



Endoscopic electronic medical record systems

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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 methods are used, with 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 adverse events 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 1 or 2 members of the ASGE Technology Committee, reviewed and edited by the committee as a whole, and 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 January 2015 for articles related to endoscopic electronic medical record systems by using the key words “endoscopic electronic medical record systems,” “endoscopic reporting software,” “endoscopic reporting systems,” “practice management software,” “electronic medical record,” paired with “endoscopy,” “endoscopy unit,” “endoscopic imaging,” and “quality reporting.” Technology Status Evaluation Reports are scientific reviews provided solely for educational and informational purposes. Technology Status Evaluation Reports are not rules and should not be construed as

establishing a legal standard of care or as encouraging, advocating, requiring, or discouraging any particular treatment or payment for such treatment.

BACKGROUND

The capabilities of endoscopic electronic medical record (EEMR) systems have evolved greatly since they were initially created in the 1980s. Whereas early EEMR software was essentially limited to an endoscopy reporting system (ERS), allowing users to digitally compose an endoscopy report, current versions have evolved into sophisticated electronic medical record databases incorporating comprehensive electronic practice management (EPM) software. The Health Information Technology for Economic and Clinical Health Act was enacted as part of the American Recovery and Reinvestment Act of 2009. This was designed to promote the adoption and meaningful use of health information technology in the form of the electronic health record (EHR). Therefore, the integration of EEMR and EPM software with the EHR will be vital. The purpose of this review is to discuss the main features and benefits of current EEMRs and their associated EPM software as well as their ability to integrate with the EHR and/or be a stand-alone EHR.

TECHNOLOGY UNDER REVIEW

The central role of the EEMR system is the generation of the endoscopy procedure report. Previously published ASGE guidelines outline what information should be contained in the procedure report and are not reviewed in this document.¹⁻³ These systems comprise hardware, including image/video capture workstations, documentation workstations, and network servers, that have minimum system requirements based on the proprietary EEMR software (Table 1). Servers are computer systems, which are used as the central repository of data and various software applications that are shared by several workstations in a network. Workstations are generally connected in a

TABLE 1. EEMRs currently marketed in the United States

	CORI v4	EndoSoft	EndoPRO iQ, v4.6
Website	www.cori.org	www.endosoft.com	www.pentaxmedical.com
Company (location)	Clinical Outcomes Research Initiative (Portland, Ore)	EndoSoft LLC (Schenectady, NY)	Pentax Medical (Montvale, NJ)
Minimum server system requirements	Microsoft Server 2003, R2 GHz processor, 1 GB RAM, 30 GB hard drive	Microsoft Server 2008 R2, Intel Xeon 3.00 GHz processor, 32 GB RAM	Microsoft Server 2008 R2, Intel Quad Core 32 or 64 bit, 16 GB RAM
Minimum workstation requirements	Microsoft Windows XP, VISTA, 7	Microsoft Windows 7, Intel Core i5 3.00 GHz, 160 GB hard drive	Microsoft Windows 7, Quad Core Processor 2.8 GHz, 4 GB RAM, 80 GB hard drive
Cloud-based system option	N	Y	N
EHR	N	Y	N
Meaningful use (MU) certified	N	Y	N
Service contract (cost/yr/room; %of installation)	*	15-20%	15%
Software and installation (cost/room; USD)	*	10,500-11,500†‡§	750-4000‡

EEMR, Endoscopic electronic medical record; EHR, electronic health record; N, No; Y, Yes.

*CORI is no longer funded by the National Institute of Diabetes and Digestive and Kidney Diseases and therefore is no longer available as an endoscopic reporting system for new users.

†Olympus will stop supporting the Endoworks product on March 31, 2018. Therefore, they are not selling any new installations of this product.

‡Pricing information is meant to serve as an estimate and is not meant to reflect actual quotes from any individual companies. Please contact individual vendors for actual pricing information.

§Includes first year of service contract built in to pricing.

network to a minimum of 1 main storage server along with a backup server. Several vendors offer cloud-based servers as well. The number of servers required varies, depending on the practice size, number of facilities, and whether the system is used to capture and archive video. All EEMR software programs commercially available in the United States are only compatible with Microsoft Windows (Redmond, Wash) operating systems. Most EEMRs have options to allow for remote access to the network via a personal desktop or laptop computer.

Endoscopic reporting systems

In the 1990s the ASGE, the European Society for Gastrointestinal Endoscopy, and the Japanese Society of Digestive Endoscopy formed a task force with the goal of devising a “minimal” list of terms that could be included within any computerized ERS used to record the indications, findings, and conclusions.⁷ The incorporation of Minimal Standard Terminology (MST) for GI endoscopy, now in its third version, offers a template for data entry within the main descriptive sections of the endoscopy report and standardizes the descriptions of findings.⁸ MST is the foundation for all ERS software; however,

many vendors have expanded upon the MST database to include additional descriptors. The ERS software module within the EEMR is able to generate most of the endoscopic report with simple mouse click or keystroke input, using pull-down menus and checklists.⁴⁻⁶ The eMerge Endo (Cincinnati, Ohio) software is unique in allowing voice-activated commands for note generation.

Most ERS software programs allow for the creation of customizable templates based on the user’s practice, which allow for rapid procedure note generation. All ERS software programs allow for free text data entry options as well as free text editing of menu-driven entries, before finalizing the note. All available ERS software programs allow integration of most dictation software. EndoSoft (Schenectady, NY) offers optional built-in dictation software to complement the standard pull-down menu options. Importantly, free text entry by typing or dictation may negatively impact the efficiency and accuracy of subsequent database searches as well as the generation of Current Procedural Terminology and International Classification of Diseases (ICD) codes for billing purposes.

Once the procedure note has been created, all ERS software programs can automatically generate billing codes

TABLE 1. Continued

EndoProse	EndoWorks v7.4	gMed	MD-Reports	ProVation MD	eMerge Endo
www.summitimaging.net	www.endoworks.com	www.gmed.com	www.md-reports.com	www.provationmedical.com	www.emergeendo.com
Summit Imaging, Inc (Lee's Summit, Mo)	Olympus America, Inc (Center Valley, Pa)	gMed, Inc (Weston, Fla)	Infinite Software Solutions, Inc (Staten Island, NY)	ProVation Medical, Inc (Minneapolis, Minn)	eMerge Health Solutions (Cincinnati, Ohio)
Microsoft Server 2003, Intel Xeon Dual Core Processor, 2 GB RAM, 250 GB hard drive	Microsoft Server 2003, Intel Quad Core 2.4 GHz processor, 4 GB RAM	Microsoft Server 2008 R2, Intel Xeon 3.00 GHz processor, 16 GB RAM, 600 GB hard drive	Microsoft Server 2008 R2, Intel Xeon E5-2440 2.5 GHz or higher, 16 GB RAM, 1 Terabyte hard drive	Microsoft Server 2008 R2 Intel Quad Core 2.4 GHz processor, 4 GB RAM 20 GB hard drive	Microsoft SQL Server 2012 Intel Xeon E-series 8 GB RAM 250 GB hard drive
Microsoft Windows XP Pro, Intel Pentium Dual Core Processor, 1 GB RAM, 80 GB hard drive	Microsoft Windows Pro 7, Intel Core i5 3.3 GHz processor, 4 GB RAM, 500 GB hard drive	Microsoft Windows 7, Intel i5 2.5 GHz processor, 4 GB Ram, 160 GB hard drive	Microsoft Windows 7, Intel i5 2.5 GHz processor, 4 GB Ram, 250 GB hard drive	Microsoft Windows 7, Intel i5 2.5 GHz processor, 4 GB Ram, 250 GB hard drive	Microsoft Windows 7, Intel Core 2 Duo 2.8 GHz processor, 4 GB Ram, 250 GB hard drive
N	N	Y	N	N	Y
N	N	Y	Y	N	N
N	N	Y	Y	Y (MU 1 only)	N
20%	†	15%	10%	20%	20%
10,500-50,000‡	†	13,528-20,023‡	4000-12,000‡	Please call for pricing	5000‡

and incorporate them into the document. The Current Procedural Terminology and ICD 9th or 10th revision codes are generated based on MST elements selected within the procedure note.^{5,9} ERS software also allows for tracking of procedure time, including the time to reach the cecum and colonoscope withdrawal time. Procedure time tracking requires a manual time stamp entry by mouse click, performed by the nurse or endoscopy technician during the procedure. These are usually performed at the time of endoscope insertion, start of endoscope withdrawal, and at the time of endoscope removal. Once the procedure note has been finalized, most software allows for automatic insertion of the procedure note into the hospital EMR and for forwarding of the procedure note to the referring provider via email or fax.

All information entered into the endoscopy procedure note is saved on the network server, which also functions as an endoscopy database for the practice. The Clinical Outcomes Research Initiative (CORI) software serves as both an endoscopy practice database and a larger deidentified endoscopy repository for all endoscopy practices using CORI software. CORI is no longer funded by the National Institute of Diabetes and Digestive and Kidney

Diseases and therefore is no longer available as an endoscopic reporting system for new users. Technical support ceased as of August 2015. Because most data entry is performed using pull-down menus and/or checklists, the data can be extracted with software query tools to generate reports for data analysis. Only the EndoSoft program allows the endoscopist the option of performing free text query report generation. For all other software programs, the software vendor is able to complete these types of queries. This may or may not require additional fees. Many software companies may add new search items at the request of the software buyer if there is a specific search item(s) that an endoscopy practice plans on repeatedly searching. This again may or may not require additional fees.

The database can service various aspects of an endoscopy practice including but not limited to physician quality assurance, risk management, practice management, and clinical research. Endoscopy practices can use the database to track procedure volume (total procedures or by specific procedures) and trend it over any desired period of time. This tracking can also be performed for individual providers in a similar manner. Endoscopist performance can be assessed for several endoscopy quality measures,

including polyp detection rate, cecal intubation rate, and colonoscopy withdrawal time. These quality reports allow for self-assessment and quality benchmarking within an endoscopy practice. If the practice participates in a quality improvement registry, they can also compare their practice to others that participate in the registry. For academic practices with fellows, all software allows tracking of fellow procedure numbers as well as fellow procedure performance (eg, extent of procedure completed independently by the fellow). Risk management reports can be generated to search for adverse events over a specified time frame, by procedure, and by endoscopist. However, this requires recognition and entry of the adverse event before completion of the endoscopy report. In addition, the software allows for searches for specific adverse events, provided they are listed in the drop-down menu. Free text searches as detailed above are more difficult for most software programs and may require the vendor to search for a specific adverse event.

The use of MST to generate endoscopy reports creates a searchable database that can be used for clinical research. The query tools allow a researcher to search for any combination of indications, findings, and procedures. Reports can be generated based on specified time frames and can include any list of providers in the practice. MST 3.0 includes several classification systems (Table 2) used in both clinical practice and research studies. Some software systems allow customization for additional non-MST classification or scoring systems. As previously mentioned, free text query report generation is limited.

Image and video capture

All systems on the market allow for still image capture and some allow for video capture (Table 3). For more information on image and video clip management, refer to the ASGE technology document on this subject.¹⁰ Images may be captured by pressing a designated button on the endoscope or via a mouse click on the EEMR image capture software screen. Similarly, depending on the setup, video recording can be initiated and paused via touch screen and/or mouse click, depressing a foot pedal, or pressing a designated button on the endoscope. Image and video capturing workstations require a graphics card and an image or video capture card. Image and video capture cards are specific for either standard-definition or high-definition images and videos. The images and/or videos are then saved on the EEMR server and can subsequently be exported to other media (eg, flash drive, CD, DVD, cloud). Having a fully integrated image capturing and EEMR software system allows the digitally saved images to be incorporated into the endoscopy report. All the EEMR software systems on the market allow for image annotation with the ability to link the endoscopic image to an appropriate anatomic diagram. The image and labeled diagram are then incorporated into the endoscopy procedure report. Images from a variety of sources (endoscopy video, fluoroscopy,

TABLE 2. Classification systems incorporated in MST 3.0

MST 3.0 Classifications
Los Angeles classification of erosive esophagitis
Size classification of esophageal varices
Prague C & M classification of Barrett's esophagus extension
Paris classification of neoplastic lesions
Japanese Gastric Cancer Association classification of superficial neoplastic lesions
Forrest classification of ulcer bleeding
Goligher grading of hemorrhoids
Kudo classification of colon polyp surface pattern

C, Circumferential length; M, maximal length.

and US) can potentially be incorporated into the procedure report. All image capturing devices should conform to Digital Imaging and Communications in Medicine specifications.⁵

EEMR systems

Perioperative and ancillary documentation. EEMR systems have evolved to allow perioperative and ancillary documentation (Table 3). Perioperative documentation allows for input of preprocedural history and physical examination by the endoscopist. Some EEMR systems allow for documentation by anesthesiologists. EEMR systems also allow for complete electronic nurse charting during all 3 phases of the endoscopy (pre-, intra-, and postprocedure). The information entered into nursing documentation can be integrated into the physician endoscopy report to allow for consistent data across the patient's record. Many systems allow for automatic patient vital sign capturing that is incorporated directly into the nursing record. This is achieved either through a direct serial cable connection to the vital sign monitor or via a Health Level 7 (HL7) standard interface. Most perioperative software programs have time tracking tools to follow patients through the preprocedural, intraprocedural, and postprocedural process. These data allow for assessment of workflow efficiency, because it can identify bottlenecks in patient processing through the endoscopy unit.

Creation of ancillary documents. EEMR systems allow providers to generate several types of ancillary documents. These include consent forms, patient discharge instructions, and procedure-related correspondence to referring physicians. The letters to referring physicians automatically identify and insert key results acquired from the procedure note. The letter can be electronically signed and sent via email and/or fax to referring physicians. EEMR systems can generate patient discharge instructions. These forms provide endoscopy findings as well as pictures from the endoscopy. The forms may contain educational materials regarding the diagnosis and discharge care instructions. Discharge forms will have a patient acknowledgment section documenting their understanding of the above instructions. Many EEMR systems

TABLE 3. Features of different endoscopic electronic medical records

	CORI v4	EndoSoft	EndoPRO iQ, v4.6	EndoProse	EndoWorks v7.4	gMed	MD- Reports	ProVation MD	eMerge Endo
Automated recording of patient monitoring	-	+	+	+	+	+	+	+	+
Image capturing	+	+	+	+	+	+	+	+	+
Video clip capturing	-	+	+	+	+	+	+	+	+
Automated coding	+	+	+	+	+	+	+	+	+
Schedule future appointments	+	+	+	-	-	+	+	+	+
Remote internet access	-	+	+	+	+	+	+	+	+
Patient handouts	+	+	+	+	+	+	+	+	+
Letter generation	+	+	+	+	+	+	+	+	+
Inventory tracking	+	+	-	-	+	-	-	+	+
Scope tracking	+	+	+	+	+	+	+	+	+
Pathology report integration	+	+	-	-	+	+	+	-	+
Searchable fields (database query)	+	+	+	+	+	+	+	+	+
Nursing note module	-	+	+	+	-	+	+	+	+
GIQuIC certified	+	+	+	+	+	+	+	+	+
AGA Digestive Health Outcomes Registry	+	-	-	-	-	+	-	+	-

GIQuIC, GI Quality Improvement Consortium; +, available option; -, currently unavailable; AGA, American Gastroenterological Association.

have a pathology interface module that has the ability to generate specimen labels and pathology requisition forms. The requisition forms automatically pull in data from the procedure note, including ICD-9 or -10 codes. Some software also has the ability to integrate with electronically enabled pathology labs. This provides endoscopists with the ability to access pathology reports electronically via their EEMR. Finally, some systems allow the ability to add an addendum to the endoscopy report while reviewing pathology reports and to initiate patient scheduling by generating a recall letter.

Quality improvement registries

Quality improvement and benchmarking in endoscopy are integral features in current healthcare initiatives. The GI Quality Improvement Consortium is a national GI endoscopy data repository for storage and maintenance of specific endoscopy quality measures for endoscopists. Measures have been developed from an American College of Gastroenterology–ASGE joint task force for the development of GI endoscopy quality indicators (Table 4). The American Gastroenterological Association has a Digestive Health Outcomes Registry also looking at several quality measures, including colorectal cancer procedure outcomes (Table 4). All EEMRs participate in the GI Quality Improvement Consortium, and several participate in the AGA Digestive Health Outcomes Registry. Registry questions are built into the ERS pull-down menus and/or checklists to allow for ease of use and to ensure completion of the registry questionnaire. Many systems allow data to be transferred electronically to these registries.

Electronic practice management

Many EEMRs have practice management software options (Table 3). Many systems can capture patient demographics, schedule appointments, maintain insurance payer lists, and perform billing tasks. The software allows for auditing of charge reports, searching for unsent charges, and following coding trends. The EPM software can maintain an accurate endoscope usage log, which allows the generation of endoscope usage reports. Individual endoscope usage history can be mapped out by dates used, location/s used, endoscopist(s) performing the procedure, and patient(s) on whom the endoscope was used. They also have the ability to track endoscope maintenance history. In addition, some software programs have the ability to track the inventory of endoscopic accessory devices as well as medications used in the endoscopy unit.¹¹ Reports can be generated to quantify medication and equipment usage, allowing optimization of ordering practices. EPM systems can also track nurse and technician use. The systems can generate endoscopy unit productivity statistics (eg, room utilization, starts per hour, and average procedures performed over a specified time frame). Some programs also have the ability to track procedure delays and the reason for delays. This allows endoscopy managers to target areas for process improvement to improve endoscopy unit efficiency.

Software integration

With the federally mandated implementation of “meaningful use” incentives to adopt an EHR, the integration of

TABLE 4. Quality improvement measures collected in endoscopy registries

GIQuIC	AGA Digestive Health Outcomes Registry
Colonoscopy measures	Rate of precancerous polyps and cancers identified during initial colon cancer screening examinations (adenoma detection rate)
History and physical documentation	Appropriate indication for examination
Informed consent documentation	Documented risk of colorectal cancer
Adequacy of bowel preparation	Complete colonoscopy examination
Written discharge instructions: outpatient	Preparation quality
ASA category documentation	Colonoscopy interval for patients with a history of adenomatous polyps
Indication documentation	Potentially avoidable adverse events during the "colonoscopy episode" (7 days precolonoscopy and 14 days postcolonoscopy)
Cecal intubation with photo documentation	Use of anesthesia professional to administer sedation for colonoscopy in ASA class I-II patients undergoing screening examination
Adenoma detection rate for screening	
Withdrawal time	
Immediate adverse events	
EGD measures	
Appropriate specimen acquisition in Barrett's esophagus	
Appropriate management of new diagnoses of bleeding esophageal varices	
Appropriate endoscopic therapy for stigmata of peptic ulcer disease bleeding	
Appropriate anticoagulation management	
Appropriate antibiotic prophylaxis	
<i>Helicobacter pylori</i> status	
Written discharge instructions: outpatient	
ASA category documentation	
Informed consent documentation	
History and physical documentation	
Indication documentation	
Immediate adverse events	

GIQuIC, GI Quality Improvement Consortium; ASA, American Society of Anesthesiologists; AGA, American Gastroenterological Association.

EEMR systems is vital. All systems on the market allow for integration by complying with HL7 messaging standards. Current EEMR systems can interface with most EHR and practice management systems on the market. Some EEMR systems are also "meaningful use" certified and can function as a stand-alone EHR, whereas others offer modular "meaningful use" certification. Healthcare interoperability is defined as the extent to which systems and devices can exchange data and interpret that shared data.¹¹ The ability for the EEMR data repositories to bidirectionally share patient information with other hospital, endoscopy unit, or office software is crucial when choosing software. Purchasing all EEMR modules from the same vendor generally ensures complete interoperability. Purchasing modules from multiple vendors requires information technology support to ensure interoperability.

EASE OF USE

The perceived ease of use between different EEMRs can vary significantly between users, based on individual expertise and comfort levels in using medical software. All software systems have slight variations in their pull-down menus and checklist features. EGD and colonoscopy reports can usually be generated with simple mouse clicks. More complex endoscopic procedures, such as ERCP and EUS, often require more free text entry regardless of the software system, and procedure note generation may therefore take longer. However, many software systems allow customizable options for complex procedures, where large blocks of previously generated free text may be inserted with a single mouse click.

If one is choosing to use the EEMR's administrative and practice management features, then the ability of the endoscopy unit staff to quickly learn and efficiently use

the software is an important consideration. For some endoscopy units information retrieval, such as when generating unit statistics and research-related database searches, is essential, and therefore the ease of doing these searches should be taken into account. The ease of integration of the EEMR with other EPM and EHR systems varies, even when using HL7 messaging standards. Therefore, information technology support on the purchaser's side as well as on the vendor's side is important when selecting a system.

OUTCOMES AND COMPARATIVE DATA

No known studies compare the various EEMR systems. One study indicated that menu-driven, structured, data-entry systems resulted in fewer reports with missing data compared with free text reporting (18% of reports vs 48%).¹² Another study demonstrated that the time needed to generate an endoscopy report was similar whether generated by handwritten (113 seconds; range, 108-117), dictated (including transcriptionist's time) (237 seconds; range, 225-250), or computer-generated means (102 seconds; range, 95-110).¹³ 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.¹⁴

SAFETY

EEMRs must be Health Insurance Portability and Accountability Act (HIPAA) compliant and maintain the privacy of patient medical records. The software should have access control, password protection, and allow for password management. The EEMR interfaces with other hospital software such as the EHR should be secure. All servers must be secure, and data should ideally be encrypted based on National Institute of Standards and Technology standards. If one purchases software that allows for remote access, then the server must be secure and password protected. Automated communication with referring providers (such as by fax or email) 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. Furthermore, there also should be a data backup and storage plan. EEMR generated reports are permanent patient records, and the daily backup of servers should ensure their longevity. EEMRs usually require continuous upgrading to keep the database safe and functioning properly.

FINANCIAL

The cost of purchasing an EEMR system varies by vendor but is primarily based on the number of software features/modules purchased. The cost per room will vary

greatly depending on whether a basic ERS or a complete EHR is purchased. Estimated costs for EMR software systems can be found in [Table 1](#); however, for more accurate pricing please contact the individual vendors directly. Software companies may discount the rate if multiple endoscopy rooms will use the software. Hardware, including desktop computers, servers, and printers, will also be required; however, this generally does not need to be purchased from the software provider. Most software companies offer onsite training during the initial installation of the software. Yearly service contracts are necessary to ensure sustainability of the software and typically range from 10% to 20% of the price of the software. In addition, extra costs may be added based on the degree of software customization and integration with other existing software.

EEMR software is a considerable investment for an endoscopy unit. The expectation is that the EEMR will reduce the overall endoscopy unit costs by reducing or eliminating transcription fees and may lead to increased unit efficiency and productivity.⁹ Enhanced communication with referring physicians as a result of EEMR use may also boost practice referrals and volumes. Quality indicators and benchmarking will be important in the future for reimbursement purposes; therefore, EEMR software may be crucial for documenting and submitting quality measures.¹⁵

AREAS FOR FUTURE DEVELOPMENT AND RESEARCH

Several areas pertaining to EEMRs need further development:

1. The development of EEMR software compatibility with mobile devices.
2. Improved search capability for free text documentation.
3. Enhanced image and video capture ability for 1080p HD quality image and video.
4. The integration of the EEMR into the hospital EHR can be expensive. Therefore, the development of low-cost integration solutions is warranted.
5. Although routine endoscopy documentation is relatively straightforward and efficient in the EEMR, improved documentation efficiency for complex procedures deserves further development.
6. Improved integration of pathology report data into the EEMR to allow for automated calculation of data reports such as adenoma detection rates.

Several areas pertaining to EEMRs deserve further study:

1. Cost-to-benefit analysis of EEMRs in an endoscopy unit has not been studied and warrants investigation.
2. The impact of EEMRs in improving endoscopy unit efficiency and quality needs further study.

3. Comparative studies of current EEMRs with respect to interoperability, endoscopy unit efficiency, and quality improvement should be performed.
4. Studies evaluating the accuracy of database searches, coding, and billing within the EEMR are needed.

SUMMARY

EEMRs have evolved dramatically from simple electronic procedure report writers to comprehensive practice management software programs for the endoscopy unit and practice. EEMRs permit standardized reporting using MST, which allows the entered data fields to become a searchable database for clinical research and quality improvement initiatives. Features such as ancillary document production may allow for improved and efficient communication with referring providers. Perioperative documentation and EPM systems may improve patient care and enhance endoscopy unit efficiency and productivity, but further studies are needed. The integration and interoperability of the EEMR with existing hospital, ambulatory endoscopy unit, and or practice systems is paramount when purchasing software.

DISCLOSURE

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Abbreviations: CORI, Clinical Outcomes Research Initiative; EEMR, endoscopic electronic medical record; EHR, electronic health record; EPM, electronic practice management; ERS, endoscopy reporting system; HIPAA, Health Insurance Portability and Accountability Act; HL7, Health Level 7; ICD, International Classification of Diseases; MST, Minimal Standard Terminology.

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