Free and Open Source Software for Dental Information Management System

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Free and Open Source Software for Dental Information Management System

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Abstract:

The use of dental information system provides an advantage over the use of paper-based patient records in terms of improved access, reduced cost, reduced frequency of errors, more reliable and refined basis for outcomes management and decision support and, data protection and security. But acquisition cost and reliability of technology have been some of the major issues in adopting information technology in dental practice. The increasing development and availability of free and open source software (FOSS) for dental information system have started to address these concerns providing an affordable and reliable alternative.

Keywords:

Dental Informatics, Electronic Dental Patient Records, Dental Practice Management Software, Computerized Dental Patient Management Systems, Free and Open Source Software

I. Introduction: The need for electronic dental information management system

In patient management, a lot depends on how dentists keep records of their patients. Accurate patient records therefore is a very important resource in a dental clinic as in any health care facility and computerized or electronic based records further enhances the maximization of this resource.

The benefits of using a computerized patient records are :

Improved access

A patient record facilitates the tracking of a patient's treatment and activity over time. Improved access including easy retrieval and recording through the use of technology have been considered a significant advancement in managing health care. It has contributed greatly in the delivery of timely and efficient health care especially when it involves large volumes of data involving a large number of patients. It also prevents the waste of precious time which usually occurs when searching for patients record.[1]

Reduced Cost and Reduced frequency of errors

Electronic patient records are also capable of unifying the different clinical data which can reduce the cost of filling paper records, and can eliminate problems such as illegible notes, lost charts and illegible prescription orders. Studies have shown that encoding of orders electronically have reduced more than half of serious medication errors or have prevented adverse drug interactions

especially when dosages can be selected electronically. [1]

Studies have shown that the transition from paper based to the electronic records resulted to “better documentation, more efficient work flow, greater patient safety, and readily available remote access to data as a few ways in which (health care) practices have improved.” [2]

Based also on the same study, electronic patient records also make it possible to incorporate billing, scheduling, and claims functions. [2]

This means that better documentation and efficient patient management through the use of technology have contributed directly to the improvement of clinical practice aside from also facilitating better patient scheduling and better accounting practices that includes billing and collection.

Outcomes management and decision support

Electronic patient records provides a more reliable and refined basis for outcomes management since various patient data can be easily combined in making clinical decisions. It can include various data formats aside from text including imaging as part of the patients chart and dental history. The resultant database can also be used for epidemiological studies in terms of improving health care both at the clinical and the public health level.[1]

Protection of confidential information

Electronic patient records provides greater protection by restricting access to patient's confidential data compared to paper-records. Different levels of access and data security are provided by available technologies including access control level and data encryption.

II. Main Issues in the adoption of Information Technology

There are two main recurring issues as regards the adoption of information technology:

Affordability

With the current decreasing budgets of health care organizations rising inflation and costs of dental practice, adoption of new technologies can be relatively expensive.

Based on the American Dental Association's (ADA) Vendor Directory of Practice Management Software, listing forty (40) commercial dental practice management software providers, fourteen (14) of the listed software costs USD2,500 (PhP 125,000 using a PhP 50 = USD 1 convrersion rate) or less, while nineteen (19) costs between USD 2,500 (PhP 125,000) to USD 5,000 (PhP 250,000) and four (4) costs more than USD 5,000 (PhP 250,000) [3].

This does not include also technical support costs that runs several thousands of pesos depending on the support being availed.

Reliability of technology and ease of use

One of the questions that those who have been reluctant to adopting the technology is the reliability of the electronic system in terms of handling data, ensuring accuracy, data availability when needed

and the problem of maintaining the system that includes available technical support.

Ease of use is also one of the issues being raised by skeptics arguing that adopting a new system would likely disrupt their current work flow.

Experience have shown that adoption of information technology have resulted in better reliability and accuracy of patient's data due to features and user interface design that ensures lesser errors in entering and reading data. [4] These are errors which are more likely to occur in paper-based records keeping rather than in a computerized system.

Current advancement in interface and usability design technologies including design practices that includes user and stakeholders participation have also resulted in more "user friendly" systems. [4]

III. Free and Open Source Software: Providing reliable, affordable and accessible dental Information Systems

Free and open source software (FOSS) offers an alternative that is both affordable, accessible and reliable. It removes the cost barriers in adopting information technology. This includes the use of electronic records in patient management by providing technology for a lower total cost of acquisition.

Present computer hardware and networking cost have gone down considerably and its only the cost of commercial or proprietary software that has remained expensive. FOSS tries to solve this high cost of software by providing an alternative to commercial software.

Free and open source software (FOSS) philosophy

The Free Software Definition aptly illustrates what FOSS is in the following paragraph[5]:

> *Free software is a matter of liberty, not price. To understand the concept, you should think of free as in free speech, not as in free beer.*
>
> *Free software is a matter of the users' freedom to run, copy, distribute, study, change and improve the software. More precisely, it refers to four kinds of freedom, for the users of the software:*
>
> - *The freedom to run the program, for any purpose (freedom 0).*
> - *The freedom to study how the program works, and adapt it to your needs (freedom 1). Access to the source code is a precondition for this.*
> - *The freedom to redistribute copies so you can help your neighbor (freedom 2).*
> - *The freedom to improve the program, and release your improvements to the public, so that the whole community benefits (freedom 3). Access to the source code is a precondition for this.*

Free and open source software therefore works on the philosophy that software should be free and its source code freely available to anybody compared to commercial or proprietary software whose source code is "closed" and is kept a secret.

Free and open source software not only provides software at a lesser or no monetary cost at all. It also provides users and people who supports these users the freedom to view and test in detail the source code and revise the software to conform to the needs of its users.

FOSS as an affordable technology

Since users doesn't need to pay for licenses, use of the software can be totally free except for hardware cost --- or at a lower cost if the user opts to hire an IT personnel to install, maintain or customized the system or enroll in a support contract provided by existing developers of free and open source software.

Since software is not treated as a commodity to be sold, FOSS operates on the idea of "Software as a Service" also known as SaaS. These business model has greatly reduced acquisition cost, making software more affordable.

FOSS as a reliable technology

Since FOSS source code is made freely available, it is considered "peer-reviewed" software and therefore more reliable than closed commercial or proprietary software. Mature open-source code is as stable as software can ever be. [6] This stability is not present with closed commercial software counterparts that usually tends to get slower, freezes or "hangs" during processing or are prone to computer viruses.

The reliability of FOSS coupled with speed of development and improvement, stability, portability and scalability can be gleaned from the fact that FOSS developers are usually users of the software, that source code is publicly available and that developers are members of a community of developers.[7]

FOSS projects usually starts from a personal need. These personal need usually attracts other user-developers that are encourage to contribute in the process. And since developers are also users of the software they have a deep understanding of user's requirements.[7]

Since the source code is open, it is publicly available for inspection and contributions by interested individuals. The existence of developer communities provides a venue for exchanges of bug fixes, contributing to further development and maturity of the software.[7] The public availability of source code and the existence of these developer communities ensures the speed of development compared to closed commercial software where one has to wait a longer time until the commercial software programmers discover the bugs and fix them. Opening the source code also means increased security with "problems being found and fixed instead of being kept secret until the wrong person discovers them."[6]

The reliability of FOSS is proven by the fact that most of the popular software currently running large systems including the Internet are free and open source software like Apache web server comprising sixty percent (60%) of all web servers in the world, Sendmail which is estimated to handle around ninety percent (90%) of email traffic and Linux that is currently estimated to be in use by twenty five percent (25%) of computers around the world.[8]

Available Free and Open Source Dental Practice Management Software

There are currently twenty-two (22) free and open source software projects on dental practice mostly found at Source Forge (http://www.sourceforge.net), a web portal dedicated to hosting several software projects and from those hosted independently.

The available free and open source software for dental information system runs on different operating systems: Microsoft Windows (5), Linux and other Unix-like (4) and thirteen (13) are operating system independent that can run on Microsoft, Linux and any other operating system.

Around fourteen (14) are either still being developed to become complete dental practice management systems while four (4) are already developed as a complete system. The remaining are being developed either for dental imaging only or for dental laboratory management while two (2) are devoted only for patient scheduling.

In terms of language, eleven (11) are in English, nine (9) in other languages such as German, Portuguese, Spanish, Turkish and Polish while two (2) provides users a choice of English or another language.

Of the twenty-two (22) software only four (4) are mature or stable while the others are either still in the planning stage (9), or alpha (5), beta (3) and inactive (1). Those in alpha and beta stages are considered to be usable but still with bugs in their varying stages of development with alpha being in its earlier stage compared to beta which is just a few steps towards being a stable version. These alpha and beta software are being release to the public so it could be tested for feedbacks from volunteer users.

This paper will discuss here only two of the dental practice management software that can benefit local dentists since they are already both mature or stable and has English as the language of the user interface.

From the dental practice management software Free Dental developed by Dr. Jordan Sparks, a dentist, were derived two well known software. These are Open Dental (http://www.open-dent.com/) and Prime Dental (http://www.primedentalsoftware.com/). [9] [10]

There are about 1,000 dentists currently using Open Dental, with an estimated 10,000,000 patient records [9].

Both Open Dental and Prime Dental runs on Microsoft, Linux and Mac OS X and uses another free and open source database software, MySQL.

Both Open Dental and Prime Dental has the following features [9] [10]:

Appointment

- Support unlimited operatories and unlimited providers
- Customizable views, colors, default values
- Easy to set up and modify appointments, recalls
- Show pop-up alerts, financial and medical notes

Family

- Support complete patient records (HIPAA compliant)
- When possible, fields are filled automatically or checked for potential errors

- Save billing type and insurance information
- Track student status and referrals
- Track credit and contact notes
- Sign Procedure Notes: Digital Signatures. Sign or initial procedure notes using a Topaz signature pad or by using a stylus on a touchscreen.
- Patient Info Terminal: A way for a new patient to enter their own information from the waiting room. The receptionist controls the terminal from another computer. Can also be used to let patient update their info if it has changed. New patients can check off items in list of diseases.
- Medical History Questionnaire: Customized list of questions and answers added to pt info terminal.

Account

- Customizable and easy recall scheduling
- Send letters and emails to patients
    - Email appointment reminders, recare appointments. Supports SMTP servers that require a user name and password for sending email. Allows saving email to send later.
- Comprehensive billing system with e-claim support
    - E-claims: go through a clearinghouse to submit all e-claims or submit directly to carries that support the X-12 files/claims. The X-12 Format is the standard defined by HIPAA. No other dental software that we know of creates claims in X-12 format. Instead you have to go through a clearinghouse and they converts the data to X-12 format.
- Track all referrals and lab cases
    - Lab Cases: Each lab can be set up with its own turnaround times on each procedure type. Due dates are calculated automatically, taking into account holidays.
- Create and track payment plans
- Open Dental has built-in accounting that is intended to replace QuickBooks for small offices.
    - Patient's finances are organized on a patient basis, not a family basis.
- Credit Card Processing Integrated credit card processor with swipe terminal.

Treatment Plan

- Easy to view and prioritize patients' treatment plans
- Support multiple treatment plans
- Print or send electronically insurance preauthorization forms

Chart

- Easy to enter and organize patients' clinical information

- Full featured 3D tooth charting
- Track progress and treatment notes
- Simple to write and print prescriptions
    - Rx Alerts: Crosslink Diseases to Rx definitions so that an alert is triggered for allergies, etc when writing an Rx.
- Procedure codes: Currently, the following sets of procedure codes are available as separate databases: blank, usa, canada, uk.
- Perio Charting: voice recognition software to help with charting

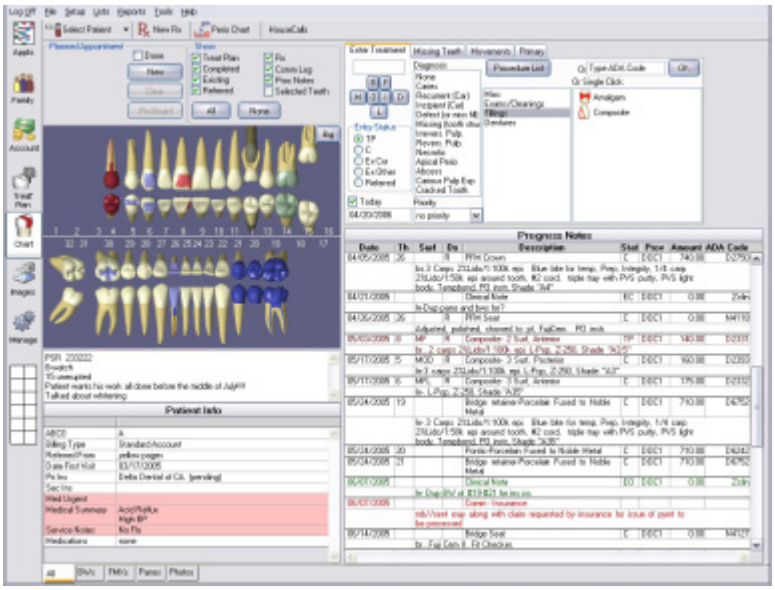

Fig. 1. Sample Chart of Open Dental [9]

Images

- Add and manage all images
- Integrate with Radiography, scanner, digital camera devices
- Images can be zoomed in and out, rotated.
- Can attach Word, PDF, and Excel files

Manage

- Create and send e-claims or paper claims
- Billing automation
- Audio and visual office intercom
- Critical data backup
- Flexible user-defined queries and reports
- Track employees' hours and breaks

- Support daily, weekly & monthly task lists
- Built-in accounting module
- Secure remote access
- Language support: The code is all written to automatically adapt to the user's computer settings. The translations are specific to the culture (country), not just the language.
- Built-in support for Oracle database.
- Time Cards: Customizable pay periods added so that you don't have enter the date range each time. Tracks 40 hour workweek, computes overtime, allows adjustments, and prints.
- New Reporting Framework: We have included the open source RDL Project with Open Dental. It will also allow export to PDF.
- Import from XML : This allows other programs to safely pass information to Open Dental without having to worry about accidentally corrupting the database. This will eventually lead to the ability to 'send' a patient 'chart' to another office electronically. The main purpose for now is to allow new patients to fill out their forms online.
- Multiple Server Support

Both Open Dental and prime Dental offers freely downloadable trial versions that can accommodate 30 patients. For a full version, the current cost is USD 299 (PhP 14,950) which is much lower compared to commercial software. Since both provides the source code, users can modify the system to fit their needs and can rely on local programmers for maintenance.

III. Conclusion

The use of information technology in health care including dental health have been advancing and will be a defacto standard in clinical practice. And Free and Open Source offers a more affordable and reliable alternative to the costly commercial dental information systems.

Although a few at present, but with the existing comparable features of current mature software and more in the development stage, its just a matter of time for free and open software source dental information system to become the dominant software used by dental practitioners.

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