



Market Brief

**Emergency Department information Systems
Fall 2003**

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Executive Summary

Emergency Department Information Systems improve operational efficiencies and patient care

Emergency Departments are operating at critical capacity. Social and economic pressures ranging from increased industry regulation and higher standards for quality care have resulted in a 15 percent decline in the number of hospital-based EDs. Meanwhile, factors such as the aging population and the growing number of uninsured patients, have caused a 16 percent increase in average yearly visits. To counter this crisis, many EDs are looking to computerized Emergency Department Information Systems to improve patient care and increase operational efficiencies.

Technology and EDISs play a critical role in enabling health care facilities to comply with regulatory mandates associated with patient care and triage. To address these mandates, health care executives should consider exploring secure technology that leverages information sharing through the Internet, bar coding, wireless networks, voice recognition and integration with an electronic medical record system as well as financial and reporting systems.

EDIS vendors typically are proponents of either a single comprehensive system that offers a total solution within the context of the existing enterprise, or a module-based system that offers similar functionality and the option for integration with the existing enterprise system.

For health care facilities considering an EDIS, this report reviews the strategic role EDs play within health care and the importance of increasing efforts to automate processes by implementing or upgrading information technology. The document provides an industry snapshot of the market, including a description of typical vendors, implementation issues, recent industry trends, regulatory influences, costs and return on investment scenarios. Company profiles of select vendors are provided.

Emergency departments across the United States are at the breaking point, with fewer resources to treat increasing numbers of patients, including a growing population of uninsured patients with no other access to medical care.¹

George Molzen, M.D., President of American College of Emergency Physicians.

i. Defining Parameters *[scope and layout of the market, areas covered vs. excluded]*

The 3,934 emergency departments in the U.S. act as the gateway to all other medical resources available in a hospital.² They are critical in their contribution to hospital admissions and revenue. For example, in 2001, 12 percent of the patients seen in the emergency department were actually admitted to the associated hospital. This national average of emergency department admissions represents an average proportion of 40 percent of a given hospital's overall admissions, and in some cases, the proportion can be as high as 70 percent.³

Additionally, the experience of patients and their families in the ED reflects on how the entire health system is perceived within the community it serves. Thus, the national crisis of overcrowding in the ED threatens the perception of delivering quality care and the success of the entire health care organization.

In spite of the ED's strategic role within a health care organization, there has been little focus on upgrading automation until the last few years. Many of the processes and information requirements within the ED overlap and interface with those found in other areas of the hospital. Figure 1 depicts these processes and their interface within the hospital.^a However, the work flow requirements of the ED are unique and require a purpose-built piece of software. Based on the literature, the following modules are considered necessary for an effective emergency department information system:^{4 5 6}

Triage – A triage module should provide documentation capability for patient complaint, history, initial vitals and any initial orders. It should be fully integrated with a patient tracking system in order to determine availability of rooms and other resources.

Patient Log – The EDIS should allow the ED to admit a patient even if the hospital admitting system is not available.

Patient Tracking – Active patient tracking includes a status board that allows any clinician to know the disposition and location of the patient at all times. The tracking board should provide automatic updates to tracking information and data displayed should be customizable. The tracking board should allow the blanking out of sensitive patient data. Tracking is essential to patient placement so that the triage nurse knows what rooms are available and for what patients.

Physician Charting – The physician charting function should provide prompts for compliance with the Centers for Medicare & Medicaid Services evaluation and management documentation guidelines. It should provide templates that cover a number of different common presenting complaints. These templates should be customizable by ED. The documentation should manage drawings to allow easy specification of location of injuries or pain. This should include the ability to annotate diagrams. A significant benefit of an EDIS charting system is that more documentation occurs, thereby improving reimbursement and risk management efforts.

^a MTR, Inc. created the figure as a component of research for VHA Inc. October 2002.

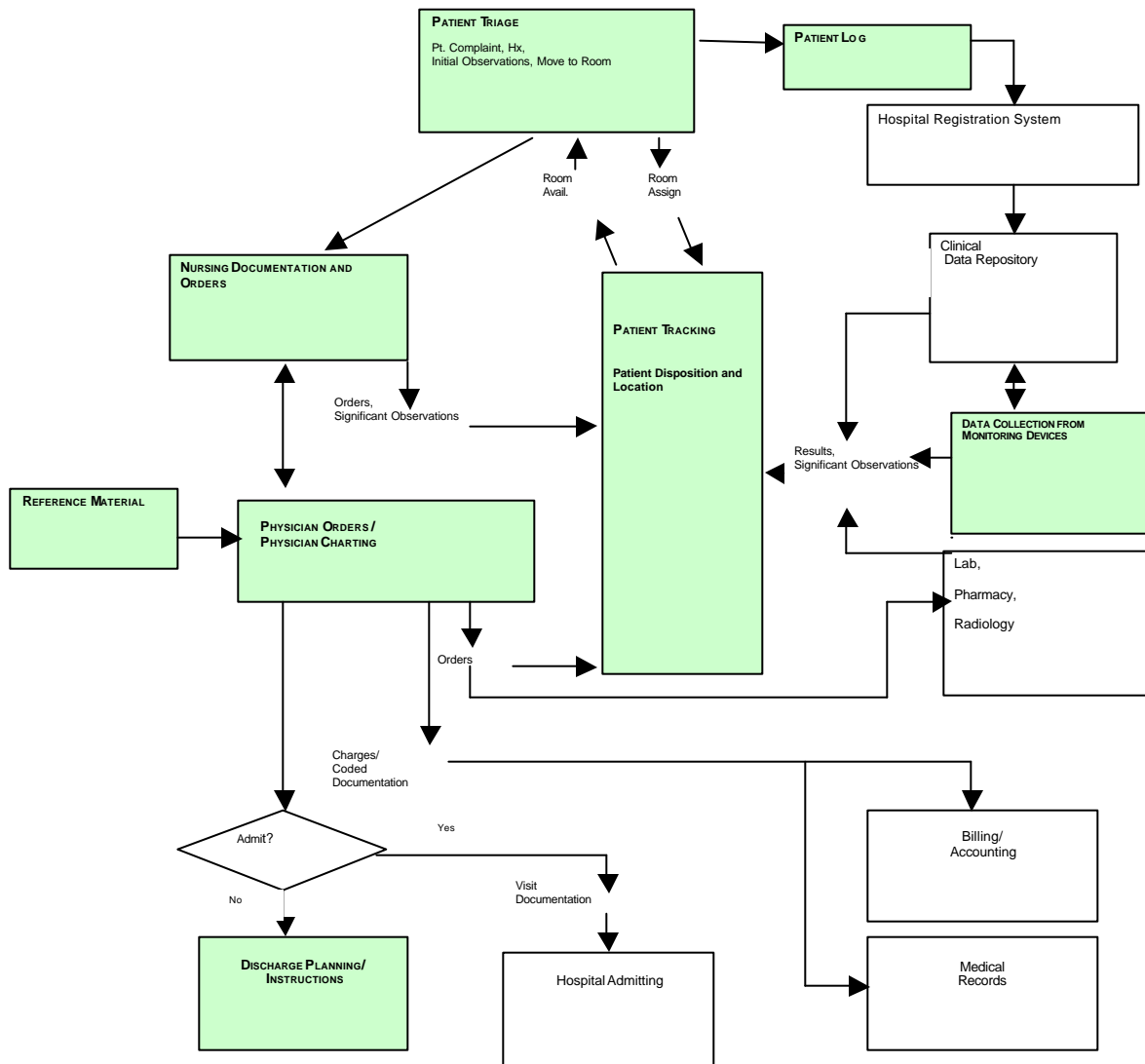


Figure 1

Source: © MTR, Inc.

Prescription Writing and Physician Order Entry – The EDIS should provide automatic triggering of orders from clinical paths or guidelines. Clinical information should be available at the time of ordering to prevent avoidable errors such as drug - drug interactions and allergy alerts as well as avoid duplicate or unnecessary treatments and assure compliance with standards of care. Clinical alerts should notify the clinician of potential errors or duplicate orders.

Nursing Documentation – Systems should provide automated entry of common complaints, interventions, medication/dosages and common nursing orders. The EDIS should also provide automated entry of vital signs directly from patient monitors and provide documentation that is integrated with inpatient nursing.

Reference Material – The EDIS should provide access to online reference material for clinical support and risk management.

Discharge Planning/Instructions – These instructions should be automatically printed for patients based on diagnosis. An option to print in multiple languages is important to allow the ED staff to provide for the increasing multilingual population in the U.S.

Reporting – The EDIS should provide the capability to develop standard and ad hoc management reports as well as specialized reporting requirements of public health agencies.⁷

Interfaces – Interfaces to laboratory, pharmacy, radiology and to the organization’s clinical data repository are required to provide clinicians with known information about a patient so that they can make more informed decisions. Interfaces to admitting /registration, order entry, staff management, general accounting and billing systems are required to reduce duplicate paperwork and streamline work flow.

Security – Information security within an ED has additional challenges over other areas of the hospital because of the easy access of the public to the ED. The system should provide automatic timeouts when workstations are not in use, automatically updated passwords and provide role-based access by limiting user access by feature, function and module. Additionally, the advent of wireless networks, hand-held technology, the Internet and regional information systems that track the availability of emergency room space add security challenges, as EDs automate or upgrade and come into compliance with the security requirements of the Health Insurance Portability and Accountability Act.⁸

This report addresses Emergency Department Information Systems designed to manage the distinct work flow, documentation requirements, operational efficiencies, and the delivery of quality care within the ED.

Definitions used in this report are:

ADE	Adverse Drug Event
APC	Ambulatory Payment Classification
ASP	Application Service Provider
ED	Emergency Department
EDIS	Emergency Department Information System
EMTALA	Emergency Medical Treatment and Labor Act (federal “anti-dumping” act)
HIPAA	Healthcare Information Portability and Accountability Act
HIS	Hospital Information System
PDA	Personal Digital Assistant

Niche (also stand-alone): provides functionality that is specific to given market segment; refers to vendor-developed software that is for a specialized and narrow market segment, in comparison to the broad market for commercial off-the-shelf-products such as operating systems and office product suites which are mass produced.⁹

Enterprise (also HIS or hospital-wide): In the computer industry, an enterprise is an organization that uses computers. It encompasses corporations, small businesses, non-profit institutions, government bodies, and possibly other kinds of organizations; applied much more often to larger organizations than smaller ones.¹⁰

A CDC June 4, 2003 report indicated that between 1992 and 2001, the number of ED visits increased by 20 percent to over 107 million a year, and this underscores the vital and growing role emergency departments play in safeguarding the public’s health.

George Molzen, M.D., President, American College of Emergency Physicians.^{11 b}

^b The report also indicated that during the same period, the number of hospital-based EDs has declined by 15 percent to 3,934, further emphasizing the importance of the ED in U.S. communities.

I. Industry Snapshot *[current structure, general size and growth rate]*

A. Overall *[as applicable]*

There is no analogous offering of emergency department information systems in non-health care industries.

B. Health Care *[as a subset of the overall market]*

A review of the literature found that most EDs today are using disparate systems developed for other areas of the hospital that enable isolated processes within the ED. These systems were not designed to support ED work flow and require “work-arounds” on the part of the ED staff.¹²
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Some EDs have augmented these systems with stand-alone systems for a specific function such as scheduling or triage. In such cases, they are often developed internally and present a challenge to maintain and integrate with enterprisewide systems. As a consequence, ED staff members perform additional work to supply required information to the hospital systems.¹⁴

Because of the regulatory and economic pressures the ED faces, many are now looking to computerized information systems to help improve patient care as well as increase operational efficiencies.¹⁵ According to the American College of Emergency Physicians in September 2002, at least one in six hospitals have upgraded their emergency departments.¹⁶ A survey of more than 500 hospital ambulatory care directors, emergency services administrative and medical directors and chief information officers, indicated that close to 40 percent of EDIS have been installed since 1999.

1. Industry characteristics

a. Number of vendors in the market

Some acquisition activity was noted from 2000 to 2002, particularly among the larger niche vendors of full EDIS systems. Partly because of the relative young age of this category, the total number of vendors providing a comprehensive ED solution appears to be less than 16.^{17 18}

b. Typical vendor description

According to the July 2003 KLAS Emergency Department System Study,^c ED vendors offer a wide variety of functionality which may include nursing documentation, physician

^c The July 2003 KLAS Emergency Department Systems Study surveyed 196 IT executives and reported on the vendors who qualified for the report based on their functionality and associated statistical significance. The vendors were A4, Cerner, ibex, LOGICARE, MedHost and Wellsoft. Several other vendors in various stages of development are also featured: CodoniX, Eclipsys, Emergisoft, McKesson, Meditech, PCTS, T-System and Vital Works. The KLAS database represents the opinions of health care executives, managers and clinicians from over 4,000 health care facilities on 300+ vendors and 500+ different products. The information is continually refreshed with new performance evaluations and interviews daily. KLAS utilizes a two-step process to collect candid performance data. First, KLAS collects a series of direct product/vendor evaluations completed by health care provider organizations covering 40 performance areas. Second, KLAS performs in-depth, confidential interviews with the IT executives and department directors completing the

documentation, chart tracking, patient tracking, clinical system integrations, discharge documentation, voice dictation, clinician alerts, and quality management and productivity reports.¹⁹

The KLAS study indicated that ED systems may also provide regulatory compliance features, such as physician order entry to alleviate possible transcription and legibility problems addressing patient safety mandates in addition to patient privacy and system security features to meet HIPAA requirements.²⁰ Interestingly, patient tracking and discharge planning are the two most popular live components, followed by results reporting, nurse documentation/charting and patient registration (in that order). This is consistent with that reported in 2002.²¹

Overall, vendor types can be split into two groups:²²

- those who believe a single comprehensive system offers a total solution with seamless integration
- those who feel modules offer greater system design flexibility, easier integration and lower initial costs

These vendors can further be broken into three categories of vendors in the ED market: enterprise vendors, niche vendors and specialty vendors.

While the technology to accomplish it may be different, all EDIS vendors in the KLAS 2003 study have clients with multiple sites “live” on their ED systems. Although all vendors claim between 50 percent and 67 percent of their installations are for only one emergency department in a given integrated health care delivery network, several of the vendors claim that 13 percent of their installations are for two or three emergency departments.²³

Enterprise Vendors

These enterprise vendors, also known as hospital information system vendors, have developed comprehensive systems for the overall management of the hospital and departmental systems. Most of these vendors have systems that address the ED clinical and department management needs. They also offer the added benefit of having incorporated most of the integration technology required to access their enterprise functionality (e.g. clinical data repository, financials).

Niche Vendors

These are software developers focused on functionality for the emergency department. They offer solutions that address most of the functionality required for departmental management, charge capture, patient tracking and documentation.

Specialty Vendors

These are vendors that sell software or a service solution for a particular need in the ED (e.g. coding, staff scheduling, out-sourced dictation).²⁴

2. Installation/implementation issues/barriers

questionnaire to gather valuable insight into specific strengths, weaknesses and future expectations for the product.

EDIS should be considered an enabler for improving work flow efficiencies. The implementation of an EDIS offers the opportunity to analyze existing processes and work flow and to determine where process changes are needed. Without such analysis, full benefits are unlikely to be achieved.

a. Technical issues

Technical issues related to EDIS usage include the need for integration with other systems such as the hospital patient registration system, order entry, electronic medical records and diagnostic results systems.²⁵ Technical considerations supporting that effort follow.

The July 2003 KLAS study results indicate that interfacing is the most common approach to technological communication between the EDIS and other components of the organization's systems. Of the featured vendors, a minimum of 85 percent of installations were defined as being "interfaced" to other systems in the organization.²⁶

The July 2003 KLAS study results indicate also that EDIS installations most commonly involved interfaces to admissions, discharges, transfer (75 percent), laboratory (51 percent) and radiology (24 percent) department systems.²⁷

Health Level 7 Standard

The use of HL7^d compliant interfaces by most EDIS vendors eases the implementation of interfaces between the EDIS and other hospital systems.²⁸ This integration with hospital systems is essential in optimizing the returns from an EDIS, because it gives clinicians full access to information throughout the organization and reduces the duplicate work of supporting multiple systems

Data Elements for Emergency Department Systems

The National Center for Injury Prevention and Control is coordinating national efforts to develop uniform specifications for data entered in ED patient records.²⁹ The initial product, Data Elements for Emergency Department Systems, Release 1.0, was released in 1997 and select specifications from DEEDS have been incorporated into HL7 Implementation Guides.³⁰

Consolidated Health Informatics Initiative

The Departments of Health and Human Services, Defense, and Veterans Affairs have announced plans to develop uniform standards for the electronic exchange of clinical health information within the federal government. Under the plan, all three federal agencies will adopt HL7 messaging standards, National Council for Prescription Drug Programs standards, the Institute of Electrical and Electronics Engineers 1073 series of standards, Digital Imaging Communications in Medicine standards, and Laboratory Logical Observation Identifier Name Codes.³¹ This standardization has an impact for all EDISs since they contain and manage patient information electronically.

^d Health Level Seven is both an American National Standards Institute-accredited standards organization and a standard. The organization was founded in 1987 with a mission to provide standards for the exchange, management and integration of data that support clinical patient care, and the management and delivery of health care services by defining the protocol for exchanging clinical data between diverse health care information systems. The HL7 organization works through volunteer efforts to create flexible, cost-effective approaches, standards, guidelines, methodologies and related services for interoperability between health care information systems.

Patient Privacy/Security

The clinical data for patients that are managed through an EDIS are considered part of the patient's confidential medical record. The implementation of EDIS, therefore, requires careful evaluation of security and procedures surrounding access and use of the information. Subsequently, the system should comply with security requirements mandated by HIPAA. For example, the product architecture should support user authentication and role-based authorization, audit capability, encryption, data authentication and support for an electronic signature and automatic log off capability.

b. Enterprise/human resource issues/barriers

Staff Acceptance

In all areas of implementation, any changes introduced by automation should be evaluated based on their impact on clinicians.

- Getting people to enter data is noted as the major human factor for hospitals that are reluctant to incorporate an EDIS.³²
- Implementation should be carefully balanced, ensuring that the addition of new or different sources of clinical information does not hamper or fragment the information needed by clinicians to do their job.³³
- Within the ED, all clinicians need to use the same methods of documenting in order for them to know reliably where to find information.³⁴ Otherwise, clinicians will not be able to rely on the system.
- Human resource issues experienced during one EDIS implementation included the discovery that part-time and temporary staff were not familiar with the system and that some physicians could not type or use a keyboard.³⁵

Implementation

Based on the literature, a modular approach to an EDIS implementation is recommended.^{36 37}

- functions that cause the least disruption to physicians should be considered first
- most hospitals start with patient tracking, before implementing charting modules, and proceed next with automated coding and better compliance documentation

Analysis of client win/loss commentary in the 2003 KLAS Emergency Department Study provides insight into the vendor selection process and the reasons why a vendor is selected or not. The percentages are taken from the overall commentary on the subject of wins and losses. Overall, functionality is the most common reason an ED vendor is typically selected.³⁸

According to the July 2003 KLAS study, some of the common successes and lessons learned noted by respondents include:

- interfacing is one of the toughest pieces; determine cost, availability, and timelines during contracting
- a united team consisting of nursing, physicians, and IT staff will assist in a successful implementation
- choose a system that matches your existing work flow process or one that can be customized to follow your process

- the ease of the application navigation process and ease of system training is a key factor in nursing and physician system use; techniques such as templates, drop down lists and the like appear to simplify the on-line documentation process
- downtime on an emergency room system is disruptive and there is never a “good” time for it; include downtime discussion during contracting.
- ensure system of choice will integrate with any future Computerized Patient Record goals
- review vendor supplied discharge instructions to ensure they meet your population needs, both in content and language ³⁹

II. Recent Trends in Industry [*recent changes in general structure, market size, and growth rate*]

A. Overall [*as applicable*]

Not applicable.

B. Health Care [*as a subset of the overall market*]

Overcrowding in the ED:

Overcrowding in the ED is at a crisis point and affecting the delivery of quality care. In July 2002, the Joint Commission on Accreditation of Hospital Organizations issued an alert about catastrophic delays in hospital treatments that involved death or serious injury. Half of the cases were ED-related, with overcrowding cited as a factor in 31 percent of those cases.⁴⁰

Since the JCAHO alert in 2002, several supportive indicators of overcrowding and the associated medical risks in the ED have been released.

- First, EDs today are operating at critical capacity. As noted, according to data published June 4, 2003 from the Centers for Disease Control and Prevention, the number of ED visits has increased and the number of hospital-based EDs has declined.^{41 42} This decrease in overall ED capacity and increasing visits has resulted in an increase of approximately 16 percent in average yearly visits per ED to approximately 27,000 in 2002.⁴³
- Secondly, because overcrowding is causing delays, patients are leaving the ED without medical evaluation. A General Accounting Office report issued March 27, 2003, indicated that communities with large uninsured populations have almost twice the median percentages of patients leaving emergency departments prior to medical evaluations.⁴⁴ These, along with the number of hours that ambulances are diverted to other hospitals and the percentage of patients who are “boarded” in the ED for two hours or more, are the key indicators of overcrowding.⁴⁵

Changing Demographics

As our population continues to age, the ED will experience even more pressure than it has in the past.

- Persons 75 years of age and over had the highest ED visit rate (59.7 visits/100 persons).⁴⁶

- People 65 years and older are the fastest growing segment of our population and are expected to consume one-third of health care resources by 2025, up from the current 25 percent.⁴⁷
- Currently the 65-and-older population accounts for 34 percent of all dispensed drugs.⁴⁸
- In the ED, there has been an 8 percent increase in the average age since 1992, to an average of 35.7 in 2001.⁴⁹

As patient visits to the ED among the older population increase, and diagnostics and therapies become more sophisticated and complex, the volume of data to be processed, tracked, analyzed and communicated will escalate.

The Leapfrog Group^e: Ambulatory EMR and e-Prescribing

The first three Leapfrog quality standards involved inpatient care. It centered on the adoption of three best-practices to increase patient safety standards: use of computerized physician order entry, use of intensivists to staff intensive care units and evidence-based hospital referrals.⁵⁰

As of June 2003, the Leapfrog Group began addressing patient safety in the ambulatory setting. It will add a quality initiative focused on ambulatory EMR with e-prescribing and direct transmission of prescriptions to pharmacies.⁵¹ The ED functions as an ambulatory clinic until the patient is admitted to the acute care facility and subsequently, EDs should consider implementing EMR and e-prescribing to remain favorable with the Leapfrog initiative. This electronic prescription initiative by the Leapfrog Group is consistent with the Prescription Drug and Medicare Improvement Act of 2003 presented by the House and the Senate (discussed later).

Technology Trends in the ED

In an industry where cash is scarce and federal funding continues to decline, the trend is to 'do more with less' by extending the usefulness of existing applications to delay costly upgrades or replacements.^{52 53 54}

Adjusting to these major concerns, software developers have moved to engineer applications that optimize interaction with a hospital's current system. Two major strategies being applied to current software development are open standards and object-oriented technology.

Open standards involves:

- A product or system is described as open when its workings are exposed to the public and capable of being modified or improved by anyone. The alternative is a proprietary product or system. Also known as *open source*.^f

^e Composed of more than 140 public and private organizations and representing more than 34 million health care consumers in all 50 states, The Leapfrog Group works with medical experts throughout the U.S. to identify problems and propose solutions that it believes will improve hospital systems that could break down and harm patients. The Leapfrog Group focuses on the quality of certain aspects of care relevant to urban area hospitals. Patients are usually in fragile health when in the hospital and the consequences of preventable medical mistakes can be serious.

^f Open source refers to any program whose source code is made available for use or modification as users or other developers see fit. (Historically, the makers of proprietary software have generally not made source code available.) Open source software is usually developed as a public collaboration and made freely available. (Source: http://searchenterprise.linux.techtarget.com/sDefinition/0,,sid39_gci212709,00.html)

- For those who buy information systems, there is a clear move away from proprietary management systems that manage on a single vendor's equipment and increased emphasis on cooperation between vendors and the support of open technology standards like HL7.⁵⁵

Object-oriented technology involves:

- A revolutionary concept that changed the rules in computer program development, object-oriented programming is organized around "objects" rather than "actions", data rather than logic. Historically, a program has been viewed as a logical procedure that takes input data, processes it, and produces output data. The programming challenge was seen as how to write the logic, not how to define the data. Object-oriented programming takes the view that what we really care about are the objects we want to manipulate rather than the logic required to manipulate them.⁵⁶
- The computer industry in general is rapidly moving to object-oriented technology.^{57 58}
- Specifically, object-oriented databases are becoming the standard management repositories, and object-oriented programming techniques are used to produce many of the new management systems.^{59 60}
- The end result for users should be more powerful and stable management systems.⁶¹

Utilizing open standards and object-oriented technology advancements in EDISs will optimize the systems interaction with the rest of the enterprise and promote greater system efficiencies.

Community-wide sharing of ED capacity status via the Web

- Web-based networks that are designed to track an ED's bed capacity are starting to be deployed in metropolitan areas around the country. They help hospitals communicate with one another and with emergency management service agencies.⁶²
- Web-based technology enables the information to be shared more quickly across the emergency network than the use of faxes or telephones for updating status information.^{63 64}

Bar coding In the ED

- The Food and Drug Administration has estimated that, through bar coding of medications, hospitals could save \$41.4 billion from intercepting 50 percent of medication errors and an additional \$7.6 billion in administrative costs.⁶⁵
- Electronically tracking patients with wrist bands or identification cards has been identified as a method that could solve "bottlenecks" within the ED.⁶⁶ The tracking available with today's EDISs enhances the work flow and triage of patients because the spatial status within the ED is evident through the system.

Wireless Networks in the ED

The use of wireless networks to provide access to EDIS functions through mobile devices, such as Personal Digital Assistants, will help meet the information access needs of EDs without disrupting work flow.⁶⁷

- One organization that has benefited from wireless application in the emergency department is the California Emergency Physicians Medical Group. The medical group's goal was to enable access to drug information without being tied to computers

or even the Internet. About 600 clinicians, working at 66 emergency care facilities in California, signed up for the service. The devices contain drug prescription and interaction information that helps the physicians keep current on necessary information.⁶⁸

- At the Medical College of Georgia, Augusta, emergency physicians began reaping the benefits of wireless hand-held devices in late November 2001. Because of a bedside wireless device, physicians can order all necessary treatments on the spot and then go on to the next patient.⁶⁹

Voice Recognition in the ED

In a study reported by the *American Journal of Emergency Medicine* comparing voice recognition dictation software to traditional transcription, the voice recognition software was found to be nearly as accurate as transcription (98.5 percent vs. 99.7 percent).⁷⁰

Now that the JCAHO's Leadership Development standards are requiring hospital leaders to address ED overcrowding, facilities must learn how to improve patient flow, which will ultimately result in providing quality medical care not only to the patient in the exam room, but also to those patients in the waiting room.⁷¹

Joint Commission on Accreditation of Healthcare Organizations, *Leadership Development Standards*. www.jcaho.org, September 9, 2003.

III. Key Considerations in Health Care

A. Regulatory Influences

JCAHO Draft ED Standards

In July 2002, JCAHO issued an alert about catastrophic delays in hospital treatments harvested from its database of "sentinel events" involving death or serious injury.⁷² Half of the cases were ED-related and overcrowding was cited as a factor in 31 percent of those cases.⁷³ Since then, the reported number of treatment delays resulting in sentinel events more than doubled to 122, of which 49 (40 percent) were related to ED care.⁷⁴ Because of this alert, JCAHO has proposed a draft set of new requirements that calls on hospital leadership to address ED overcrowding. Proposed requirements include plans to:⁷⁵

- efficiently move patients through a health care facility
- incorporate the issue of emergency department overcrowding into performance improvement activities
- predict and monitor the capacity of areas that receive emergency patients
- plan for the care of patients placed in temporary beds
- work with other community services to better coordinate the flow of emergency cases into and out of the ED, from paramedic and ambulance services to long-term care and home health agencies

e-Prescribing and Prescription Drug and Medicare Improvement Act of 2003

In early June 2003, testifying before the U.S. Senate, JCAHO president Dennis O'Leary, M.D., emphasized the deep concern the Commission has that medical errors" remain unacceptably high, despite the focus of significant national attention on patient safety in recent years".⁷⁶ Given that medications are prescribed at 74 percent of ED visits, computer-assisted

prescriptions in the ED can reduce errors to a third and pharmacist clarification to a fifth vs. handwritten prescriptions.^{77 78}

On June 27, 2003, the Senate and the House each passed versions of PDMIA legislation that would reform Medicare, including provisions requiring health care providers to electronically transmit prescriptions.⁷⁹ Key components affecting EDs are:

- The Senate bill requires the HHS Secretary to “develop or adopt” standards for electronically transmitting prescriptions and other relevant information on patients’ medication history, eligibility and benefits.⁸⁰ The standards would require that physicians use e-prescribing and associated standards, except in cases when patients request that their prescription not be sent electronically.⁸¹ The bill also authorizes grants for health care providers for implementing e-prescribing programs.⁸²
- The House version authorizes the creation of a task force to develop standards for the electronic transmission of prescriptions, as well as drug and formulary information and any cost-effective alternatives for the prescribed drug.⁸³ The bill sets a 2006 creation deadline.⁸⁴

2002 Outpatient Prospective Payment System

In the 2003 incarnation of OPSS proposed regulations, hospitals may experience ambulatory service revenues higher than the proposed 3.5 percent rate hike, while others may experience lower revenues depending on their changes in ambulatory payment classification composition, APC payment rates, individual hospital outpatient mix, and the impact of the wage index on hospitals.⁸⁵ For hospitals with a high percentage of outpatient clinic and emergency department visits, the impact will be significantly greater than for similar hospitals with less volume.⁸⁶

- A recurring theme throughout the proposal rule for 2003 was that hospital submission of data will become more and more critical in terms of establishing APC rates - particularly proper and complete claims data.⁸⁷ An EDIS can improve physician documentation compliance with the Medicare guidelines by prompting them through documentation requirements and by providing automatic APC coding from the documentation, thereby standardizing coding practices.

Health Care Safety Net⁹ Oversight Act of 2003 (S.732)

The American College of Emergency Physicians has applauded the introduction of the Senate Bill 732, which will create the Safety Net Organizations and Patient Advisory Commission. The purpose of this legislation is to form an independent and nonpartisan commission to monitor the stability of the health care safety net. The commission will be charged with tracking changes in the status of the health care safety net, linking and integrating existing data systems, and making recommendations to Congress as to how to best preserve and improve the safety net. SNOPAC will also establish an early-warning system to identify impending failures of safety net systems and providers.

Terror Preparedness

⁹ According to the Institute of Medicine, the “safety net” refers to the default system of care for many of the 44 million low-income Americans with no or limited health insurance and Medicaid beneficiaries and people who need special services. It is neither uniformly available nor financially secure and is a patchwork of providers supported through a variety of financing options that vary from locale to locale.

In March 2003, JCAHO president Dennis O'Leary, M.D., advised that most communities experiencing a terrorist attack would be on their own for the first 24 to 72 hours.⁸⁸ At a minimum, he advised, a coordinated response must include fire, police, emergency medical services, public health agencies, local governments and hospitals.⁸⁹ Information technology is part of the infrastructure needed for a coordinated response and the hospital CIO looms as a key player in establishing emergency preparedness.⁹⁰ With automated systems, patterns of illness can be analyzed more readily and warning signs can be detected earlier. However, less than 5 percent of hospital emergency departments have the clinical charting software needed to generate reports that some health officials now demand, according to Gartner.⁹¹

EMTALA

The federal "anti-dumping" law, or Emergency Medical Treatment and Labor Act, was enacted by Congress in 1986.⁹² EMTALA requires emergency care to be provided to anyone who needs it, regardless of their ability to pay.⁹³ As a result, EDs have been in conflict with managed care plans over reimbursements for legitimate emergency visits and many are operating at a loss.

After hearing complaints from scores of hospitals and physicians that the old standards were onerous and confusing, exposed them to lawsuits and fines and encouraged free care in EDs, the Bush administration announced relaxation of the rules on Sept. 2, 2003.⁹⁴ The new rule, which takes effect Nov. 10, 2003, reduces the compliance burden for hospitals and physicians by expanding the situations in which hospitals are exempt from the federal requirements.⁹⁵

The implementation of an EDIS can assist an ED in addressing EMTALA requirements in several areas. The system can guide staff through documentation requirements and help remind them of their obligations for EMTALA, thereby avoiding violations based purely on faulty documentation. In addition, with an EDIS, the ED can streamline processes, such as patient registration, enabling them to comply with EMTALA as well as identify and evaluate true emergencies more quickly.

B. Industry Associations [their role in the industry and what they offer]

American College of Emergency Physicians

ACEP is a national medical society with more than 22,000 members who specialize in emergency medicine. ACEP's mission is to improve the quality of emergency care through continuing education, research, and public education. Headquarters are in Dallas, Texas.

Emergency Nurses Association

The Emergency Nurses Association aims to provide visionary leadership for emergency nursing and emergency care. The vision of ENA is to define the future of emergency nursing and emergency care through advocacy, expertise, innovation, and leadership. ENA is an international, action-orientated organization ready to support the profession with access to important scientific information and the latest research; networking opportunities with key governmental, academic, and professional contacts; and monitoring of government activities affecting the profession. Members are staff nurses; ED nurse managers; administrators; clinical nurse specialists; pediatric, trauma, or flight nurses; pre-hospital coordinators; nurse practitioners; educators and student nurses.

C. Typical Cost or Fee Structure

Some vendors license their EDIS software on a one-time license basis and charge annual maintenance fees in subsequent years that are a percentage of the original license fee. An example of this pricing is \$300,000 paid for an EDIS at Ingalls Health System, Harvey, Ill.⁹⁶

An EDIS is also priced by module. For example, the tracking, patient instruction, physician documentation and nursing documentation modules can be purchased separately. Other vendors, however, license their software on a yearly transaction basis, based on the number of patients or patient visits served by the module.⁹⁷ Costs can vary from \$1 per patient visit for patient instructions to \$3 per patient visit for instructions with tracking.⁹⁸ Newer systems with documentation and order entry components are considerably higher in price.⁹⁹

The cost of hardware required to run the software, as well as the cost of implementation, needs to be added to the software license cost in order to determine the total cost of ownership for the system. A rule of thumb is that software costs are only about 20 percent of the total project costs.¹⁰⁰

D. Return on Investment Expected [case studies, savings testimonials, actual cost saving]

An investment in an EDIS can be evaluated based on both hard and soft dollar returns. Examples include:

1. Hard Dollars (Quantitative Returns)

Revenue enhancements

- an increase in charge capture of \$105 per visit or \$3.78 million annualized was achieved by implementing an EDIS¹⁰¹
- an increase in charge capture of \$41 per visit or \$1.6 million annualized was achieved by implementing an EDIS¹⁰²
- Chicago's Rush-Presbyterian-St. Luke's Medical Center, in six months, captured \$1.5 million in professional charges based on the improved documentation capabilities of their EDIS¹⁰³
- a malpractice carrier offered a 15 percent discount - a savings of \$30,000 - upon learning that Providence St. Peter Hospital, Olympia, Wash., had installed an EDIS and would soon incorporate "Training Effective Teams," developed through VHA's work with Dynamic Research Corporation's MedTeam initiative¹⁰⁴
- insurance denial in the ED decreased with improved documentation spurred by the deployment of an EDIS¹⁰⁵
- Carilion Health System in Roanoke, Va., saved \$14,000 on incomplete or illegible orders¹⁰⁶

Material and Expense Reductions

- capturing order information via the EDIS saved more than \$68,000 for one organization. This was as a result of eliminating paper charting and by enhanced order capture in five EDs¹⁰⁷
- decreased space needed for storage of ED charts¹⁰⁸

Increased Capacity

Six months after EDIS implementation, length of stay in the ED was reduced by an hour at Chicago's Rush-Presbyterian-St. Luke's Medical Center.¹⁰⁹

Risk Management

- risk management was enhanced by having real-time pop-up reminders of serious risk factors to be considered, as patients' data was being entered into an EDIS ¹¹⁰
- litigation risk management is enhanced due to better documentation of every action taken regarding the patient ¹¹¹
- real-time notification of out-of-range vital signs was provided to 10 percent to 25 percent of patients who might be discharged without these abnormal signs being treated first¹¹²
- the sickest patients are seen first, which reduces the hospital's risk and liability ¹¹³
- potentially avoided 3,640 medication errors per year, based on 140,000 ED visits ¹¹⁴

2. Soft Dollars (Qualitative Returns)

Margin pressures are driving ROI analysts to dig deeper into the resultant effects of technology investments. At the strategic level, projects are evaluated more on the new business relationships that the software offers rather than the advantages of the software.¹¹⁵ IT projects that will bring an organization closer to their short and long term goals will make more sense to boardroom decision makers, especially as it relates to EDIS investment.

E. Target Market [who would most likely benefit]

EDIS vendors interviewed and profiled in this report have focused on EDs with 15,000 or more visits/year as primary candidates for EDIS. Health care organizations seeking to improve work flow, reduce errors, reduce overcrowding, improve the patient's experience and/or improve charge capture within the ED are candidates for an EDIS.

F. Benefits to Target Market

VHA conducts ongoing research to identify the needs of member organizations. Our most recent information identifies the following seven key areas of need: clinical effectiveness, patient safety, expense management, operational efficiencies, work force impact, patient experience/satisfaction and consumer experience. Not every product and service VHA researches will impact each of these needs; however, VHA has identified that EDIS implementation can impact members in the following manner:

1. Clinical effectiveness

- Physicians felt that they practiced better medicine by accessing reference information when and where it was needed using an electronic medical library. ^{116 117}
- Emergency patients can be taken immediately to beds and registration clerks using wireless portable computers register them into the system. ¹¹⁸
- All medical personnel involved in caring for a patient will be working from the same electronic medical record that is instantly available to numerous people simultaneously. ¹¹⁹
- Patients' vital signs and lab tests will be charted instantly using noninvasive methods that don't involve the use of needles or wires. ¹²⁰

- Enhanced transfer of information by electronic means between the ED and primary care physicians improves the continuity of care by better primary care follow-up and knowledge of care provided in the ED.¹²¹

2. Patient safety

- Patient safety requirements are ensured by the fact that reminders and cautions are built into the EDIS via the electronic medical record.¹²²
- EDIS applications for patient triage and tracking provide optimum safety management.¹²³

3. Expense management

- Washington Hospital Center reported increasing the volume of emergency patients from 37,000 in 1995 to 57,000 in 1999, without expanding staff or space, because of technologies it employed to streamline services.¹²⁴

4. Operational efficiencies

- Applying technology and streamlining processes can help reduce overcrowding by making emergency departments more efficient.¹²⁵
- Patient volumes are improved by applying technology and streamlining that help reduce ED overcrowding.¹²⁶
- Reduction in physician's time spent looking for charts, diagnostic results, mobilizing staff and redundant charting.¹²⁷
- Allows emergency physicians to access and enter information at the bedside.¹²⁸
- Emergency department patient processes (triage, registration, evaluation, radiology, laboratory workup, etc.) will be conducted in parallel, rather than sequentially.¹²⁹

5. Work force impact

- Improved staff satisfaction through improved productivity and quality of patient care.¹³⁰

6. Patient experience/satisfaction

- Customer service is improved by applying technology and streamlining that help reduce ED overcrowding.¹³¹
- The number of patients who leave without being seen is decreased when waiting times are shortened.¹³²

7. Consumer experience *[provider of choice]*

- Hospitals are more competitive with improved customer service and quality of service.¹³³

G. Legal Issues

1. Malpractice premiums

The average annual cost of premiums for emergency physicians rose to \$53,500 in 2003, reflecting a 56 percent increase over 2002.¹³⁴ In some states, premiums have increased 200 percent to 300 percent forcing EDs and trauma centers to temporarily close or downgrade services.¹³⁵

Seeking some relief at the federal level, the House of Representatives passed legislation in May 2003 that includes caps on awards for pain and suffering, but not on economic damages, which includes lost earnings, medical care and rehabilitation.¹³⁶ The use of an EDIS, with its prescription writing and real-time alerts capabilities, can help reduce errors and thereby reduce the risk of malpractice suits.

2. Risk management

As noted, litigation risk management is enhanced due to better documentation, real-time alerts, reminders, medication administration checking and improved triage.¹³⁷

Doctors are only human, and we can forget things. But the one risk factor you forget might be the one to lead to serious patient injury.

Dan Sullivan, M.D., President of the Sullivan Group.¹³⁸

IV. Market Characteristics and Leaders

A. Market Volatility [mergers/acquisition, capital investments]

A review of the niche vendor's Web sites shows investments by vendors have primarily centered on enhancing their product features by adding electronic medical record, online eligibility, speech recognition, medical device interfacing. Further, they have supported hand-held and wireless technology and are bringing their products into compliance with HIPAA.

Among the key vendors, only A4 Health Systems has recently been active with their acquisition of Compusense, an electronic medical records developer for the physician practice management market. This move is in addition to their acquisition of two niche vendors (Nine Rivers Technology and EmSTAT) acquired in 2000 and 2001.^{139 140}

The larger HIS vendors initially covered the stand-alone market by having relationships with smaller EDIS vendors, but more recently the HIS vendors are offering EDIS functionality that has been internally developed to integrate with their core systems (Cerner, McKesson and Meditech). Siemens announced a relationship with VitalWorks (formerly InfoCure Corporation) for emergency department functionality in July 2001.¹⁴¹

B. Market Development Stage [early innovative, peak growth, or phasing out]

The EDIS market, because of environmental forces and the overall acceptance of information technology in health care, appears to be at the very beginning of peak growth. The fact that HIS vendors are interested in offering EDIS products is another indication of acceptance.

The 2003 ED Systems Study is the second such report from KLAS (initial report May 2002). The 2003 report features a total of 14 vendors as compared to the 2002 report that featured a total of 11 vendors. The fact that there now are more sites to survey and more vendors to

“report on” suggest that the ED system market is growing. Competition comes from both standalone ED system vendors as well as hospital-wide vendors who have developed or partnered for their own ED systems/modules.¹⁴²

C1. Market Distribution of Vendors with Available Information *[based on annual revenue or installations/contracts]*

Vendors in the market were examined for their relative market share distribution. Table I lists total installations and associated overall and VHA-only percent of installs by vendor.

From a review of the vendor’s product offerings in Table I and the literature, it may be concluded that there are a diverse number of system configurations used to manage the ED. Many emergency departments are using either HIS systems designed for the enterprise, home-grown systems, single purpose systems (e.g. staff scheduling) or a combination of all three to manage the ED.

Excluding the large HIS vendors, there are eight niche vendors with a primary focus on the development and marketing of comprehensive information systems that address the specific needs of the ED.

Table I shows that, with all vendors included, Meditech, McKesson and Siemens Health Services hold more than 51 percent of the market share of products used in the ED. However, this does not indicate if these products are comprehensive EDISs. When the data is analyzed for the eight niche vendors (see asterisks in Table I), these account for 274 installations, or 18 percent, of the total installations.

Software Vendor	Total Install Numbers^j	Total Install Percents	VHA Install Numbers	VHA Install Percents
Meditech	434	29.2	69	16.9
McKesson	185	12.5	84	20.6
Siemens Health Services	147	9.9	45	11.0
Cerner	105	7.1	22	5.4
Logicare*	85	5.7	36	8.8
CPSI	69	4.6	11	2.7
Self Developed	58	3.9	11	2.7
A4 (EmSTAT, 9 Rivers,Cyberplus)*	59	4.0	24	5.9
Pro-Med*	41	2.8	0	0.0

^h The Sixth Dorenfest Complete Integrated Healthcare Delivery System (IHDS+) Database (2003) TM. Chicago: Sheldon I. Dorenfest Associates.

The Dorenfest IHDS+ DatabaseTM is the a source of information about health care information technology used in 1,500 healthcare delivery networks and their associated 40,000 facilities systems throughout the country. This annually updated database is used by both suppliers and providers. It includes IT hardware, software, contractual and planning data. (Source: Dorenfest website, www.dorenfest.com)

ⁱ Source: Sheldon I. Dorenfest & Associates, data pulled July 1, 2003

^j ibex currently claims 68 clients (Source: Web site)

Table 1 Total and VHA Installations per Vendor^{h i}				
Software Vendor	Total Install Numbers^j	Total Install Percents	VHA Install Numbers	VHA Install Percents
Undisclosed	34	2.3	14	3.4
Eclipsys	25	1.7	8	2.0
IDX	21	1.4	6	1.5
Picis	21	1.4	12	2.9
Wellsoft Corp.*	19	1.3	6	1.5
New Wave Software*	17	1.1	2	0.5
QuadraMed Corp	17	1.1	2	0.5
ibex*	13	0.9	12	2.9
GE Medical	13	0.9	1	0.2
Medhost*	13	0.9	7	1.7
Dairyland	12	0.8	2	0.5
Healthcare Mgmt. Syst.	10	0.7	3	0.7
Spacelabs Medical (acquired Orca)*	10	0.5	3	0.7
Keane	9	0.6	1	0.2
Vitalworks*	9	0.6	4	1.0
Emergisoft*	8	0.5	0	0.0
Other (35 with 6 sites and under)	51	3.4	23	5.6
TOTAL	1485	99.9	408	100.0

* = niche vendor with primary focus on EDIS.

C2. Key Vendor Listing *[vendors of note in the market]*

According to the July 2003 KLAS Emergency Department Systems Study, survey respondents most frequently mentioned the following vendors as included in the ED selection process: they ranged from Cerner at approximately 31 percent to VitalWorks at 3 percent. A4 HealthMaticsED, ibex, Wellsoft, A4 EmSTAT, MedHost, LOGICARE and Meditech were vendors with a mention rate of between 13 percent to 28 percent for consideration in the EDIS selection process.¹⁴³

Vendors were also examined for how they were represented in the market research. For this, news releases, journal articles, Web sites and analyst reports were reviewed. Table 2 lists some of the key vendors and the reasons they were noted.

Table 2 Vendors of Note in the Market Research	
Vendor	Reason Noted
A4 Healthmatics ED	A4 Healthmatics ED provides shareable, real-time, mobile access to comprehensive patient information from registration to disposition, including tracking board, triage, chart review, reports, biometric sign-on authentication and passive tracking. Integrates to existing hospital systems via interfaces.

**Table 2
Vendors of Note in the Market Research**

Vendor	Reason Noted
	(Web site: www.a4healthmatics.com) #6 in 2003 mid-year KLAS report, previously #6 ¹⁴⁴ Top 25 for total installs, based on Dorenfest data ¹⁴⁵
Cerner Millennium FirstNet	Cerner Millennium FirstNet automates a wide range of functions performed in the ED – registration, triage, tracking, orders, documentation, medical records and more. Provides clinicians with a comprehensive resource for quick and effective patient evaluation, results viewing and care documentation. (Web site: www.cerner.com) #7 in 2003 mid-year KLAS report, previously #5 ¹⁴⁶ Top 25 for total installs, based on Dorenfest data ¹⁴⁷
Emergisoft	EmergisoftED automates each step of the patient management and patient documentation process, including triage, tracking, nursing and physician charting, disposition, charge capture, management reporting and syndromic surveillance. (Web site: www.emergisoft.com) Top 25 for total installs, based on Dorenfest data ¹⁴⁸
ibex Pulse Check	ibex Pulse Check is a complete, Web browser-based patient tracking and documentation system, from triage to disposition, that integrates with existing hospital information systems. (Web site: www.ibexhealthdata.com) #3 in 2003 mid-year KLAS report, previously #3 ¹⁴⁹ Top 25 for total installs, based on Dorenfest data ¹⁵⁰
Logicare	Logicare's OnTrack systems now offer user authentication, role-based authorization and a Security Manager that gives users the ability to add users to role-based groups, configure automatic log-off, and automatically generate user IDs and passwords, audit trails and secure status board. (Web site: www.logicare.com) #4 in 2003 mid-year KLAS report, previously #2 ¹⁵¹ Top 25 for total installs, based on Dorenfest data ¹⁵²
McKesson	McKesson's first emergency department installation occurred in 1998 and the company now boasts more than 60 customers actively using its solution. Horizon Emergency Care – McKesson Information Solutions' integrated Emergency Department Information System - enhances clinical quality, facilitates department management, and improves financial performance in the emergency room by providing integrated, adaptive automation tools that optimize communication, patient management, and clinician workflow. Horizon Emergency Care integrates ED data across the entire health care enterprise. Top 5 vendor for total installs, based upon Dorenfest data
MedHost	Medhost's EDMS Tracking product consists of a graphical touch screen interface including floor plan views of the ED, patient list providing text alternative to graphical locator, visual indicators on the patient bed providing staff with patient status information,

**Table 2
Vendors of Note in the Market Research**

Vendor	Reason Noted
	<p>patient summary screen providing a detailed overview of the patient's ED visit and an extensive set of discharge instructions and prescription education documents. (Web site: www.medhost.com) #1 in 2003 KLAS mid-year report, previously #4¹⁵³, Recently signed as preferred provider for Tenet¹⁵⁴ Top 25 for total installs, based on Dorenfest data¹⁵⁵</p>
Meditech	<p>In 2001, MEDITECH addressed a growing need by introducing a suite of Ambulatory Care products. Central to this product suite is the Emergency Department Management Application. MEDITECH's Emergency Department Management Application helps hospitals simplify the stressful task of managing an Emergency Room by providing clinicians and staff the tools that will enable them to receive, manage, document and discharge patients quickly and efficiently. As of 5/1/03, MEDITECH has 34 installed.¹⁵⁶ Top for total installs, based on Dorenfest data.¹⁵⁷ Website: www.meditech.com</p>
New Wave	<p>NWS/EDS system features include intuitive and friendly user interface, patient location and care status tracking, built-in staff communications and alerts, order entry and result status updates, real-time monitoring of the department statistics, advanced electronic charting capabilities, electronic boards, support of wireless hand-held devices, and seamless interfaces to other hospital systems. (Web site: www.newwavesoft.com) Top 25 for total installs, based on Dorenfest data¹⁵⁸</p>
Spacelabs	<p>Spacelab Ultraview Clinical Messenger's provides the ability to view and control Windows applications, access timely lab results, view reports and do charting on the monitor display, at the patient's bedside. Also features secondary notification by forwarding patient alarm information to hospital staff. (Web site: www.spacelabs.com) Top 25 for total installs, based on Dorenfest data¹⁵⁹</p>
Vitalworks	<p>Vitalworks Emstation includes physician documentation, nurse documentation, discharge instructions, prescription writer, patient tracking and has a full complement of interfaces available. (Web site: www.vitalworks.com) Top 25 for total installs, based on Dorenfest data¹⁶⁰</p>
WellSoft	<p>The Wellsoft System EMS incorporates patient tracking; triage; M.D. and R.N. charting; Integrated Voice Recognition; order entry/results; discharge instructions; prescriptions, AutoFax; report generation with graphing; ICD-9, CPT coding, charge capture and systems integration/HL7. (Web site: www.wellsoft.com) #2 in 2003 mid-year KLAS report, previously #1¹⁶¹ Top 25 for total installs, based on Dorenfest data¹⁶²</p>

D. Key Vendor Profiles

Key vendors were selected for additional profiling and are listed in Appendix A. They were selected based on extent of activity in news releases and health care journals, association with formidable health care firms and organizations, identification as being innovative, and/or have indications of support by the financial community.

The hospital emergency room is not the fix for an overburdened health care system that is broken.¹⁶³

Don Nelson, senior vice president of Quality Leadership, American Hospital Association.

V. Closing/Considerations *[summation of key points and considerations for going forward]*

Several forces are acting on the under-penetrated EDIS market and should be considered. Recent alarms by JCAHO and supporting statements by the CDC highlight the increased utilization and resulting overcrowding issue in the ED brought on by aging demographics, decreasing health insurance coverage and decreasing numbers of EDs serving the public. This overcrowding is seen as contributing to the increase in serious injury and death and counterproductive to the drive to reduce medical errors and increase patient safety by organizations such as Leapfrog. The attention given to the ED by these organizations will undoubtedly increase efforts to implement or upgrade information technology. The ED is unique in its ideal work flow functionality and requires a purpose-built system. To date, few EDs have fully implemented such systems and the market remains relatively unpenetrated. The need for EDs to advance their technology to allow for an easier path to real-time integration with other systems is critical in creating efficient work flow and the resultant economic and safety rewards. Modern EDISs will optimize value when they are integrated into EMR, financial and reporting systems.

VI. References/Endnotes

See Appendix B.

Appendix A: Key Vendor Profiles^{k l}

Characteristics	A4 Health Systems
1. Company full name	A4 Health Systems Inc.
1a. Company structure	Private
2. Location address / phone	5501 Dillard Dr. Cary, NC 27511-9234 (919) 851-6177
2a. Web site address	www.a4healthsystems.com
3. Non-health care verticals	None.
4. Vertical industry focus in priority order	Serves health care industry only.
4a. Health care business strategy	“A4 Health Systems is dedicated to promoting community-based healthcare through the delivery of Electronic Medical Record solutions for consolidated clinical, financial, and administrative patient information management.” (Company Web site)
5. Size [number of employees, past year, current year and rate of change]	2002 Employees: 220 1-Yr. Growth Rate: Not available (Hoover's)
6. Revenue [total sales, health care sales past year, current year and net rate of change]	2002 Sales (mil.): \$31.0 1-Yr. Growth Rate: Not available (Hoover's)
7. R&D portion of total operating budget	Not available.
8. Product name and functions, features-type description	<p>“HEALTHMATICS[®] ED is the most comprehensive Emergency Department Information System for streamlining Patient Registration, Triage, Tracking, Nursing & Physician Charting, Disposition, Charge Capture & Reporting.</p> <p>HEALTHMATICS ED enables concurrent staff & provider management of a single, seamless patient record in a Microsoft[®] Windows-based environment. Users value the solution, developed by an exclusive team of ED physicians, nurses, & technologists, for its design focus on the unique demands of the Emergency Department environment.</p> <p>HEALTHMATICS ED utilizes drill-down navigation & voice, pen-based or touch-screen technology to perform all aspects of data management for the Emergency Department.” (Company Web site)</p>
9. Number of clients and/or market share	“EMSTAT is the most widely used Emergency Department Information System among the top 1,000 hospitals in the country.” (Company Web site)
10. Typical customer characteristics	Maimonides Medical Center, WakeMed, NorthCrest Medical Center, Mount Carmel St. Ann's, St. Joseph's Hospital, Mobile Infirmiry Medical Center, Kingman Regional Medical Center, Tenet Healthcare, BryanLGH Medical Center, Robinson Memorial Hospital, Columbia Memorial Hospital, Alexian Brothers Medical Center, Annie Penn Hospital, St. Cloud Hospital (Company Web site)

^k Source: company advertisements and Web sites, trade journal articles, news releases, law journals, Hoover's business capsules, Dun & Bradstreet business reports, and company 10-K reports.

^l The most currently available company information was incorporated at the time of report creation.

Characteristics	A4 Health Systems
11. Portion of business from existing customers vs. new customers	"A ⁴ HEALTH SYSTEMS, leading provider of Electronic Medical Record solutions, announced today a 28 percent increase in year-to-date revenues over the same period 2002 in its Acute Care Division. The rising valuation of the Emergency Department as a source of hospital revenue and admissions has led a fast-growing number of hospitals to automate their EDs and embrace HEALTHMATICS ED or EMSTAT as their comprehensive EDIS solution of choice." (Company press release, August 5, 2003)
12. Value proposition and key differentiators	"A ⁴ HEALTH SYSTEMS' solutions enable better management of clinical, financial and administrative processes within every healthcare setting. The solutions provide seamless access to patient information collected within, between and across care-delivery organizations. From start to finish, the entire patient encounter is better managed by the enterprise-wide integration of scheduling, point-of-care, order management and billing procedures. " (Company Web site)
13. Top competitors	Cerner, Eclipsys, IDX Systems, Misys Healthcare, QuadraMed, Quality Systems, Quovadx, VitalWorks (Hoover's)
14. Strategic business partner alliances	Microsoft Certified Solutions Provider, Oracle, ACI Financial, HEX Laboratory Systems, The Coker Group, Microsoft Healthcare Users Group, HIMSS Silver Corporate Member, Advanced Data Systems, Millbrook Practice Management Solutions, Nuesoft Technologies, Midmark Diagnostics, McKesson, Primetime Medical Software, MED3000, EPIC Software Systems, Stockell, Sentillion, Data Direct Technologies, Topaz Systems, Versus Technology, Emergin (Company Web site)
15. Contact person [list sales person or CEO] ^m	John P. McConnell (CEO and Chairman) (919) 851-6177

^m Default contact for inquiries.

Appendix A: Key Vendor Profiles (cont.)

Characteristics	Cerner
1. Company full name	Cerner Corporation
1a. Company structure	Public (NASDAQ: CERN)
2. Location address / phone	2800 Rockcreek Pkwy. Kansas City, MO 64117 (816) 221-1024
2a. Web site address	www.cerner.com
3. Non-health care verticals	Serves health care industry only.
4. Vertical industry focus in priority order	Health care, acute care, IDN and stand-alone laboratories. (Company Web site)
4a. Health care business strategy	Maintain functional dominance and secure first place in market share. To do this they have two sales groups; one for large enterprise and the other for the stand-alone market. No number of sales representatives given. Modular approach and remote hosting option allows for highly flexible pricing structure that can be configured to fit budgets of large and small entities. (Company Web site) "Key elements of Cerner's business strategy include: Penetrate the integrated health care provider market. Increase market share in individual domains and further penetrate the existing client base. Remain committed to a common architecture. Expand solutions and services. Continue pursuit of excellence in implementations. Offer its solutions on a hosted solution basis." (10-K)
5. Size [number of employees, past year, current year and rate of change]	2002 Employees: 4,791 1-Yr. Employee Growth: 14.8% (Hoover's)
6. Revenue [total sales, health care sales past year, current year and net rate of change]	2002 Sales (mil.): \$751.9 1-Yr. Sales Growth: 38.6% (Hoover's)
7. R&D portion of total operating budget	\$129.6 million in software development of \$751.9 million in total revenues. (2002 Annual Report)
8. Product name and functions, features-type description	"Cerner's <i>FirstNet</i> ® Emergency Medicine Information System is the most completely integrated emergency department solution on the market today. <i>FirstNet</i> automates a wide range of functions performed in your ED – registration, triage, tracking, orders, documentation, medical records, and much more. For clinicians, <i>FirstNet</i> is a comprehensive resource for quick and effective patient evaluation, results viewing and care documentation. For executives or administrators, <i>FirstNet</i> helps evolve a Clinically Driven Revenue Cycle, seamlessly aligning clinical documentation with coding so the department is appropriately reimbursed for the care it provides." (Company Web site)
9. Number of clients and/or market share	Cerner has over 1,500 clients worldwide. (10-K)

Characteristics	Cerner
10. Typical customer characteristics	FirstNet clients include the University of Alabama at Birmingham Medical Center, North Broward Hospital, and Memorial Medical Center (Springfield, IL). (Company Web site)
11. Portion of business from existing customers vs. new customers	Not available.
12. Value proposition and key differentiators	"Cerner's revolutionary person-centric <i>Cerner Millennium™</i> architecture is designed to fundamentally transform health care delivery. Cerner solutions combine technology with knowledge to deliver vital data for effective, real-time decision-making across the enterprise. Our passion for health care – our only focus from our inception – and proven vision and results are a testament to our commitment to eliminate error, variance, waste, delay and friction for more efficient business management and better patient care." (Company Web site)
13. Top competitors	Eclipsys, IDX Systems, McKesson (Hoover's)
14. Strategic business partner alliances	Cerner maintains a strategic partnership with IBM. (Company Web site)
15. Contact person [list sales person or CEO]	Neal L. Patterson (CEO) (816) 221-1024

Appendix A: Key Vendor Profiles (cont.)

Characteristics	Emergisoft
1. Company full name	Emergisoft Corporation
1a. Company structure	Public (95% owned by Berlwood Five)
2. Location address / phone	2225 Avenue J Arlington, Texas 76006 (817) 633-6665
2a. Web site address	www.emergisoft.com
3. Non-health care verticals	None.
4. Vertical industry focus in priority order	Serves health care industry only.
4a. Health care business strategy	“Since 1992, Emergisoft Corporation has focused its clinical point of care development efforts on creating professional-grade, full-HIS-interface systems for the Emergency Department.” (Company Web site)
5. Size [number of employees, past year, current year and rate of change]	2002 Employee Range: 31 to 40 (Hoover's)
6. Revenue [total sales, health care sales past year, current year and net rate of change]	2002 Sales Range: \$300,001 to \$400,000 (Hoover's)
7. R&D portion of total operating budget	Not available.
8. Product name and functions, features-type description	“Emergisoft <i>ED</i> allows your facility to electronically and intuitively triage, track, document (physician and nursing documentation), and discharge patients that enter your emergency department. Regardless of your HIS environment, Emergisoft <i>ED</i> is the leading solution for emergency department automation, electronic medical records and HIS integration. Since 1992, Emergisoft is the proven integration leader in all major HIS environments including Siemens SMS, McKesson, Eclipsys, and MEDITECH.” (Company Web site)
9. Number of clients and/or market share	“Today, more than four million electronic medical records have been created with Emergisoft systems and over 800 clinicians across the United States use our EDIS products.” (Company Web site)
10. Typical customer characteristics	Trinitas Health System, Rockdale Health System, Tri-Health Good Samaritan, Winthrop University Hospital, Oakwood Heritage Hospital, Oakwood Annapolis Hospital, Greater Hazleton Health Alliance, St. Vincent's Hospital of Manhattan (Company Web site)
11. Portion of business from existing customers vs. new customers	Not available.
12. Value proposition and key differentiators	“Emergisoft's vision is to empower clinicians, hospital administrators and health agencies with the ability to electronically document and retrieve complete patient, departmental work flow, and syndromic surveillance data from America's Emergency Departments in real-time.” (Company Web site)
13. Top competitors	Not specified in Hoover's.
14. Strategic business partner alliances	HIMSS (Company Web site)
15. Contact person [list sales person or CEO]	Ash Huzenlaub (President) (817) 633-6665

Appendix A: Key Vendor Profiles (cont.)

Characteristics	Ibex Healthdata Systems
1. Company full name	Ibex Healthdata Systems, Inc.
1a. Company structure	Private.
2. Location address / phone	5600 N. River Rd. Suite 150 Rosemont, IL 60018 (800) 331-9648
2a. Web site address	www.ibexhealthdata.com
3. Non-health care verticals	None.
4. Vertical industry focus in priority order	Serves health care industry only.
4a. Health care business strategy	“Developed by emergency room clinicians, nurses and staff, ibex PulseCheck has been designed specifically for the emergency department with the flexibility to meet individual hospitals' and emergency departments' needs. The system's Web browser-style format is easy for clinicians to use, and the system connects seamlessly to virtually all other hospital information systems.” (Company Web site)
5. Size [number of employees, past year, current year and rate of change]	Not available.
6. Revenue [total sales, health care sales past year, current year and net rate of change]	Not available.
7. R&D portion of total operating budget	Not available.
8. Product name and functions, features-type description	<p>“ibex PulseCheck is a complete, Web browser-based patient tracking and documentation system -- from triage to disposition -- that easily integrates with existing hospital information systems. With the ability to add a full complement of hardware accessories, including hand-helds, it is no surprise that ibex PulseCheck is quickly becoming the nation's first choice for EDIS solutions.</p> <p>The strength of ibex PulseCheck lies in its flexibility. Using the Tracking Board as a base, health care facilities can start with any one of the powerful features, like physician or nursing documentation, and add other features to complete their emergency department information system at their convenience.</p> <p>The system is also flexible in scope and easily accommodates multiple sites across an intranet or ASP model from a single server, thanks to ultra-thin client architecture. The intranet ease comes without any sacrifice in security -- data is stored in the hospital's SQL database and complies with JCAHO, HIPAA and EMTALA requirements.” (Company Web site)</p>
9. Number of clients and/or market share	“2.8+ Million Patients Tracked and Managed Annually Throughout Client Base; 70 sites nationwide” (Company Web site)
10. Typical customer characteristics	Rush-Presbyterian St. Luke's, Altoona Hospital, Lancaster General Hospital, Regional Medical Center of Orangeburg, Longmont United Hospital, Riverside Regional Medical Center, Jewish Hospital HealthCare Services, Rockingham Memorial Hospital, Banner Health, Sherman Hospital, Alegent Health System, Genesis

Characteristics	Ibex Healthdata Systems
	HealthCare System (Company Web site)
11. Portion of business from existing customers vs. new customers	Not available.
12. Value proposition and key differentiators	<p>“The result of a collaborative effort between emergency medicine clinicians and health care IT experts, ibex Healthdata Systems is the proud provider of ibex PulseCheck, a complete, web browser-based patient tracking and documentation system – from triage to disposition – that easily integrates with existing hospital information systems.</p> <p>With the ability to add a full complement of hardware accessories, including hand helds, and additional software modules, ibex PulseCheck offers comprehensive, customizable relief for the communication confusion and lost financial charges experienced by many Emergency Departments.” (Company Web site)</p>
13. Top competitors	Not specified in Hoover’s.
14. Strategic business partner alliances	NASA, 2003 ENA Leadership Challenge, Johns Hopkins University (Company Web site)
15. Contact person [list sales person or CEO]	Mark D. Crockett, MD (CEO and President) (800) 331-9648

Appendix A: Key Vendor Profiles (cont.)

Characteristics	Logicare
1. Company full name	Logicare Corporation
1a. Company structure	Private.
2. Location address / phone	2125 Heights Drive, 4th Floor Eau Claire, WI 54701 (800) 848-0099
2a. Web site address	www.logicare.com
3. Non-health care verticals	None.
4. Vertical industry focus in priority order	Serves health care industry only.
4a. Health care business strategy	“Our products are unique because we design them from the perspective of our users -- both clinical and information services – making them the most widely used ED systems available. While LOGICARE views customer support as a task for everyone in the company, we also take pride in the excellence of those who work with our customers daily.” (Company Web site)
5. Size [number of employees, past year, current year and rate of change]	2002 Employees: 50 (Nexis Company Dossier)
6. Revenue [total sales, health care sales past year, current year and net rate of change]	2002 Sales (mil.): \$2.6 (Nexis Company Dossier)
7. R&D portion of total operating budget	Not available.
8. Product name and functions, features-type description	“OnTrack™, Emergency Department product line, all with reporting and discharge instructions: Automated Log, Essential Patient Tracking, and Full Patient Tracking. “ (Company Web site)
9. Number of clients and/or market share	“LOGICARE Corporation serves over 535 hospitals as a leading provider of software and services for Emergency Departments and Patient Education.” (Company Web site)
10. Typical customer characteristics	Not available.
11. Portion of business from existing customers vs. new customers	Not available.
12. Value proposition and key differentiators	“LOGICARE’s systems are designed to meet the specific needs of Emergency Departments and clinical educators. The company’s product line is scalable, meaning customers may add products as their needs and resources grow. The company will only sell software that has proven itself in actual use. The company’s systems use mainstream technology, and are continually upgraded, often with refinements proposed by customers. LOGICARE places great emphasis on its relationship with its customers and on customers’ success. LOGICARE prides itself on having still-active relationships with over 90 percent of its customers, and providing the support and services they need to make LOGICARE software an essential part of the care process everyday.” (Company Web site)
13. Top competitors	Not specified in Hoover’s.
14. Strategic business partner alliances	Business Objects, Health Level Seven, IDX, Sentillion (Company Web site)

Characteristics	Logicare
15. Contact person [list sales person or CEO]	David Elvig, MD (CEO) (800) 848-0099

Appendix A: Key Vendor Profiles (cont.)

Characteristics	Medhost
1. Company full name	MedHost, Inc.
1a. Company structure	Private.
2. Location address / phone	15455 North Dallas Parkway Suite 400 Addison, TX 75001 (972) 560-3100
2a. Web site address	www.medhost.com
3. Non-health care verticals	None.
4. Vertical industry focus in priority order	Focuses on health care industry only.
4a. Health care business strategy	“Ensure Customer satisfaction by providing the highest levels of quality, performance and service to enable each customer to achieve its desired outcomes. Establish the “MedHost Solution System” and related products and services as the standard for the health care clinical market.” (Company Web site)
5. Size [number of employees, past year, current year and rate of change]	2002 Employee Range: 41 to 50 (Hoover's)
6. Revenue [total sales, health care sales past year, current year and net rate of change]	2002 Sales Range: \$1.5 million to \$2 million (Hoover's)
7. R&D portion of total operating budget	Not available.
8. Product name and functions, features-type description	<p>“Benefits of EDMS Tracking: The MedHost Emergency Department Management System Tracking application is a patient tracking and communication system created to accomplish the following results and more:</p> <ul style="list-style-type: none"> · Decrease total patient visit time in the Emergency Department. · Increase staff communication. · Increase the availability of decision-making criteria concerning a patient's status. · Allow the effective management of patients and procedures in the ED. · Manage patient data. · Track the overall turnaround times, as well as the last time an ED employee visited a patient. · Reduce TATs, redundancy in communication, and confusion as to the current status of a patient, including admit times, orders, and disposition times. <p>Highlights of EDMS Tracking</p> <ul style="list-style-type: none"> · The Locator screen's graphical touch screen interface includes floor plan views of your ED · Patient List provides text alternative to graphical Locator · Visual indicators on the patient bed provide staff with patient status information · Patient Summary screen provides a detailed overview of the patient's ED visit · Extensive set of discharge instructions and prescription education documents”. (Company Web site)
9. Number of clients and/or	

Characteristics	Medhost
market share	Not available.
10. Typical customer characteristics	Tenet Healthcare, Gaston Memorial Hospital, Silver Cross Hospital (Company Web site)
11. Portion of business from existing customers vs. new customers	Not available.
12. Value proposition and key differentiators	"MedHost is a software solutions company providing highly visual, easy-to-use process management technology for the healthcare industry. The MedHost EDMS product suite has been adopted by leading institutions throughout the United States and proven to dramatically improve ED processes and increase customer satisfaction." (Company Web site)
13. Top competitors	Not specified in Hoover's.
14. Strategic business partner alliances	A-Life Medical, Emergency Nurses Association (Company Web site)
15. Contact person [list sales person or CEO]	Craig E. Herrod (President) (972) 560-3100

Appendix A: Key Vendor Profiles (cont.)

Characteristics	Wellsoft
1. Company full name	Wellsoft Corporation
1a. Company structure	Private.
2. Location address / phone	605 Franklin Blvd Somerset, NJ 08873-3671 (732) 828-5470
2a. Web site address	www.wellsoft.com
3. Non-health care verticals	None.
4. Vertical industry focus in priority order	Serves health care industry only.
4a. Health care business strategy	“Founded in 1988, to provide real world software solutions in the challenging environment of Emergency Medicine, Wellsoft Corporation is the market-leading provider of Emergency Department Information Systems. Wellsoft products and services are designed to combine the latest in proven software technologies with mission-critical reliability. Wellsoft has experience implementing their Integrated Clinical Management System in single hospital emergency departments, as well as across healthcare enterprises.” (Company Web site)
5. Size [number of employees, past year, current year and rate of change]	2002 Employee Range: 21 to 30 (Hoover's)
6. Revenue [total sales, health care sales past year, current year and net rate of change]	2002 Sales Range: \$4 million to \$5 million (Hoover's)
7. R&D portion of total operating budget	Not available.
8. Product name and functions, features-type description	Functions include Electronic Patient Records, Real-Time Patient Tracking, HomeEasy Patient Discharge Instructions, Prescriptions, Clinical Documentation, Order Entry & Results Reporting, Report Generation, Staff Directory/Auto-Faxing, Charge Capture and Coding, and Text Processing. Special features include Transient Field Locking, Form-a-Field, Rapid Report, and Design-a-Display. (Company Web site)
9. Number of clients and/or market share	Not specified. (Company Web site)
10. Typical customer characteristics	Pittsburg Mercy Health System, Central Indiana Health System, North York General Hospital, Frankford Hospital System, Hamilton Medical Center, Alameda County Medical Center, Frankford Hospital System, Duke University Medical Center, Santa Clara Valley Health and Hospital System, Children's Hospital of Philadelphia, FirstHealth of the Carolinas, Carilion Health System (Company Web site)
11. Portion of business from existing customers vs. new customers	Not available.
12. Value proposition and key differentiators	“Every aspect of the The Wellsoft System has been designed with a critical eye towards meeting the unique needs of the Emergency Department. It is packed with features that have been developed and tested for use in that environment. These features make The Wellsoft System the most versatile tool available for the computerization of your department. Backing up this feature-packed software is

Characteristics	Wellsoft
	Wellsoft's iron-clad guarantee which promises that unless the system meets with complete clinical acceptance, you're entitled to a complete refund." (Company Web site)
13. Top competitors	Not specified in Hoover's.
14. Strategic business partner alliances	Not specified. (Company Web site)
15. Contact person [list sales person or CEO]	John Santmann, MD (President) (732) 828-5470

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