

## Electronic Medical Informatics Software and Systems (EMIS<sup>2</sup>)

### Introduction

Healthcare has increasingly become results oriented, with dissatisfaction among purchasers, providers, policy makers, and consumers driving significant changes in the way medicine is practiced and measured. Patients have become newly empowered by an overwhelming explosion of healthcare information, at the same time that they assume new roles of financial responsibility for their own care. As healthcare continues to evolve, clinicians need new tools to support an information- and process-driven care delivery model, and in so doing relieve frustrations and inefficiencies by leveraging the patient as a partner and capturing experiential data for continuous learning and quality improvement. In this edition of the *Review*, we explore a “next generation” version of informatics technologies designed explicitly as clinician instruments that support an advanced form of care delivery. We term this model Electronic Medical Informatics Software and Systems (EMIS<sup>2</sup>).

Eleanor Herriman, MD, MBA

*Executive Vice President,  
Chief Science Officer,  
IC Sciences Corp*

*Executive Director,  
Division of Medical  
Information Sciences*

Jessica Cerretani

*Medical Informatics Review Editor*

### The Information Revolution: A New Era of Care Delivery

America’s healthcare system is being transformed by the increasing use of information technology, as has largely already occurred across other industries as part of the 21<sup>st</sup> century phase of the “Information Revolution.” Healthcare delivery is also being actively re-engineered by purchasers, policy makers, and consumers who are dissatisfied with the functions of and results

produced by the healthcare marketplace. A number of factors are converging to drive this major systematic change in healthcare. First, extreme healthcare spending burdens have led purchasers to demand new payment incentives, accountability, and adoption of information technologies. At the same time, a number of prominent researchers have reported that Americans receive an average of only about 55 percent of recommended care and that medical errors lead up to 98,000 deaths annually,

signaling an ongoing quality crisis in the healthcare industry (Asch). In addition, the recent explosion of health information availability has created a generation of newly empowered consumers.

These dynamics have heralded the evolution of the healthcare marketplace toward a patient-centered, value-based, and transparent system in which the ways that providers are measured, evaluated, and compensated are being altered. Specifically, this new medical era will be information-driven.

Informatics can improve care delivery in myriad ways. Perhaps the greatest potential for advancement rests in creating a new sort of patient-clinician relationship—a type of symbiotic partnering based on the patient’s involvement as an informed and accountable member of the care team. Patients can best make decisions concerning their health and are more likely to adhere to recommended treatment plans when they are well informed and able to more productively use precious encounter time for educated discussions with clinicians. As rates of chronic disease rise, and shortages of providers continue, new approaches for preparing and supporting patients in self-management must be developed. Furthermore, using web-based tools to collect data from patients throughout the care continuum serves to save time, improve accuracy, and capture clinical results for quality improvement and practice-based “research.”

Clinical experience information from the marketplace will be needed to drive assessments of value, with “real-world” experience emerging as a major new source of scientific evidence. Clinical and biological information will also constitute the initial phase of personalized medicine. These changes depend on the effectiveness

of patient engagement, which in turn depends on informing processes and systems. Simply put, clinical experience information is poised to represent the new market “currency” in healthcare.

## **New Suite of Informatics Instruments Required**

Healthcare purchasers, particularly Medicare, are increasingly demanding a care delivery model in which physicians’ services move from periodic encounters to a continuous, longer term advisory services approach. Other characteristics of this emerging model include a provider team-based approach, clinician management across the patient panel from a population perspective, and providing behavioral expertise and support to patients who increasingly must self-manage their own chronic conditions. Finally, measurement and evaluation of the quality and productivity of clinical services and interventions is becoming a reality, and providers will be required to clinically justify their results and demonstrate the presence of some sort of quality program in their routine practice.

In this new medical marketplace in which patients are evaluating their experiences as healthcare consumers, payers are setting reimbursement levels based on the quality and resource consumption of clinical services, and information regarding clinical results and pricing is widely available at the provider level, providers need new sorts of “instruments” to deliver care in new ways.

By capturing and channeling core clinical information content and task and data streams, these informatics instruments equip clinicians for patient engagement and for more efficient and systematic care processes. Equally important from a business perspective, these instruments

# Beyond the EMR-EMIS<sup>2</sup>

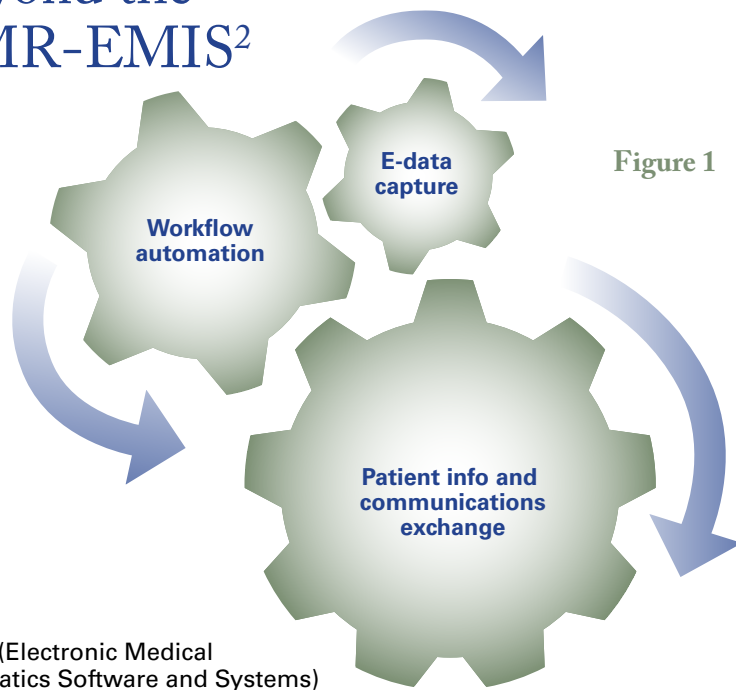


Figure 1

EMIS<sup>2</sup> (Electronic Medical Informatics Software and Systems) are designed to support clinicians in providing an advanced care delivery model. The technology represents an integrated system comprised of instruments that expand the capabilities and bandwidth of clinicians, enabling them to practice medicine in a consumer-driven and results-focused marketplace.

The triad of foundational instrument platforms includes:

- 1 Patient information exchange and engagement
- 2 Clinical workflow automation
- 3 Electronic data capture for quality purposes

will drive the metrics and data warehouses that will form a key foundational asset for clinical practices.

The essential elements enabling higher quality and efficiency have been established from decades of experience in other industries and other domains such as engineering, continuous quality improvement, and operations. They include:

- Developing and automating protocols for aspects of work that are reliably repeatable
- Grouping and linking tasks into processes and programs based on their common contribution to service lines
- Establishing informational feedback loops regarding end results and iteration to improve those results

- Connecting participants, ancillary groups, and customers/patients into interactive communities and supply chains

To effectively support clinicians in these ways, the instruments' functionalities must be congruent with clinical workflow, with tools and systems adapted for various phases along the longitudinal care continuum, and for connecting and coordinating within care teams, staff, referring clinicians, and patients.

In this manner, an interconnected series of modular instruments forms an "informatics skeleton" upon which clinical service programs can be delivered. Delivered in this way, clinical practice operations can be managed for improved coordination, efficiency, effectiveness, and value generation. Analogous to the systematic execution required in conducting an interventional procedure, clinical service line work needs the application of protocols, coordinated teamwork, feedback based on results for learning and quality improvement, and tools to support the patient in order to meet the current market's demands for excellence.

## Electronic Medical Informatics Software and Systems

Viewing clinicians' informatics needs through this lens suggests that current clinical IT products such as first-generation EMRs may be inadequate or suboptimal in their functionality. Most current EMRs are essentially designed to document clinical encounters versus serving as supportive instruments for engaging patients, systematizing clinical workflow, and measuring results.

Advocates for a different sort of EMR, such as Dr. Peter Elkin at the Mayo Clinic, are developing systems that are both minimally invasive in terms of supporting clinical workflow rather than interfering with it, and "intelligent" in terms of capturing data "in a knowledge-

representation form... so one can repurpose that information for secondary uses such as quality monitoring and research and education” (Robinson).

These same principles are reflected in a new clinical IT system architecture that provides clinicians with informatics instruments designed for an advanced model of care delivery. Named Electronic Medical Informatics Software and Systems (EMIS<sup>2</sup>), the technology represents an integrated system of instruments that expand the capabilities and bandwidth of clinicians, enabling them to practice medicine in a consumer-driven and results-focused marketplace. The triad of foundational instrument platforms includes patient information exchange and engagement, clinical workflow automation, and electronic data capture for performance measurement and quality feedback (See Figure 1). Effectively implemented on web-based platforms, the system allows for patients, family support, staff, and other providers to securely access the content and tools anywhere.

These tools can also be customized by condition or intervention and bundled into modules customized by stage in the care continuum. For example, a condition or service line EMIS<sup>2</sup> program might comprise the following temporally sequential modules:

- **Screening /outreach module:** Content and tools for electronically publishing educational materials and assessment questionnaires to primary care clinicians or other community organizations regarding a particular risk factor or early manifestation of a condition
- **Pre-consultation and evaluation module:** Electronic content and questionnaires delivered securely to new patients to inform them regarding their condition(s) and testing, as well as collect registration information, medical history, risk profile, and condition-specific review of systems

- **Intervention module:** Electronic content, decision-support, and informed consent for patient, as well as instructions for procedure preparations or treatment programs
- **Post-care module:** Electronic post-procedure instructions and patient questionnaires to assess recovery progress and report symptomatic and quality of life outcomes
- **Monitor and manage module:** Electronic tools to support patient self-management of chronic conditions, encourage secondary prevention interventions, and be alert for other manifestations of condition and co-morbidities.

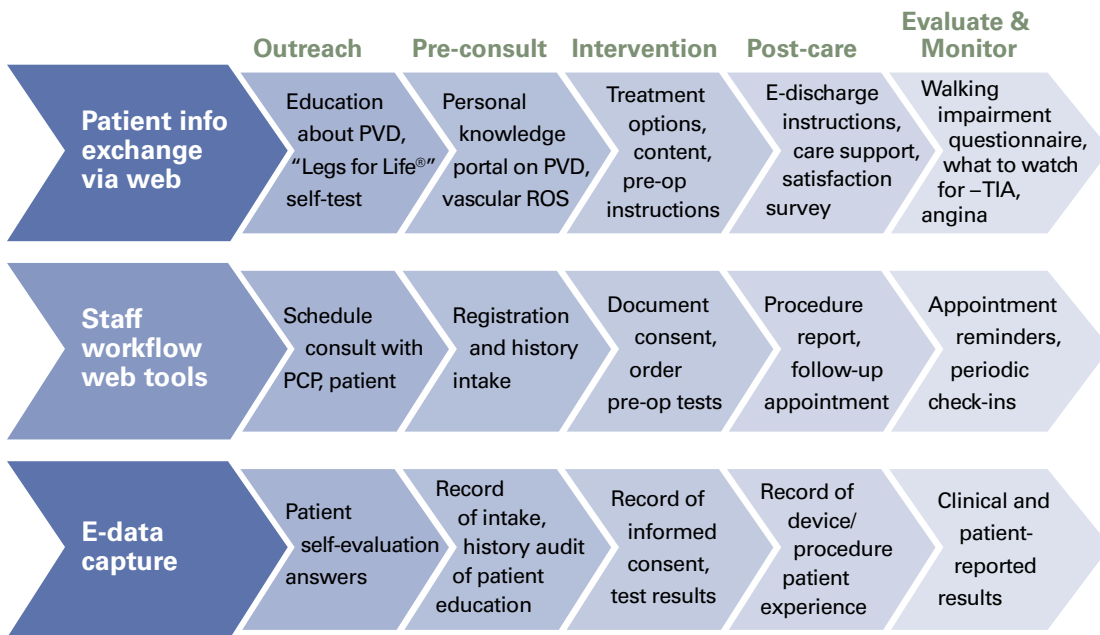
## Peripheral Vascular Disease: Informatics at Work

To illustrate the functionality and impact of EMIS<sup>2</sup>, we describe an application for managing a peripheral vascular disease (PVD) specialty service line. Increasing rates of PVD incidence, low awareness, and significant risk of morbidity and mortality translate into a significant opportunity for benefits from the perspectives of public health, patient lifestyle, and practice growth.

Using a PVD EMIS<sup>2</sup> application, a specialty practice can help raise consumer and primary-care physician awareness of PVD; identify at-risk, asymptomatic, and early-disease patients; facilitate greater patient education and engagement in the care process; and support long-term patient adherence and clinical surveillance. Figure 2 details examples of the PVD EMIS<sup>2</sup> functionality and content by care continuum stage.

### Outreach Stage

At this stage, the system provides tools for generating PVD awareness and specialty referrals for evaluation and treatment of PVD. These tools enable both “pushing” electronic content to primary-



# EMIS<sup>2</sup> Peripheral Vascular Disease Module

Figure 2

care referrers and patients regarding PVD and engaging consumer web browsers in self-evaluation regarding PVD risks. For example, a consumer (who finds the specialist through a web search) or primary-care patient (who may be referred to the specialists' portal for more information) visits the specialty practice's EMIS<sup>2</sup> portal and is directed to brief educational material about the importance of early detection of PVD and a web-based self-assessment survey. One such self-assessment for PVD is available from Legs for Life<sup>®</sup> and includes questions such as "Do you have aching or pain in your legs when you walk?" and "Do you have a family history of diabetes or cardiovascular problems?"

The EMIS<sup>2</sup> portal sends the practice the patient's responses and facilitates scheduling an appointment with the patient using a secure messaging function. The completed questionnaires are stored in an EMIS<sup>2</sup> database for future reference. With more than 50 percent of PVD patients asymptomatic or with atypical symptoms, screening is essential for diagnosis. This process has the potential to improve rates of early detection

and may increase the prevention of PVD (Vincent). Such portals aid in practice promotion and foster the growth of new cases.

### Pre-consult Stage

At the Pre-consult Stage, the practice uses the EMIS<sup>2</sup> module to securely send the patient to a personalized web portal page with deep and customizable engagement content that informs patients about the causes, symptoms, risks, tests, and treatments of PVD, fosters informed decision making, and improves patient centeredness (Gwin, O'Connor, Weiner). Another EMIS<sup>2</sup> workflow tool automates the electronic delivery and patient completion of various administrative forms (registration intake, privacy agreements) as well as medical history intake prior to his or her office consult. This allows the patient to print and complete the forms at his or her convenience, which saves both patient and support staff time and frustration during the initial encounter. In return, the EMIS<sup>2</sup> system collects and stores the data from these forms and questionnaires, thus allowing for the electronic documentation and storage of all information received.

## Intervention Stage

After diagnostic testing has been completed, the practice uses the EMIS<sup>2</sup> Intervention Stage to deliver information regarding alternative treatments, their risks, tradeoffs, and benefits to the patient through the personalized knowledge portal. In the case of PVD, these materials could include educational information about medication therapy, angioplasty and stenting, as well as lifestyle management approaches. After the patient has evaluated options and decided with the specialist on a treatment plan, the patient receives instructions through the EMIS<sup>2</sup> of how to prepare for the procedure. Ensuring that the patient is well informed prior to the intervention reassures the patient, reduces cancellations, improves consent and outcomes, and has been shown to reduce malpractice rates as well (Forkner-Dunn, Guadagnino, Gustafson, Hoffman, Murray). The EMIS<sup>2</sup> system also provides the staff with tools for automating pre-op orders and scheduling the procedure.

### Low Public Awareness of PVD

A telephone survey of 2,501 men and women age 50 and older found that most Americans are still unaware of the causes and risks of PVD:

- 25% of respondents knew about PVD
- 44% knew that smoking is a risk factor for PVD
- 50% knew that diabetes is a risk factor for PVD
- 25% associated PVD with heart attack risk
- 28% associated PVD with stroke risk
- 14% associated PVD with amputation risk
- 14% associated PVD with risk of death
- 18% had been tested for PVD

**Source:** Hirsch AT, Murphy TP, Lovell MB, et al. 2007. Gaps in public knowledge of peripheral arterial disease: The First National PAD Public Awareness Survey. Published on September 17, 2007 on the *Circulation* website.

## Post-Care Stage

Following the procedure, the practice uses EMIS<sup>2</sup> to send the patient procedure-specific information including post-procedure instructions, medication information, and other support tools, which may

also be sent to the patient's family or care advocates. For example, a patient who underwent stenting will be advised to avoid heavy lifting and practice wound care until they have healed. Reports on the procedure and outcome are also sent electronically to the referring physician. The secure messaging system included in a comprehensive EMIS<sup>2</sup> solution enables caregivers or the patient to correspond with the practice regarding recovery and the patient's experience. This approach helps improve clinical outcomes and adherence (Chan, Rasmussen, Roumie, Artinian, Strecher). From a business perspective, collecting such information can boost patient referrals and pay-for-performance scores.

## Evaluate and Monitor Stage

EMIS<sup>2</sup> applications provide practices with a long-term communications channel with patients. In the case of the PVD application, tools would include automated, periodic delivery to the patient of follow-up status checks related to walking impairment, relevant medical news about PVD, guides for patient and family to monitor for complications, and information about comorbidities, such as cerebrovascular and cardiovascular diseases. Involving the patient in comprehensive condition and risk factor management helps reduce morbidity and can benefit the practice's quality performance programs.

Importantly, the EMIS<sup>2</sup>'s longitudinal channel connection with the patient can be used to evaluate the results of treatment interventions. There are multiple validated survey instruments available for PVD-related patient reported outcomes, including the Walking Impairment Questionnaire (<http://www.cebp.nl/media/m152.pdf>) and the Peripheral Artery Questionnaire. The system supports electronic delivery of these types of patient questionnaires and stores patients' replies in a practice clinical data warehouse.

This clinical data warehouse may rep-

resent one of the practice's most important assets, both from clinical and business standpoints. De-identified versions of the data collected throughout the specialist's diagnosis, treatment, and management of the condition can serve multiple "secondary uses." Statistical and algorithmic pattern recognition analyses of these data will likely fuel a new class of medical evidence, unprecedented in its "bottom-up," community practice orientation. Payers and government agencies are projected to fund "practice-based research" studies to assess the relative effectiveness of alternative interventions for particular patient cohorts and best practices for procedures. Also, therapeutics manufacturers value these de-identified clinical data warehouses and are currently paying providers for access to

these data for market research purposes.

## Conclusion

The advent of the new, information-driven medical era and the emerging focus on chronic disease management have combined to set the stage for a care delivery model that equips clinicians with informatics instruments that engage patients and create more efficient and systematic care processes. An instrument such as EMIS<sup>2</sup> allows for the capture and channeling of core clinical information content and task and streams, as well as drives the metrics and data warehouses that will form a key foundational business asset for practices.

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