practitioner. Many institutions will have thousands of providers and hundreds of thousands of patients; therefore, usually a more industrial-strength database manager is required.

In addition dental academics multiple providers can be assigned to a patient and multiple levels of system access based on user privileges, such as students having different permission levels than faculty and staff. Many times, patient assignment is driven by related therapies and problems that patients present with. That is why mechanisms to screen and identify types of patients and to associate those with the right provider type are needed. This presents functionality unique to an academic setting. Other significant differences include the evaluation of performance, such as grading related to the delivery of care by students. This data may or may not be collected in an electronic patient record/clinical information system. Students, or residents, also may be managed as a group and different reports, queries ,and management tools using the electronic record are needed. Additionally the systems may be tied to the management of materials and devices such as instrument cassettes. Dental academic institutions house a broad variety of specialties and therefore EDR/PMS systems have to be tailored to multi-specialties.

Though dental academics have strong ties to clinical research, practice-based research has become a particularly important topic in the private practice of dentistry. Consideration needs to be given to identifying patients for a particular research study, whether based on coding diagnostics and treatment or medical conditions of patients. Also to be considered would be the output needed related to the management of these patients and data points that would be collected to evaluate success of their care. Evidence-based care will be at the forefront of curriculum development as it is translated to the clinical environment of dental educational experience.

In the dental academic setting, scheduling becomes a much more complex issue related to multiple variety, multiple appointment books, and rotation schedules whether internal or external. Evaluating effective use of clinic time then becomes a needed additional functionality in the system, giving practitioners the ability to effectively manage dental academic settings. Related to the financial side, the upfront fee structures may be in place based on level of provider, such as a student, residents, or faculty. Multiple specialties usually are supported by EDR in the academic setting.

Dental academic settings may have additional state, federal, and local requirements based on the nature of their program and whether it is state-based or private. There also can be compliance related issues related to the university and university system that can translate into a multitude of queries and reports. To aggregate the data together, many academic settings use some type of data warehouse. The Commission on Dental Accreditation also requires a quality assurance component to patient care that impacts clinic management; EDRs will be used to support this effort.

e. What are issues impacting large group dental practices related to EDR?

There are similarities to dental academics, some of which have already been noted. Two significant issues are security profiles and permissions of large numbers of users of systems in these settings and system scalability. Regulations like HIPAA on federal and state levels require limiting access to patient data based on an individual role in the organization. Large group practices likely have separate clerical staff or outsource functions of billing, claims, collections, and certain types of patient correspondence. Staff and or external partners who perform these functions need much different patient information access than the clinician at chair-side, who, for example, requires the patient's medical history or drug list. Systems need to provide the ability to set up different levels of access to designated components for the electronic record and clinic information system. If external parties are involved, “business associate agreements” should be in place related to use of patient data and the protection of that information. Large practices will have a high likelihood of having many more providers of care and dental staff that support the care in those organizations as well as a larger patient base, which translates into greater amounts of patient data being stored, accessed, and aggregated. With this increase in the size of data and demands for electronic record systems performance, electronic record

systems supporting large group practices must be more scalable, both at the underlying database level and the client software engineering in order to most efficiently retrieve and display information.

d. What are some issues impacting hospital-based practices and JCAHO accreditation using EDR?

Many accreditation organizations, such as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the American Association for Ambulatory Healthcare have established standards addressing the collection, storage, use, access, and release of health information. The authority of these organizations derives not from law but from the consent of those organizations seeking accreditation and indirectly through their reimbursement mechanism.

JCAHO has long addressed information management requirements as part of their accreditation suite. For example the 1995 JCAHO Standards IM3 3.1.1, 9.2.1.2 and 9.2.1.3 required standardization of data sets, definitions, codes, classifications and terminologies throughout an organization and compatibility with externally developed standards when these exist.

Health data ownership and confidentiality issues often are considered along with those of data authenticity and retention. The 1995, JCAHO Standards IM 7.9 7.9.3 allows for computer key authentication of health data entries. As shown in the table below, the 2004 JCAHO information management standards have been streamlined.

JCAHO 2004 Health Information Standards
IM.1.10 The organization plans and designs information management processes to meet internal and external information needs.
IM.2.10 Information privacy and confidentiality are maintained.
IM.2.20 Information security, including data integrity, is maintained.
IM.2.30 The organization has a process for maintaining continuity of information.
IM.3.10 The organization has processes in place to effectively manage information, including the capturing, reporting, processing, storing, retrieving, disseminating, and displaying of clinical/service and non-clinical data and information.
IM.4.10 The information management system provides information for use in decision making.
IM.5.10 Knowledge-based information resources are readily available, current, and authoritative.
IM.6.10 The organization has a complete and accurate clinical record for every individual assessed or treated.
IM.6.20 Records contain resident specific information, as appropriate, to the care, treatment, and services provided.
IM.6.100 Clinical record documentation includes the provision of and response to medical treatment and care.
IM.6.110 Clinical record documentation includes the provision of and response to rehabilitation services.
IM.6.120 Clinical record documentation includes the provision of and response to social service interventions.
IM.6.130 Clinical record documentation includes the provision of education and its effectiveness.
IM.6.140 Clinical record documentation includes significant changes in the resident's condition, care, and treatment.
IM.6.150 Treatment provided to the resident by off-site sources is documented in the clinical record.
IM.6.160 The effects of medications on residents, and associated pharmacist's evaluation and physician consultation, are documented
IM.6.170 Discharge information provided to the resident or to the family, as appropriate and permissible, and/or to the receiving organization is documented.
IM.6.50 Designated qualified personnel accept and transcribe verbal orders of authorized individuals.
IM.6.60 The organization can provide access to all relevant information from a resident's record when needed for use in resident care

IM.6.70 Clinical record documentation includes the provision of and response to the activities program at least quarterly.
IM.6.80 Clinical record documentation includes the provision of and response to nutrition care services at least quarterly.
IM.6.90 Clinical record documentation includes the provision of and response to nursing care.

IX. Dental Informatics Standards

Why are EDR standards important?

ADA Informatics Standards Development

In 1992, there was interest in the standardization of clinical information systems related to electronic technology in the dental environment. After evaluating current informatics activities, a Task Group of the ANSI Accredited Standards Committee MD156 (ASC MD156) was created by the ADA to initiate the development of technical reports, guidelines, and standards on electronic technologies used in dental practice. In 1999, the ADA established the ADA Standards Committee on Dental Informatics (SCDI). The ADA SCDI is currently the group that reviews and approves proposed American National Standards (ANSI approved) and technical reports developed by the standards committee's working groups. The ADA became an ANSI accredited standards organization in 2000.

The ADA SCDI is comprised of volunteer technical experts who serve as representatives of organizations affiliated with the profession, dental industry, academia and the government with a material interest in dental informatics. The standards committee operates under the procedures and scope outlined in the "American Dental Association Standards Committee Operating Procedures" and serves as the consensus body that approves all candidate American National Standards within its scope. The ADA SCDI operates under the principles of consensus and due process.

After approval by the standards committee, candidate standards are usually submitted to the American National Standards Institute (ANSI) for consideration as American National Standards. When a standard is designated an “American National Standard,” it means that all of ANSI’s requirements for consensus, due process, public review, and ANSI review have been met.

Development of EDR and *ANSI/ADA Standard No. 1000, Standard Clinical Data Architecture*

In 1992 the ADA House of Delegates adopted four resolutions on issues of electronic technology in dentistry. Resolution 18H-1992 (Trans. 1992:597) addressed facilitating the development of a computer-based dental patient record for the benefit of patients and the profession as a whole. As a first step in complying with this resolution, the ADA Council on Dental Practice convened a COHR (Computer-based Oral Health Record) Working Group whose members had expertise in paper-based records systems, computer applications in clinical care, and experience developing computer-based records systems in academia and the government.

In 1994, following a review of the state of the art for computer-based patient records and oral health records, the working group selected a model-based analytical approach for this task and began analysis of the care delivery processes and the information requirements to support these processes. This model was reviewed, modified to reflect a consensus view, and approved by the COHR Working Group in April, 1995. In May 1995, the Council on Dental Practice approved release of the draft Concept Model to the public for general review. Over the following months numerous comments were received along with recommended revisions from consensus-building sessions at several

professional meetings. Concept Model baseline version 1.0 was published in February 1996 to present the consensus viewpoint of the Working Group and the large body of reviewers.

Subsequent to publication of the Concept Model in 1996 the ADA House of Delegates adopted Resolution 92H-1996, which states that health information must be seamlessly available at the time and point of care to all authorized users, with no isolation by profession, specialty, discipline or care delivery environment. Anticipating the need for what we now widely recognize as healthcare information interoperability, Resolution 92H-1996 further states:

> *"The American Dental Association believes that, for optimal patient benefit, with assurance of confidentiality safeguards, appropriate health information should be available at the time and place of care to practitioners authorized by the patient through the development of a computer-based patient health record."*

This resolution represents a landmark in health informatics, being the first policy statement by a leading healthcare professional organization endorsing the principles of health information interoperability and recognizing the impact these principles have on patient health and the safety, efficacy, and efficiency of care delivery.

The development of ANSI/ADA Standard No. 1000 began as an initiative to implement the 92H-1996 Resolution and based on the 1996 Concept Model.

The revised multipart documents were then combined into the version 1.0 of the proposed standard. The single document was reviewed and balloted by ADA SCDI Working Group 11.1 on Electronic Health Records and released for a second public review. The proposed standard was formalized, approved by the ADA Council on Dental Practice late in 2000, and approved by the American National Standards Institute as an American National Standard on February 2, 2001. The standard was reaffirmed by the ADA Standards Committee on Dental Informatics in 2004.

The 2010 revision of ANSI/ADA Standard No. 1000 refines and expands upon the data structures in the 2001 specification. Important changes include the addition of data structures supporting enhanced capabilities such as documenting a patient's living arrangements and revised data naming conventions that keep pace with technical advances in database management systems.

One of the purposes of this technical report is to help users of electronic dental records gain understanding of the impact of these systems and their relationship to standards development, particularly to *ANSI/ADA Standard No. 1000, Standard Clinical Data Architecture*

The standard provides data structures for the following subject areas:

1. Individual
2. Individual Characteristics
3. Population
4. Population Characteristics
5. Organization
6. Location
7. Location Associations
8. Location Characteristics
9. Communication
10. Health Care Event
11. Health Services Provider

12. Provider Credentials and Privileges
13. Healthcare Services
14. Health Services Objects
15. Health Care Materiel
16. Healthcare Materiel Item
17. Organization Healthcare Materiel Item\
18. Provider Healthcare Materiel
19. Patient Health Facts
20. Patient Specimen
21. Patient Object
22. Population Health Facts\
23. Patient Health Condition Diagnosis
24. Population Health Condition Diagnosis
25. Patient Treatment Plan
26. Treatment Plan Expected Outcome
27. Population Outcome Reference
28. Patient Health Service
29. Clinical Investigation
30. Clinical Investigation Design
31. Codes and Nomenclature
32. Reference Tables

X. Electronic Dental Records in the Future

Where are we going and where do we want to be?

Patient perspective

In the future, patients will desire an intuitive interface to any part of an electronic record system they need to interact with. With the ubiquitous use of computing, patients will need to access information through patient portals in a timely manner to be engaged in their care. Patients could garner a larger responsibility for their care, which will translate into many new benefits for them. Patients will need to be able to use visualization effectively, which can be supported by the electronic patient record as it's integrated to both imaging and patient education systems. The EDR will fulfill patients'' desires to be informed related to outcomes of care and of any adverse effects in order to assist them in effectively managing their care. It also will meet our society's desires to understand outcomes and trends in healthcare for populations. In the future, the front office will increasingly use online mechanisms to improve their patient's relationship with the practice. Additionally, patients would like their information shared and protected appropriately and in an effective and timely manner. Standards related to data interchange will become ever more important. Additionally, the interoperability of collection devices will speed input into the systems.

Provider standpoint

In the future, data acquisition becomes more transparent with the integration of additional interoperable data collection devices. Aggregation of data in the electronic record system to aid in management of individual patients as well as the practice will be facilitated by the system. Real-time analytics and prompting to the dental team will lead to increased patient satisfaction, improved outcomes of care, and enhance the whole patient care experience. Exchange of data with colleagues in all areas of the medical profession will become more important as standards are developed for information exchange with entities in multiple healthcare fields. Having common access to patient data by practitioners of all disciplines of medicine will improve effectiveness and safety of care. Practitioners also must stay tuned to

regulations, standards, and guidelines related to future developments in healthcare technologies, such as electronic prescriptions and health information data interchange.

The dentist and dental team must be attuned to advances in the technological capability of devices we use now and others being invented. That is because the continual microminiaturization of computers, medical devices, and the additional integration of devices outside the medical arena will have an impact on our profession.

Remote access and point of care technologies will facilitate better and more efficient patient care by supporting information retrieval in a timely manner as well as interaction with that information in a more meaningful way. Electronic record systems will be a backbone, supporting quality improvement, patient safety and effectiveness of care.

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