

Electronic Medical Care Delivery for High Performance Cardiovascular Centers

Built upon a foundation of clinical and cognitive sciences, EMC harnesses the massive potential unleashed by interconnected electronic networks and applies this power to novel interventions that are used by and between patients, consumers, and clinicians.

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About Electronic Medical Care

Electronic medical care (EMC) is a new, high-performance medical discipline that uses the Internet as an intervention to treat patients more effectively and efficiently. Built upon a foundation of clinical and cognitive sciences, EMC harnesses the massive potential unleashed by interconnected electronic networks and applies this power to novel interventions that are used by and between patients, consumers, and clinicians.

EMC has emerged from the nexus of three dynamics – one scientific, another technologic, and the third market based. The scientific dynamic derives from the explosion in neuroscience research in past decades, and the associated discoveries indicating the potent impact interpersonal and informational exchanges have on peoples' attitudes, mindsets, and expectations. These psychological constructs in turn shape our decisions and behavior in powerful ways. The technologic dynamic concerns the now-ubiquitous Internet and wireless telecommunications networks, and the transformational role they're playing in our social and workplace interactions and how we live our lives.

The final healthcare marketplace dynamic has erupted from the unsustainable level

of healthcare spending and deep concerns regarding patient safety and quality of care. As a result, the new care delivery model called "the medical home," as well as new physician practice functions, such as care coordination and disease management, are emerging in the market. These new areas necessitate some form of electronic medical care instrument to be effectively implemented into practices.

Electronic medical care represents the intersection of these forces in its utilization of technology in the form of Internet tools, and its application of science to design and develop information and communication interventions that affect patient and clinician mindsets in ways that advance healthcare. These advances move toward a model that is patient-centered, of higher quality, and more efficient. In this way, EMC interventions are reshaping how care is delivered. In particular, EMC adoption is being driven by its ability to answer a number of disruptive market forces; for example:

- Consumer healthcare - how to transform patients into accountable and involved healthcare consumers? Electronic medical care delivery enables patients to become involved in decisions, make behavior changes, manage their self-care, and adopt productive attitudes and psychosocial skills;

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- Value-based purchasing - how to optimize the value of a new therapeutic product or procedure? Using EMC applications as companions to a therapeutic intervention can improve results and leverage patients as human resources; and
- Pay for performance - how can medical institutions differentiate their clinical services in the newly transparent and measure-intensive marketplace? Electronic medical care instruments are patient-centered and a means to delivering high-performance services (high-quality and value).

The Internet “instruments” used in electronic medical care comprise a new industry with market sectors that include electronic medical care delivery (interventions between clinicians and patients), electronic medical care advancement (interventions between clinicians or health-care professionals) and electronic consumer care (interventions between healthcare consumers). The EMC industry can be considered part of the broader “e-health” or “healthcare IT” industries, though it is distinguished from sectors such as electronic medical or healthcare records or other practice management areas in that for EMC, the Internet is used as a clinical intervention rather than as a support tool or infrastructure platform.

Electronic Medical Care Delivery (EMCD) as a New Medical Discipline

The use by clinicians of EMC as an integral part of patient care is referred to as electronic medical care delivery (EMCD). Three attributes qualify electronic medical care delivery as a new medical discipline. First, like other clinical disciplines, EMCD is a new function or skill that requires providers to develop expertise through both didactic and experiential

learning. In the case of EMCD, examples of this expertise include oral and written communications, motivational interviewing, and navigating Internet information flows.

Second, EMCD has a scientific basis for the design, development, and implementation of its interventional instruments. The applied sciences relevant to EMCD as a discipline draw from psychosocial, health communications, medical informatics, and cognitive and clinical research domains. Finally, EMCD is a medical discipline because, by its very nature, it represents a type of medical intervention. It is a relatively new concept that the exchange of information and communications can sometimes constitute an intervention with diagnostic or therapeutic impact, but an extensive body of evidence supports this proposition.

Effectiveness of EMCD

Electronic medical care delivery entails Internet-based information and communication exchanges between clinicians and patients at the point of care. These interventions target mindsets, decisions, and behaviors, and their consequent neuropsychological results directly affect a wide range of clinically important factors, such as patient adherence to therapeutic programs and the effectiveness of self-care skills and support networks for the chronically ill.

For example, research indicates that for patients with some common chronic conditions, the patient’s mindset or confidence is a stronger predictor of positive clinical outcomes than is their behavior. As Beranova and Sykes say in the example of myocardial infarction (MI), “Past research shows that patients’ beliefs and perceptions about their illness are key determinants of recovery after MI. Patients who believed that their MI would have more long-

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lasting consequences had greater levels of illness-related disability and their return to work was slower. Similarly, patients who believed they had less control over their heart condition were found to be less likely to attend cardiac rehabilitation.” Further, cardiac education interventions have significantly and measurably affected blood pressure and mortality (Mullen et al), while positive change in activation levels “is related to positive change in a variety of self-management behaviors” (Hibbard).

Intervening to shape patient mindset using EMCD instruments is a critical role clinicians can play. It is important that the clinician deliver the intervention, as this positions the instrument as a therapeutic component of care. EMCD instruments securely deliver interactive content that provides explanations regarding a patient’s specific medical situation, and define clinical problems, tests, and treatments in “plain language” terms that the patient and their caregivers can understand. Objectives include improving patient and family knowledge levels, health literacy, confidence, and stress levels. An extensive body of studies demonstrate that when clinicians use EMC instruments to engage patients, improvements in quality, patient and provider satisfaction, and, perhaps most importantly, clinical and patient-reported outcomes occur.

EMCD for Cardiovascular Care

A continuum exists regarding the degree to which a condition’s severity is affected by patient mindset and hence, EMCD interventions. Medical conditions for which pain and related subjective symptoms are a major component are most sensitive to mindset and EMCD instruments. Also, evidence indicates that chronic conditions or treatments requir-

ing a fair degree of self-care management require patient confidence in their ability to adhere and affect outcomes for optimal results. Together these factors (pain, daily living impact, and self care management needs) determine how “mindset-sensitive” a particular condition is.

To assess the importance of EMCD in cardiovascular care, the mindset sensitivity of common cardiovascular conditions was estimated. Each condition was assigned three scores from 0 to 2 points each for pain, impact on activities of daily living, and self-care management (*see Appendix*). A score of 0 indicated that it is a major symptom or component less than 25 percent of the time, 1 it is a major component between 25 and 50 percent of the time, and 2 indicates that it is a major component more than 50 percent of the time. Out of a total of 42 conditions, 48 percent had a score of 1 or 2 for pain, 55 percent had a score of 1 or 2 for daily activities, and 71 percent had a score of 1 or 2 for self-care management. Thirty-one percent of the conditions are very mindset-sensitive, with scores of 1 or 2 for pain, daily activities, and self-care management.

Overall, then, cardiovascular care appears quite sensitive to patient mindset and thus, electronic medical care should have a major impact on patient experience and treatment effectiveness. A number of studies substantiate the potency and effectiveness of electronic medical care instruments in cardiovascular medicine, as measured in terms of both patient level “endpoints” such as patient knowledge, sense of readiness or degree of anxiety, activation and confidence, as well as of routine outcomes, either clinical or patient reported. The Mullen et al and Hibbard studies show this, in that blood pressure and self-management behaviors improved following cardiac interventions.

As Moser and Worster say, addressing psychosocial issues and giving “attention to nontraditional risk factors for rehospitalization and mortality, in addition to traditional medical risk factors, may yield improved outcomes.”

Computer-based heart failure education increased patient knowledge more than nurse-led education (Stromberg et al) in one study, and its use “is associated with improvements in patient satisfaction, better health outcomes, better compliance, more empowered patient decision making, and reduced medical malpractice” (Berano and Sykes). Furthermore, when these interventions actively involve patients and caregivers in discussion and evaluation, versus passively providing information, there is a greater effect on patient mood and access (Paul).

The sheer volume of people diagnosed with cardiovascular disease — approximately 64 million Americans — makes addressing its management urgent and crucial. Kuhl et al conclude that web-based interventions are an effective way to maximize patient care and improve physical and psychological outcomes. They reviewed the literature on arrhythmias, congenital heart disease, and congestive heart failure, and maintain that the anonymity and community an Internet tool affords has great value. Further, they found that feelings of self-efficacy and acceptance were fostered via these e-tools. The authors note 6 attributes of effective web-based intervention: informative regarding self-care knowledge, healthy behaviors, and decision making; tailored to the individual and the type of intervention; usability, as in self-directed and easy to read; engaging, in terms of a variety of text and graphics; interactive with peers and professionals; and validated by randomized controlled trials and other empirical evidence.

In a related paper, Southard and colleagues found that fewer cardiovascular events occurred in a population receiving a special heart disease intervention tool, versus those doing traditional cardiac rehabilitation. One hundred and four cardiovascular disease patients took part in this random-

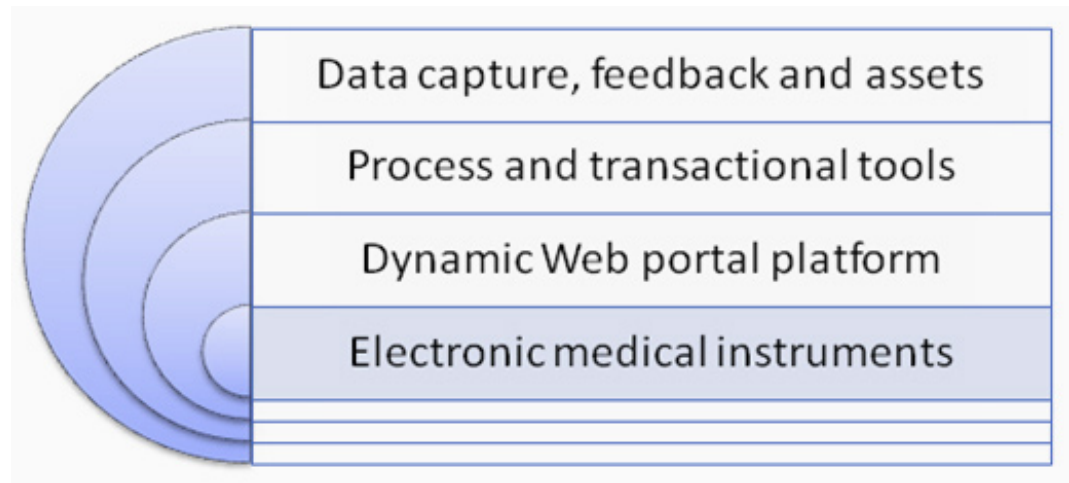
ized controlled trial, 53 of whom used the Internet tool. This entailed logging on at least once per week for 30 minutes and communicating in email format with a case manager. The case manager also assigned education modules and showed the patient how to join online discussion groups and enter in data such as number of minutes of exercise and blood pressure measurements. Participants received small rewards for actively using the tool. Not only were both patients and physicians “very satisfied” with the program, but it resulted in fewer cardiovascular events and more weight loss. The authors calculated gross cost savings to be \$1,418 per patient, with a return on investment of 213 percent.

As Moser and Worster say, addressing psychosocial issues and giving “attention to nontraditional risk factors for rehospitalization and mortality, in addition to traditional medical risk factors, may yield improved outcomes.” In their 2000 report, they discuss how in complex cardiovascular conditions like heart failure that require a constellation of self-management practices, poorer quality of life is associated with higher mortality rates and greater likelihood of rehospitalization. The research says that medical therapies often do not improve quality of life, which drives home the importance of addressing the mindset and emotional state of the patient. Echoing Kuhl et al, when these web interventions are tailored, they are generally more effective than similarly tailored or non-tailored paper-based tools for cardiovascular disease (Kukafka et al).

Implementing EMCD at Cardiovascular Centers

Delivering electronic medical care within the practicalities of an operating cardiovascular center requires a system of

Figure: Electronic Medical Care Delivery Architecture



specialized Internet tools within which the core EMCD instruments are embedded. Engaging, instructing, and involving patients in their care and treatment decisions before and after encounters/admissions is challenging using only traditional communication and clinic channels. Studies have shown that patients, on average, recall about half of what health-care providers tell them. Indeed, up to 45 percent of patients cannot remember the risks of surgery, 44 percent do not know the exact nature of their operation, and many are unable to answer basic questions about the procedures or services they agreed to receive (National Quality Forum).

An EMCD system addresses this problem by providing an integrated technical package that enables clinicians to “prescribe” personalized and interactive content that is accessible to patients, their families, and caregivers anytime/anywhere/with anyone. With the assistance of the underlying platform and surrounding tools, specialized electronic medical instruments (EMIs) guide, involve, and support patients in their care before, during, and after inpatient episodes. Also, the system regulates transactions and clinical processes around the management of particular conditions. By layering these instruments

atop a dynamic, interactive web portal, the system can serve as the institution’s window to the marketplace and as a virtual adhesive among affiliated community clinicians and across the care continuum.

Electronic Medical Instruments

The heart of the EMCD system architecture is the EMI category that constitutes electronic medical interventions with patients. These “instruments” are web-based applications that typically enable a bidirectional flow of content, data, and communications, as well as automated functionality for transactions and other utilities.

The instruments engage patients in their care through content that is high quality, expert sourced, and written at an appropriate reading level. Accompanying graphics and personalized advice based on the patient’s individual needs also promote patient confidence. Effective instruments typically engage and promote high usage through dynamic and interactive functionality. The instrument interventions also engender patient trust by being free of advertising or commercial sponsorship, being regularly reviewed and updated by medical experts, and by being delivered by a trusted source such as the clinician.

When implemented as part of medical care, EMIs offer ready electronic access to the clinician between face-to-face encounters for non-urgent questions. In addition, EMIs can expand patients' confidence and capabilities regarding their own care throughout the care continuum, by, for example, bolstering the effectiveness of a patient's family and support networks, providing access to patient peer experience, and recommending consumer healthcare technology resources.

EMIs can be grouped into various instrument classes according to the primary instrument function:

- The "Comprehension and Mindset" instrument class allows patients and their caregivers to understand their medical situation and choices outside of the confines of brief face-to-face encounters, in a manner that facilitates engagement and motivation;
- The "Patient Decision Support" instrument class assists patients in making test or treatment decisions in a way that optimizes their satisfaction with, and confidence in, the quality of the decision. These tools facilitate the Institute of Medicine joint care plan development aspect of patient-centered care;
- The "Adherence Support" instrument class employs a customized series of information, communication, and support tools that instruct and persuade patients regarding adherence to the prescribed treatment plan, including post-care, follow-up visits, medication regimens, and secondary prevention programs; and
- The "Self-Management" instrument class provides Internet delivery of the skills training and support resources needed to engage and motivate patients, families, and caregivers in managing

chronic conditions. Portal-based secure messaging and transactions allow for more efficient and effective communication between patient and provider, as well as the capture of patient-reported outcomes. These portals provide a platform for the Institute of Medicine's recommendation regarding proactive clinician follow-up and web-based monitoring and support programs.

EMIs are implemented as condition, test, or treatment-specific applications and as multi-content modules designed to follow the care continuum for managing a particular condition. In this way, EMIs facilitate a patient-centered model and streamline clinical management processes around conditions. There are cardiovascular instruments specifically configured for 42 conditions (*see Appendix*).

Dynamic Web Portal Platform

Cardiovascular EMIs are managed, delivered, and packaged within a dynamic portal platform. The portal's look and feel, content, architecture, and functionality are customized for a particular institution's needs. Portal functionality can include custom newsletters, completion of surveys, submission of inquiries by interested browsers, automated management of informational content and messaging, and data capture through web-based forms.

The portal serves a number of functions. As the institution's Internet "storefront," it embodies the institution's marketing strategy; through customized descriptions of areas of excellence and special initiatives, it implements competitive differentiation; and it unifies the institution's various facilities and people through a virtual integration across geographies, specialties, and referring community clinicians.

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Process and Transactional Tools

An important aspect of patient-centered care and the new consumer-oriented patient concerns convenience. Patients (especially the Baby Boomer cohort) now expect to have the option to transact, exchange information, and communicate via online channels. Thus the EMCD system can be configured to provide HIPAA-compliant, secure messaging and information capture through utilities that reside within the portal. These utilities also support electronic transactions such as bill payment, appointment scheduling, and administrative intakes.

This functionality integrates well with the clinical EMI interventions so that patients experience an integrated, streamlined series of services. Moreover, moving administrative exchanges and questions online frees up telephones, wait times, and results in labor cost reductions.

Electronic Medical Cardiovascular Care – The Benefits of High-Performance Medicine

As supported by both evidence and market experience, delivering electronic medical cardiovascular care translates to higher quality and more efficient and satisfying medicine.

Higher quality derives from the patient-centered orientation of the approach, as well as the clinical and patient-reported outcomes resulting from these interventions' impact on patient mindset and behavior. Efficiencies accrue from the streamlining of administrative and clinical processes, as well as the free assistance provided by an engaged patient. The integrated and more convenient nature of the patient's experience results in higher satisfaction scores.

Multiple studies indicate that patient-centered care produces better clinical outcomes, greater patient and clinician satisfaction, reduced malpractice claims and greater patient loyalty to the clinician (Meryn et al). Malpractice risk can be reduced and the level of defense raised by using EMIs for shared decision making. In 2007, Washington State passed legislation that establishes a new legal malpractice level for informed consent based on shared decision making using decision aids. This creates a higher standard of defense for a physician than the "preponderance of evidence" standard that currently exists for physicians who use informed consent forms.

Taken together, higher quality and relatively less resource intensive care equates to a high performance provider that delivers greater value to employer and Federal government purchasers. An institutional reputation based on this performance and developed through the marketing power of a sophisticated portal with advanced functionality means more referrals, performance bonuses, and potentially higher reimbursement rates.

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Appendix

Analysis of the mindset sensitivity of cardiovascular conditions.

A “Mindset Sensitivity Index” was developed. The Index reflects the degree to which a condition’s mindset impacts the disease course and response to treatment. For each cardiovascular condition, an assessment was made and score of 0, 1, or 2 was assigned for each of three variables as follows: to what extent the condition’s presentation involves (a) pain, (b) symptoms and signs that impact activities of daily living, and (c) self care management - to what extent the condition’s treatment requires complex, lengthy self-care management by the patient/caregivers.

PAIN SCORES	
Less than 25% of the time pain is a major symptom	0
Between 25% and 50% of time pain is major component	1
More than 50% of time pain is a major symptom	2

ACTIVITY SCORES	
Less than 25% of patients have impact on daily activities	0
Between 25% and 50% of patients have impact on daily activities	1
Over 50% have impact	2

SELF CARE SCORES	
Less than 25% of patients have multiple medications and lifestyle issues to manage	0
Between 25% and 50% of patients have multiple medications and lifestyle issues to manage	1
Over 50% of patients have multiple medications and lifestyle issues to manage	2

MINDSET SENSITIVITY OF CARDIOVASCULAR CONDITIONS

Condition	Pain	Daily Activities Impacted	Self Care Management Requirements
Abdominal aortic aneurysm	0	0	0
Acute myocardial infarction	2	1	2
Angina pectoris, stable	2	1	0
Angina pectoris, unstable	2	1	1
Aortic valve disease	1	1	1
Aortoiliac disease	2	1	1
Atrial arrhythmias	0	0	0
Atrial fibrillation	0	0	1
Carotid artery disease	0	1	1
Congenital heart disease	0	0	1
Congestive heart failure	0	2	2
Deep vein thrombosis	1	1	1
Diabetic vascular disease	1	2	2
Digital artery conditions	0	0	0
Dilated cardiomyopathy	0	2	2
Heart block	0	0	0
High cholesterol	0	0	1
Hypertension	0	0	1
Hypertrophic cardiomyopathy	1	1	2
Lipid disorders	0	0	1
Lower extremity disease	2	1	1
Lymphedema	1	1	1
Metabolic syndrome	0	0	1
Mitral valve disease	1	1	1
Patent foramen ovale	0	0	0
Pelvic congestion syndrome	2	0	1
Pericardial disease	0	1	1
Portal hypertension	0	1	1
Pulmonary embolism	1	0	1
Pulmonary hypertension	1	2	2
Renal artery disease	0	1	2
Stroke	0	1	2
Syncope	0	0	0
Thoracic aneurysm	1	1	1
Thoracic outlet syndrome	2	1	0
Upper extremity disease	2	0	2
Varicocele	1	0	0
Varicose veins	0	0	0
Vascular malformations	0	0	0
Venous disease	1	1	1
Ventricular arrhythmias	0	1	0
Visceral artery conditions	2	0	1

Mindset sensitivity results: What percent of common cardiovascular conditions typically involve pain, daily activity management, or self-care management issues for more than 25% of patients or more than 25% of the time for a patient.

	Pain	Daily Activities	Self-care Management
42 total conditions % of total with 1 or 2	48%	55%	71%
Conditions with all 3 mindset factors Number of Conditions	13		
Conditions with all 3 mindset factors Percent of Conditions	31%		