

Endoscopic electronic medical record systems

The American Society for Gastrointestinal Endoscopy (ASGE) Technology Committee provides reviews of existing, new, or emerging endoscopic technologies that have an impact on the practice of GI endoscopy. Evidence-based methodology is used, by using a MEDLINE literature search to identify pertinent clinical studies on the topic and a MAUDE (Food and Drug Administration Center for Devices and Radiological Health) database search to identify the reported complications of a given technology. Both are supplemented by accessing the "related articles" feature of PubMed and by scrutinizing pertinent references cited by the identified studies. Controlled clinical trials are emphasized, but, in many cases, data from randomized controlled trials are lacking. In such cases, large case series, preliminary clinical studies, and expert opinions are used. Technical data are gathered from traditional and Web-based publications, proprietary publications, and informal communications with pertinent vendors.

Technology Status Evaluation Reports are drafted by one or two members of the ASGE Technology Committee and then reviewed and edited by the committee as a whole and are approved by the governing board of the ASGE. When financial guidance is indicated, the most recent coding data and list prices at the time of publication are provided. For this review, the MEDLINE database was searched through September 2007 for articles related to endoscopic electronic medical systems by using the keyword "endoscopy" paired with "EMR," "electronic medical records," "computerized medical records," and "efficiency."

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BACKGROUND

The concept of endoscopic electronic medical record systems (EEMR) has existed since the development of

the first endoscopes. The central role of the EEMR continues to be generation of the endoscopy procedure report. Previously published ASGE guidelines outline what information should be contained in the procedure report and will not be discussed here.¹ As information systems technology and practice demands have advanced, EEMR systems have evolved into sophisticated databases with tools that extend well beyond simple report generation. This review will summarize the benefits and features of major EEMR systems available in the United States.

TECHNOLOGY UNDER REVIEW

EEMRs are essentially composed of computer workstations that have minimum system requirements based on proprietary software. These workstations may be connected in a network to a main storage server (Table 1). Early systems relied on text input from the endoscopist to generate databases.² More sophisticated tools, such as pull-down menus and checklists (often by using standardized terminology), have decreased typing and increased the utility of databases for retrospective research purposes.³

Recently, EEMRs evolved from simple report generators into more comprehensive endoscopy unit management systems. Most include features such as useful practice management tools, image and video clip management, nursing input, and readily searchable databases for research purposes. Some features, but usually not all, may be tailored to the needs of the individual endoscopy unit (Table 1).

Newer functions include interfaces with hospital-wide electronic medical record systems (EMR) and pathology databases, improved communication with referring physicians through automated faxes or e-mail, and Internet access to allow clinicians secure remote connections. Other features, such as patient scheduling and automated follow-up, inventory tracking, and endoscopy unit statistics, may streamline practice management.⁴ EEMRs can now enhance preprocedure, intraprocedure, and postprocedure data management.

In the preprocedure setting, many systems allow patient demographic information to be entered and the procedure to be scheduled weeks or even months before the day of an endoscopy. These scheduling functions may be customizable, based on the expected time needed to complete a procedure or individual endoscopist's time needs. In addition, some EEMR packages can be designed

TABLE 1. Features of major EEMR systems

	EEMR product (company)*,†		
	CORI version 3 (Portland, Ore)	gCare EMR (gMed, Inc, Weston, Fla)	Endoworks 7.3 (Olympus America, Inc, Center Valley, Pa)
Web site	www.cori.com	www.gmed.com	www.endoworks.com
Compatible hardware	Any manufacturer	Any manufacturer	IBM Intellistation
Automated recording of patient monitoring	No	Yes	No
Image management	No	Yes	Yes
Video clip management	No	No	Yes
Automated coding	Yes	Yes	Yes
Remote Internet access	No	Yes	Yes
Patient education materials	Yes	No	Yes
Inventory control	Yes	No	Yes
Searchable fields	Yes	Yes	Yes
Additional fee for vendor searches	No	Yes	Yes
Nursing note module	No	Yes	No
Office note module	No	Yes	No
Service contract (cost/y/room) (USD)	Free	\$2000-\$8000	\$900-\$2300
Software and installation (cost/room) (USD)	Free	\$15,000-\$45,000	\$5000-\$15,000

n/a, Not available.

*Minimum workstation requirements: CORI: Windows 95, 64 MB RAM, 200 MB HD, Pentium 486; gCare: Windows XP, 1 GB RAM, 40 GB HD, Pentium 4 2 GHz; Endoworks: Windows XP Professional, 1 GB RAM, 80 GB HD, Pentium 4; endoPRO: Windows XP, 256 MB RAM, 40 GB HD, Pentium 3; ProVation MD: Windows NT 4.0, 2000 Pro, XP Pro, 1 GB RAM, 10 GB HD, Pentium D; Endoprose: Windows 2000 or XP Pro, 512 MB RAM, 20 GB HD, Pentium 4; Endosoft: Windows XP, 256 MB RAM, 20 GB HD, Pentium 4.

†All EEMRs listed have the following features: scheduling, pathology interface, hospital EMR interface, automated fax and e-mail, instrument tracking, and endoscopy unit statistics.

‡Offered through a partnership with Allscripts, LLC (www.allscripts.com).

to incorporate clinical data, such as preprocedural bowel preparation, patient history, medications, and physical examination findings.

During the procedure, some systems allow automatic transfer of data from the patient's vital sign monitor to the EEMR, if the monitor has compatible outputs, most commonly a RS-232 communication port. Intraprocedure medications can be entered into the EEMR by the nurse and then transferred automatically to the endoscopy report. Several vendors offer this nursing note module, although usually at an additional cost (Table 1). Images from a variety of sources (video, fluoroscopy, and US) should be DICOM (Digital Imaging and Communications in Medicine) compatible and can often be stored in the EEMR with easy export to other sources.⁵ Many systems allow annotation of images. Some EEMRs allow digital capture of short video clips, which may be useful for publication or demonstration but use a significant amount of hard-drive storage space.

After the procedure report has been entered, most EEMRs can automatically assign CPT* (Current Procedural Terminology) codes based on the procedure performed and may allow choices or automatically assign International Classification of Diseases, 9th revision (ICD-9) codes based on indications or findings entered. Some EEMRs can automatically generate requisitions for pathology specimens, and many can interface with pathology databases and retrieve an endoscopist's outstanding pathology reports. EEMRs can also be configured to interface promptly

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TABLE 1 (continued)

EEMR product (company)*†			
endoPRO (Pentax, Research, Montvale, NJ)	ProVation MD (ProVation Medical, Inc, Minneapolis, Minn)	Endoproze (Summit Imaging, Inc, Lee's Summit, Mo)	Endosoft (UTECH Products, Inc, Schenectady, NY)
www.pentaxmedical.com	www.provationmedical.com	www.summitimaging.net	www.endosoft.com
Any manufacturer	Any manufacturer	Any manufacturer	Any manufacturer
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes (ICD-9 only)	Yes
Yes	Yes	Yes	Yes
Yes	Yes	No	Yes
No	Yes	No	Yes
Yes	Yes	No	Yes
No	No	n/a	No
Yes	Yes	Yes	Yes
No	Yes‡	No	Yes
10% of original purchase price	\$2000-\$5000	\$1000	\$2000
\$15,000-\$40,000	\$10,000-\$25,000	\$15,000-\$20,000	\$10,00-\$15,000

with a hospital EMR, usually via standard technical compatibilities, such as health level 7. The capacity to generate correspondence in the form of summary letters to referring physicians and patients, as well as to recall letters, is also a feature many EEMRs now share. Some EEMRs can be configured to correspond with referring physicians immediately by fax or e-mail, with the assumption that Health Insurance Portability and Accountability Act (HIPAA) compliance is met. Most EEMRs can generate user-designed printable patient education materials based on the diagnoses assigned in the EEMR.

EEMRs have features useful in endoscopy unit management. Many systems allow the user to track inventory, such as drugs, endoscope usage, and endoscopic accessories. In addition, many systems allow the generation of basic endoscopy unit productivity statistics. Personnel use can also be tracked for both nursing and technician involvement. Physicians and trainees can also monitor their procedure volumes.

Several EEMR vendors offer an office note module (Table 1). These modules vary in their capabilities and level of customization, but most have the following features: office note generation, automated coding, prescription writing, links to laboratory or pathology results, order tracking, automated faxing, and even voice-recognition technology.

When evaluating an EEMR, multiple issues should be considered. The needs of the community ambulatory surgery center will differ from the hospital-based endoscopy unit or the academic endoscopy unit.⁶ The physical needs of the endoscopy center, such as the number of endoscopy rooms and the number of required workstations, should also be considered. Interface with a hospital EMR or a pathology database is often essential in hospital-based endoscopy units. Extensive testing of these interface capabilities is absolutely essential before purchasing an EEMR. Any center interested in clinical research may opt for EEMRs with search engines that can search the database for free text or fixed options. A user-friendly search engine

can be particularly helpful when performing retrospective research.^{7,8} The user should be familiar with the search capabilities of a given database, because some are designed to provide practice management data, whereas others are focused on searching clinical parameters. User expertise in learning new software and the length of the learning curve for both the physicians and the staff should also be considered. Also, as with any complex software, technical support is essential. Vendors vary in whether they provide in-person or remote support, an ability to provide after-hours support, and server and database maintenance.⁷

EASE OF USE

The perceived ease of use between different EEMRs can vary significantly between users, based on individual expertise in using medical software. Systems vary in their ease of information input (pull-down menus vs free-text entry), although more complex procedures will likely take longer to enter and likely require a greater extent of free text regardless of the entry system.⁴ Newer EEMRs have extensive administrative and practice management features; therefore, the ability of the endoscopy unit staff to quickly learn and efficiently use the software is an important consideration. In many cases, easy information retrieval, such as when generating endoscopy unit statistics and research-related database searches, is essential. Most EEMRs have built-in basic queries that allow the user to search the database. However, more sophisticated SQL (structured query language) database searching usually requires the assistance of the vendor, sometimes with an added cost (Table 1).

OUTCOMES AND COMPARATIVE DATA

No known studies compare the various EEMR systems. One study showed that menu-driven structured data-entry systems resulted in fewer reports with missing data, 18% of reports surveyed versus 48% with free-text reporting.⁹ Another study demonstrated that the time needed to create an endoscopy report is similar whether generated by handwritten, dictated (including transcriptionist's time), or computer-generated means.¹⁰ A Dutch group showed that, by using text blocks based on anatomic landmarks and diagnoses, an endoscopist could generate 90% of reports within 2 minutes.¹¹ In the future, linkage of EEMRs to personal tablet computers, voice-recognition systems, and Web connectivity software may improve both efficiency and ease of use of EEMRs.¹²

SAFETY

In the post-HIPAA era, privacy of patient medical records is essential. The interfaces between the EEMR and other

databases (such as hospital EMRs) must be secure. If the EEMR is accessible by an Internet connection, then the server must be secure and password protected. Automated communication with referring providers (such as by fax or e-mail) should be HIPAA compliant. The EEMR should also allow the removal of patient identifiers if records are to be used for teaching or demonstration purposes. EEMR-generated reports are permanent patient records, and their longevity should be ensured by the daily backup of servers. EEMRs usually require continuous upgrading to keep the database safe and functioning properly.

FINANCIAL

Costs vary significantly between vendors and range between \$5000 and \$45,000 per room for software (Table 1). The Clinical Outcomes Research Initiative (CORI) distributes its software free of charge if the endoscopy unit is willing to transmit deidentified patient data to a central repository for research purposes. Some vendors have programs available to structure cost based on procedure volume. Costs may also vary based on the features needed and the level of customization required. The need for additional hardware, such as servers and printers, can significantly increase these costs. Service contracts with vendors may add ongoing costs to the basic installation of the EEMR but are usually essential. When purchasing an EEMR, the user should be confident in the viability, reliability, and contract for future support should the company not market the product in the future. The upfront and ongoing costs are often a substantial investment for many endoscopy units. However, the systems may reduce overall endoscopy unit costs by reducing or eliminating transcriptionist fees and may lead to increased unit efficiency and productivity. Communication with referring physicians can enhance practice referrals and volumes. In addition, a number of quality indicators recently published by the American Society for Gastrointestinal Endoscopy/American College of Gastroenterology Task Force on Quality in Endoscopy may be incorporated into the EEMR report system and database.¹³ Quality indicators may be important in the future for reimbursement purposes.⁸

AREAS FOR FUTURE RESEARCH

The impact of EEMRs on endoscopy unit efficiency is poorly understood and worthy of evaluation. Information management of preprocedure, intraprocedure, and post-procedure data may reduce duplication of documentation and reduce total patient time in the endoscopy center. In addition, the effect of practice management tools, such as patient recall letters on patient and physician compliance, should be further evaluated to define the value of specific EEMR features.

SUMMARY

EEMR systems have become an integral part of the daily operation of many endoscopy units. Systems have evolved from simple endoscopy report generators to sophisticated endoscopy unit managers. Newer features of these systems may improve patient care and enhance endoscopy unit efficiency and productivity, but further studies are needed. The needs of the endoscopy unit, the staff, and the endoscopist should drive the selection process when choosing an EEMR. Extensive testing of the EEMR system capabilities, especially the ability to interface with existing software programs, is essential before purchasing an EEMR system.

Abbreviations: ASGE, American Society for Gastrointestinal Endoscopy; CORI, Clinical Outcomes Research Initiative; EEMR, endoscopic electronic medical record system; EMR, electronic medical record system; HIPAA, Health Insurance Portability and Accountability Act; ICD-9, International Classification of Diseases, 9th revision.

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