Open-Source EHR Systems for Ambulatory Care: A Market Assessment

Introduction

This report provides a market assessment of ambulatory electronic health record (EHR) systems that are available under open-source licensing. A number of open-source EHRs, commonly referred to as free and open-source software (FOSS), have emerged over the past five to ten years. The goal of this evaluation was to determine whether available FOSS systems are suitable for widespread adoption and effective use as ambulatory EHRs. To this end, the authors investigated a number of existing FOSS EHR projects to evaluate their organizational structures, development communities, functional capabilities, and available implementation and support services. The evaluation also analyzed the potential advantages of FOSS EHR systems for physician practices, as well as the limitations and general challenges of this alternative approach to acquiring clinical information technology.

This document provides a summary of the findings. The detailed assessments of each EHR system, as well as additional relevant background information and resources, appear in Appendices A through F, published separately on the California HealthCare Foundation's Web site at www.chcf.org/topics/view.cfm?itemID=133551.

Methodology

The authors gathered data for this report from the projects' Web sites, existing product reviews, and extensive telephone interviews with FOSS EHR project leaders, third-party support firms, and installed practice sites. The telephone interviews followed structured interview guides to cover a consistent set of relevant topics. Many of the interviews also included online demonstrations of the EHR applications. Following initial data collection, the authors categorized the projects into three groups: those appropriate for subsequent detailed reviews, those meriting less-detailed overviews, and those requiring no further evaluation. For more information about the methodology and the specific areas of inquiry, see Appendix E.

Based on the data collected, the authors drafted written assessments of each FOSS EHR project. The principals of each project reviewed these assessments for accuracy prior to publication.

Although pricing information was collected for each of the projects reviewed, the number of data points was deemed insufficient to include pricing in this report as a basis for comparing open-source EHR systems. Pricing data are reported only in aggregate, to comment on the general costs of FOSS EHR systems relative to commercial EHR systems. See Appendix D.

The FOSS EHR Market Landscape

Free and open-source software (FOSS) emerged as a model for EHR systems between 2000 and 2002. This trend was prompted by the success of the open-source Linux operating systems and the growing recognition that proprietary clinical information systems were prohibitively expensive to purchase and difficult to customize for many health care organizations.

A number of FOSS EHR projects emerged and disappeared during this early period. Many of the early projects were initiated and sustained largely by individual hobbyists with an interest in the medical field and open-source development. These projects were academic in nature—tests to see whether medical software could be developed under the open-source model. Robust development communities, stable revenue streams, and commercial sustainability were not among their goals.

As a result, these early efforts were highly susceptible to project fatigue and abandonment. For example, the TORCH project, which developed a promising open-source EMR application, quickly dissolved after its lead developer left the project. The surviving FOSS EHR projects managed to develop larger and more stable organizational structures.

Preliminary research identified 13 active FOSS EHR projects, as defined by (1) providing software that manages patient-specific clinical information and (2) providing at least some of this software under an open-source license. These projects are listed in Table 1.

Table 1. Active FOSS EHR Projects

PROJECT	URL
ClearHealth	www.clear-health.com
IndivoHealth	www.indivohealth.org
FreeMED	www.freemedsoftware.org
GNUmed	www.gnumed.org
Medsphere OpenVista	www.medsphere.org
OpenEMR (Managed Model)	www.openemr.net
OpenEMR (Community Model)	sourceforge.net/projects/openemr
OSCAR	www.oscarcanada.org
PrimaCare	pcdom.org.my
Res Medicinae	resmedicinae.sourceforge.net
Tolven Healthcare Innovations	www.tolven.org
Ultimate EMR	www.uemr.com
WorldVistA EHR	www.worldvista.org/World_VistA_EHR

This report focuses most attention on projects that met all of the following further criteria:

- Most or all of the software is available under an open-source license;

- The application currently demonstrates clinical data-management capabilities;

- The application is designed for the ambulatory care setting in the United States;

- The application is fully compliant with HIPAA security provisions; and

- The project has been implemented in at least ten physician practice sites.

These criteria narrowed the field to five projects: ClearHealth, FreeMED, OpenEMR (Commercial Model), OpenEMR (Community Model), and WorldVistA EHR. This study conducted detailed assessments of these projects, which are summarized below and presented in detail later in this report. Note that this study evaluated a beta-test version of WorldVistA EHR (then known as VistA-Office EHR) in 2006. Hence, that system was not assessed anew for this study, although certain enhancements had been made since 2006. The report of the previous evaluation is available at www.sujansky.com/vista.php.

Table 2. FOSS EHR Projects Included in Detailed Review

ClearHealth
FreeMED
OpenEMR (Commercial Model)
OpenEMR (Community Model)
WorldVistA EHR

Briefer overviews of five additional projects were also conducted. Although these projects did not meet all of the criteria above, they were of interest because they represent interesting approaches or promising future directions in open-source health care information technology. One of the projects, Practice Fusion, is not an

open-source project, but was reviewed because of its novel business proposition. The five projects that this study briefly overviewed are listed in Table 3, along with the reason(s) they did not qualify for a detailed assessment.

Table 3. FOSS EHR Projects That Underwent a Less-detailed Overview

PROJECT	FINDINGS
IndivoHealth	Intended primarily as a personal health record; implemented at only two sites
Medsphere OpenVista	Primarily designed for and marketed to hospitals; some of the core software is not available under an open-source license
Practice Fusion www.practicefusion.com	Software is proprietary and not available under an open-source license; EMR features are not yet available
Tolven Healthcare Innovations	Intended primarily as a personal health record; implemented at only two sites
Ultimate EMR	Implemented at only two sites

Lastly, four of the FOSS projects this study identified provide ambulatory EHR systems for use primarily outside of the United States. Certain of these projects, such as the Canadian system OSCAR, have a robust set of features, a sizable following, an active development community, and a good number of implementations. However, this study conducted neither a detailed review nor a brief overview of these projects because they may not meet the functional requirements of EHR systems in the U.S., particularly requirements related to HIPAA compliance and billing practices.

These projects and their base countries are: GNUmed (Germany); OSCAR (Canada); PrimaCare (Malaysia); and Res Medicinae (Germany).

General Concepts

A number of concepts apply across all of the FOSS EHR systems that this study reviewed. These concepts are summarized below and described in greater detail in Appendix C.

Licensing models. Dozens of open-source licensing models exist, from the benchmark General Public License (GPL) to esoteric variations, such as the Cryptix General License, modified BSD License, and Zope Public License. The specific terms and provisions of each open-source license determine the rights and obligations of anyone possessing software published thereunder. Of the many licenses that exist, only three are relevant to the FOSS EHR systems that this study reviewed in detail:

- The **GNU General Public License (GPL)** stipulates that anyone in possession of the software may use, modify, and redistribute it without restriction as long as the source code is made available with any distributions and the recipients of any distributions also use, modify, and redistribute the software under the terms of the GPL.

- The **GNU Lesser General Public License (LGPL)** is similar to the GPL, but, unlike the GPL, it allows LGPL software libraries to be linked to proprietary software systems without the latter becoming derivative works (and thereby no longer proprietary).

- The **Mozilla Public License (MPL)** allows source code and derivative works covered under its terms to be directly integrated into proprietary software systems (not just linked to such systems), although the license also requires that any modifications made to MPL software libraries be distributed with source code.

Organizational structures. The open-source projects that this study reviewed each fall into one of three general organizational patterns: (1) community organizations—loose affiliations of individual software contributors with minimal centralized management or financial resources; (2) commercial organizations—for-profit business entities that directly fund, staff, and centrally manage the development of open-source EHR systems; and (3) nonprofit organizations—like commercial entities, nonprofits also provide centralized management for open-source systems, but rely more on external

benefactors for funding and software-development resources. These organizational models differ in their methods for funding feature enhancements, providing software installation and support services, managing the code base, and generating revenue.

Software architectures. Many FOSS EHR projects are built on the same basic open architecture, known as the LAMP stack (i.e., a solution stack). This architecture consists of the following components: Linux for the operating system, Apache for the Web server, MySQL Version 5 for the database, and PHP Version 5 for the server-side business logic. Four of the five projects that this study assessed in detail are built on the LAMP stack and run on the latest versions of the LAMP components.

Software deployment options. The five FOSS EHR systems that this study reviewed in detail offer a number of implementation options for practice sites. These options include (1) on-site installation of the EHR software only; (2) on-site installation of computer appliances that pre-configure all of the hardware and software needed; and (3) remote Web-based hosting of the EHR system, with no on-site installation required. The availability of these options varies across projects and may affect the ease with which physician practices can adopt specific FOSS EHR systems.

Detailed Reviews of Systems

Four FOSS EHR systems were deemed the most mature and the best candidates for use in the ambulatory setting: FreeMED, ClearHealth, OpenEMR (commercially sponsored), and OpenEMR (community sponsored). A synopsis of each assessment is presented below. Overviews of five other FOSS EHR systems that this study evaluated more briefly also appear later in this summary.

ClearHealth. ClearHealth has very strong practice-management features, but recently added medical-record functionality (as of June, 2007). Although template-based documentation, problems lists, medication lists, and lab-result reporting are available, the system does

not yet print lab orders or use standard clinical coding systems, such as LOINC. Nevertheless, ClearHealth is a commercial entity whose managers and programmers have significant experience in the EHR field and will likely continue to improve the product. ClearHealth itself provides most of the installation and support services for its EHR, which is offered as either an on-site client-server implementation or a remotely hosted web application.

FreeMED. FreeMED has a good combination of practice management and medical-record functionalities. It supports clinical documentation, problem lists, lab reporting, document management, and some prescribing. The system uses standardized data coding where possible, and provides options for data interfacing. Electronic ordering is not yet available, and limited decision-support capabilities are present. The FreeMED project is managed by a nonprofit organization that is committed to preserving the open-source status of the software, even at the cost of omitting certain functionalities that are not available as open-source modules. This organization itself does not provide installation and support services, but a small number of third-party firms are available to help interested practices. The EHR uses Web technology, but must be installed on-site and is not yet available as a remotely hosted application.

OpenEMR (Commercial). This version of the OpenEMR code base, which is managed by the commercial firm Possibility Forge, offers the most mature combination of practice-management and medical-record-management functionality. The system offers clinical documentation, problem lists, medication lists, lab ordering, lab result reporting, and document management. In addition, other functionalities are available through the purchase of commercial add-on modules, such as drug-interaction checking and decision support for coding. Possibility Forge is not averse to supplementing the open-source code base with proprietary add-on modules to achieve the functionality desired by its clients. Possibility Forge performs most of the installation and support for this version of

OpenEMR, which is offered both as an on-site client-server implementation and as a remotely hosted Web application.

OpenEMR (Community). This project, which maintains an alternative version of the OpenEMR code base, is organized under the pure community model for open-source development. The source code is maintained and the project is managed exclusively on the SourceForge Web site. There is no business entity managing the project and only a modest degree of central coordination among the programmers actively working on the system. Although the system has the same practice-management functionality as the other commercial OpenEMR project, the medical-record functionality is very basic and consists only of free-text encounter notes and problem lists, as well as a document manager for faxed lab reports, consult notes, and so forth. There is only one vendor offering installation and support services, providing the system as a pre-built server appliance. No remote Web-based hosting is available.

WorldVistA EHR. This system is based on a public domain version of VistA, the clinical information system in use at Veterans Health Administration facilities. The source code for this version (known as FOIA-VistA) was placed in the public domain pursuant to a freedom-of-information-act (FOIA) request. The Centers for Medicare and Medicaid Services (CMS) subsequently adapted FOIA-VistA for use in physician practices and clinics in the private sector under the name VistA Office EHR (VOE). VOE included extensive clinical functionality and some practice-management functionality. The nonprofit firm WorldVistA first deployed a beta-test version of VOE in 2006 (under contract to CMS), and a detailed evaluation of this beta test is available at www.sujansky.com/vista.php. Since then, WorldVistA has made additional enhancements to the system and renamed it WorldVistA EHR. In May, 2007, WorldVistA EHR achieved CCHIT certification, the first open-source ambulatory EHR to do so.

Advantages and Limitations of FOSS EHR

Detailed assessments of these four EHRs indicate that the FOSS approach offers several advantages to physician practices seeking an EHR solution, including lower acquisition and maintenance costs, greater opportunity for customization and enhancement, decreased barriers to interoperability, and less vulnerability to vendor failure or product termination. At the same time, the assessments identified several functional limitations that were common across FOSS EHR systems, including a general lack of decision-support capabilities, greater reliance on free text relative to coded clinical data, and less support for electronic prescribing and lab-test ordering (although none of these limitations were universal among the systems reviewed).

This study also identified several challenges facing the FOSS EHR model in general, including the need to establish trust in the physician marketplace, the problem of duplicated effort across FOSS EHR projects, a limited numbers of vendors that provide installation and support, and an absence of open-source knowledge bases to enable decision-support capabilities. As such, there are steps that proponents of EHR adoption should consider to augment the appeal of open-source EHR systems and increase their use among ambulatory practices:

- Raise awareness of FOSS EHRs as an appropriate EHR solution for certain practices;

- Support the development of open-source knowledge bases for decision support;

- Facilitate greater coordination of effort and sharing of resources among FOSS EHR projects; and

- Establish a registry of firms available to install and support FOSS EHR systems.

A more detailed assessment of the advantages and limitations of FOSS EHRs for ambulatory settings, as well as general recommendations to increase the use of FOSS EHR systems, appear in Appendix D.

Other FOSS EHR Projects of Note

In addition to the four projects assessed in detail, higher-level overviews were also conducted of five additional FOSS EHRs. Although these systems did not meet criteria as viable open-source alternatives for ambulatory EHR systems, they are all noteworthy in that they offer interesting approaches to clinical data management and lower costs than many commercial EHR offerings.

IndivoHealth. A project that is developing a Web-based personally controlled health record system that combines features of personal health records (PHRs) and Health Information Exchanges (HIEs). Indivo emerged from an academic setting and is still in its pilot phase.

Medsphere. A commercial firm that is providing a variation of the VistA FOIA code base primarily to inpatient facilities. Medsphere is a medium-sized company with dozens of clients, although it has had some recent issues with management turnover.

Practice Fusion. Not an open-source project at all, but interesting because it uses an advertising model to offer clinical information technology to physician practices at no cost. The EHR features of this product are still under development.

Tolven Healthcare Innovations.. A commercial firm that has developed a document repository that provides both PHR and EHR functionality through advanced clinical coding and a sophisticated knowledge base.

Ultimate EMR. A small project that recently began offering a very basic EHR for small physician practices. Ultimate EMR provides a low-cost hosted service that may appeal to small practices with basic EHR needs, but the system provides no features for quality improvement or decision support.

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