

Emergency Department Information Systems

Why You Need It & How to Succeed

Presented By Todd B. Taylor, MD, FACEP

PRESENTATION ABSTRACT

Emergency Department Information Systems (EDIS) have been around for more than 20 years. However, it has been only in the last few years that they have begun to achieve critical mass and real usability. This presentation will review where EDIS has been, the current state-of-the-art, and what we have to look forward to in the near future. A detailed look at EDIS components and the selection process will be presented.

For a PDF of this handout or more information about this topic contact: ttaylor@acep.org

LEARNING OBJECTIVES

- 1 Identify reasons for past failures in implementing ED patient information systems.
- 2 Describe a process by which a successful EDIS strategy can be implemented.
- 3 Be able to review strengths and weaknesses of current ED information systems.
- 4 Learn how to implement information system strategies and develop an action plan.

ABOUT THE SPEAKER

Todd B. Taylor, MD, FACEP is a computer aficionado and self taught computerist who really only practiced emergency medicine to support his computer habit. After retiring from clinical practice in 2006, he recently joined Microsoft's Health Solutions Group as a Physician Executive.

He has served as Chair and Newsletter Editor for the American College of Emergency Physicians' Section for Emergency Medical Informatics. He authored the preliminary document for the Section on "A View of the Emergency Department of the Future" and continues as the principle promoter of a national Emergency Department of the Future Project. In the past, he was Chief Medical Officer for MediServe Information Systems. He frequently lectures on a variety of computer related topics and serves on several national committees related to medical computing and informatics.

Dr. Taylor received his Doctor of Medicine from Indiana University School of Medicine and completed a residency in Emergency Medicine at Mount Carmel Mercy Hospital in Detroit, Michigan. He is board certified by the American Board of Emergency Medicine and serves as a Fellow of the American College of Emergency Physicians.

He has 20 years experience teaching clinical emergency medicine at Banner Good Samaritan Medical Center, a 700-bed, level one trauma, and tertiary referral center and has held a variety of academic and professional positions. This includes having been Vice-President for Public Affairs for the Arizona College of Emergency Physicians for 15 years.

These professional and volunteer activities have afforded him the opportunity to gain experience in ED Crowding & Ambulance Diversion, EMTALA, Healthcare Legislative & Regulatory Advocacy, Healthcare Policy, Managed Care Issues, Emergency Medicine Management, Coding, & Billing, and many other issues facing emergency medicine & healthcare.

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Steps for Successful EDIS Selection & Implementation

Todd B. Taylor, MD, FACEP <ttaylor@acep.org>

What to avoid:

The “Holy Grail” Syndrome:

Waiting for the ULTIMATE solution, is no solution
Seek short-term solutions to meet specific definable needs

Don’t purchase systems that tend to automate poor manual processes:

The less human input required the better
ex. Systems that automatically track patients
Systems that automatically capture data already available in hospital HIS or previous EDIS visit

Downtime

EDIS must accommodate downtime from external systems.
Scheduled EDIS downtime (ex. for upgrades) should be less than 5 minutes

Don’t accept enterprise HIS EDIS offering unless it substantially meets EDs needs

Ultimately may be forced to do so, but due diligence in EDIS search process may allow opportunity to change course if necessary

What do to:

Establish objectives (these will be different for every ED)

Asking the right questions will achieve the right solutions
ex. Improve ED throughput to increase functional bed space, reduce LWOT
Improve availability and tracking of lab results

Certain objectives may be mutually exclusive

ex. Eliminating dictation costs with physician computer charting will likely decrease ED throughput.
Decreased throughput = less revenue which may offset savings achieved by eliminating dictation

Decide what you need then decide what you want (in that order)

What you end up with should be somewhere in the middle

Obtain a guarantee of milestone implementation

Money back guarantee if EDIS not ultimately integrate with the hospital HIS or a particular module not successfully fully implemented

Fix other “broken” aspects of ED environment before implementing an EDIS

EDIS is only a tool, not the solution

Spend as much time selecting hardware & planning deployment as selecting software

Budget as much money for hardware & deployment as the EDIS software purchase

Modular step-wise implementation in a logical order

Minimize “password bloat”

Buy for today - Tomorrow will change

Consider transition systems as a 3 to 5-year solution that will likely need to be replaced

You are going to make mistakes - Be willing to fail & change course if necessary

Major Components & Subcomponents of an Emergency Department Information System (EDIS)

Compiled by Todd B. Taylor, MD, FACEP

HIS = EDIS is part of the enterprise-wide hospital information system (+/- integration)

Best-of-Breed (BoB) = Niche EDIS vendor that must interface with the HIS

NOTE: Information about EDIS product features is most often obtained via a "Request for Information" (RFI). When investigating an EDIS purchase, it is critical to determine the components you need (and will use) vs. "wanting it all". No current EDIS (HIS or BoB) "does it all" very well. BoB systems tend to have better functionality where as HIS modules tend to have better integration (i.e. interfaces). Prioritizing components for your needs and selecting an EDIS that best meets them will significantly increase your chances of a successful EDIS implementation.

For a model EDIS RFI, e-mail your request to: ttaylor@acep.org

The following components have been place in order of importance and recommended implementation order. Certain subcomponents may be installed out of order, but typically items later in the process are dependent upon properly functioning earlier components.

System Interfaces* (See "EDIS: HIS vs. BoB" – certain interfaces may be unnecessary with HIS vendor product)

Admit-Discharge-Transfer (ADT)-inbound (will need ADT-outbound if EDIS does primary registration)

Results-inbound (from lab, radiology, etc.)

Orders-outbound (may also need orders-inbound if no CPOE)

EMR-outbound (if EDIS will not be the system of record or primary data repository)

EMR-inbound (if EDIS will capture data, example allergies, from external systems)

**NOTE: Most system interfaces are accomplished via the "Health Level Seven" (HL7) Standard, but that "standard" varies among HIS products, so custom work is often necessary to achieve data interchange.*

Security

Basic user name/password, system time out, JCAHO/HIPAA compliance

Registration (ADT)

BoB: Usually have "mini-reg" capability so patients can be managed pending the ADT interface info arrival
Matching BoB entered info with ADT info may be manual or partially automated

HIS: Most (but not all) integrate ADT directly into the HIS system
May also have "mini-reg" capability to quickly initiate patient care

Tracking

Usually displayed via a computer tracking screen that also serves as the primary system user interface

Patients, staff, assets (i.e. equipment, gurneys, wheelchairs, etc.) may be tracked

Department Metrics: Example – pre-arrival to time of arrival to triage to room to doctor to discharge

Triage Assessment

Although part of nursing documentation, triage assessment is often included as a separate component because information collected at this point (ex: chief complaint, vital signs, medical & medication history, allergies, etc.) is critical to patient management within the EDIS. Pay particular attention to this module as it has the potential to adversely affect ED staff efficiency.

Information Management

Laboratory results (current & prior +/- ability to graph trended results)

Documents (Prior EDIS documents & external text documents, ex. H&P's, D/C Summary, diagnostic tests, etc.)

Review & bring forward pertinent prior EDIS information (i.e. medical & medication history, allergies, etc.)

Digital radiography (may be achieved via link to external subsystem)

External system data archives (may be the "Holy Grail" by adding the ability to view every piece of patient data)

NOTE: Next to "Tracking", information management has the most potential for improving ED efficiency by placing "information at your fingertips". The above subcomponents have been listed in order of importance. Not all of these are necessary or even possible without other hospital subsystems (ex. digital radiography).

Revised – September 2005

Discharge Planning

Instructions, prescriptions, patient education, work\school release, etc.*
 Clinical Impressions (Final Diagnoses)* *NOTE: May be part of physician documentation, but can stand alone.
 Follow-up management (ex. nurse call back, pending results like GC\Chlamydia, ED recheck, etc.)
 Social Service (shelters, transportation, etc.)
 Reportable events (infectious disease, domestic violence, etc.)

Computer Provider Order Entry (CPOE)

Order selection with transmittal to appropriate hospital subsystem (i.e. lab, radiology, etc.)
 Order sets & protocols (ex. advance triage orders, standard “cardiac chest pain” orders, etc.)
 Order tracking (ex. track & alarm when results return time parameter exceeded)*
 *NOTE: “Order Tracking” can be done without CPOE, but requires an orders inbound interface for an automated process.
 Adverse Drug Event (ADE) (ex. allergy & drug-drug interaction checking)
 Medication Administration Record (MAR) (part of nurse documentation enhanced by CPOE)
 Order justification (ex. assures required documentation for billing purposes)

Tasks Management

Organizes & distributes tasks to the appropriate provider (or group of providers) based on EDIS functions
 Ex. CPOE orders for particular patients are directed to the primary nurse, SVN treatment orders are directed to respiratory therapy team, splinting orders directed to ortho tech, etc.
 Appropriate notification & organization of tasks is critical to the success of CPOE.
 Ex. On screen notification of provider specific task lists or defined lists sent to a wifi PDA or text pager.

Alarms & Alerts

Standard metric alarms (ex. room to Dr exceeds threshold) & ad hoc alarms (ex. remind me to recheck in 5 min)
 Alerts for various conditions (respiratory isolation, suicide precautions, VIP, etc.)

Reports, Staff Management, Workload & Productivity

Tracking allows better management of resources (beds, staff, etc.) by increasing visibility of the entire ED.
 Tools integrated into the EDIS that automate this process & provide real time information are ideal.
 Post hoc analysis of a variety of ED metrics (ex. census, acuity, staff:patient ratio, throughput, etc.) at appropriate intervals (daily, weekly, monthly, quarterly, etc) allow for improved budgeting & staffing.

Preferences

Ability to customize work flow, display screens, etc. by individual based on provider role or log-on
 Ability to customize certain documents and processes (ex. discharge instructions, prescriptions, etc.)

Clinician Documentation (nursing, technician, ancillary department personnel)

Patient assessment & re-assessments (includes narrative & objective data, i.e. vital signs)
 Procedures (ex. respiratory treatment, IV start, wound care, splinting, etc.)
 Misc. (ex. I/O bodily fluids, belongings, notifications, etc.)
 Medication Administration (see CPOE above)

Physician Documentation

Patient history, physical examination, procedures, medical decision making, discharge planning, & diagnosis*
 *NOTE: Certain aspect of physician documentation may be done without full documentation implementation (see above)

Pay particular attention to the final output as many EDIS “charts”, although readable, are incomprehensible.
 Assurance that the sense of the patient visit is easily ascertained is mandatory.

COMMENT: *Computer physician documentation is the most difficult component to implement for a variety of reasons. Efficiency is entirely dependent upon prior successful implementation of other components that “feed” information to the physician’s chart. Therefore, this component should always be implemented last & only if more than 50% of necessary information (ex. medical history – including review of systems, medication history, allergies, lab results, etc.) is efficiently captured & available for easy integration. Planned cost savings on physician documentation by eliminating dictation (or other forms of documentation) as the primary “return on investment” (ROI) for an EDIS purchase is folly. For more information on computer physician charting see:*

*“Electronic Medical Records (EMR): Do the ‘Write’ Thing” ACEP Scientific Assembly - Monday, October 18, 2004 - (MO-108) by Todd Taylor, MD
 “Systems for Charting, Order Entry, Discharge/Prescription Writing” ACEP ED Director’s Academy Series by Richard Bukata, MD*

Optional Components

NOTE: Optional components are not listed in any particular order as utility depends upon the unique needs of an ED.

Forms & Content Management

FORMS: ex. AMA, Consents, EMTALA, Advance Directives, Conditions of Authorization, Medicare ABN, etc.
Print on demand with scan & store vs. electronic forms with signature or biometric acknowledgment
CONTENT: ex. list of local 24-hour pharmacies, dental clinics, free/low cost clinics, etc.

Imaging & Document Management

Capture (i.e. scanning) of paper & external documents (ex. EMS run sheet) with integration into the EMR

Messaging & Communications

Internal Communications (ex. departmental e-mail memo, message to primary nurse by ED physician, etc.)
External Communications (ex. patient information sent to PCP, electronic Rx, etc.)

Automatic Tracking

Automates the process of patient location assignment via infrared &/or radio frequency tracking devices.
Frees staff from the burden of manually assigning patients to an area & improves accuracy of tracking metrics.
Allows tracking of other things, ex. staff & assets
For more information see: "ED Computer Tracking Systems" ACEP ED Director's Academy Series by Todd Taylor, MD

Charge Capture

Supplies & materials for billing management
E/M CPT physician documentation scoring & hospital APC determination
Correct Coding Initiative (CCI) edits, Local Medical Review Policies (LMRPs), etc.

Online Resources & References

"Information at Your Fingertips", ex. online texts, anatomy atlas, prescribing information, etc.
Medical staff, ED staff & general hospital phone lists – Regional physician phone directory
Hospital Policies & Procedures

Device Connectivity & Integration

Keep digital data, digital: Monitors, EKGs, Ventilators, etc. all record digital data often subsequently transcribed into analog form & then reentered into the EDIS creating opportunity for transcription error & data loss.
Clinical Context Object Workgroup (CCOW) standard can allow single sign-on across multiple applications

Scheduling

Nursing staff, ED physicians, specialty on-call rosters, etc.
Sophisticated scheduling programs are readily available, but seldom integrated into the EDIS. There are many potential opportunities from doing so.

Risk Management

Another "Holy Grail" of EDIS is the promise to improve the quality of care & reduce medical errors¹. While enticing, current EDIS have largely failed to deliver on this promise. Instead, the complexities, and in some cases the poor design, of such systems have introduced the opportunity for additional errors².
Decision Support: In limited form, this is becoming a reality for EDIS. Yet such functionality is still in its infancy & this feature should be taken in the context of other aspect of the particular EDIS.

Mobile Computing

This is perhaps the future of EDIS functionality and efficiency offering the ability to work wherever you are.
See: "Mobile Computing: Bringing Real-Time Information to the Bedside" ACEP Scientific Assembly - Wed, Sept 28 - (WE-197) by Todd Taylor, MD

¹ Horsky J, Zhang J, Patel V. To err is not entirely human: Complex technology and user cognition. J Biomedical Informatics 2005; In press

² Koppel R, et. al. Role of Computerized Physician Order Entry Systems in Facilitating Medication Errors. JAMA 2005;293:1197-1203

“Always consider the total cost, return on investment, time to deployment, functional consequences, interface requirements, and cultural implications of an EDIS when considering a “Best of Breed” vs. an HIS “single source” solution.

Does it meet the needs of the ED within the time frame required?”

**“Best-of-Breed”
VS
“Single Source” HIS
Enterprise Solutions
for
Emergency Department
Information Systems**

By Todd B. Taylor, MD, FACEP

“Best-of-Breed” vs “Single Source” HIS Enterprise Solutions for ED Information Systems (EDIS)

Hospitals seeking information system solutions to best meet the needs of emergency departments (EDs) are often faced with a barrage of choices and decisions when selecting an emergency department information system (EDIS). One of the first decisions may be choosing whether to go with the EDIS offering from the hospital's existing HIS enterprise vendor vs. exploring alternatives available from so called “Best of Breed” (BoB) vendors. Opinions regarding the best strategy abound, but will ultimately depend more on factors unique to the hospital and ED in question. Each choice has intrinsic advantages and disadvantages.

The search, selection and implementation process for an EDIS is covered in the Additional Readings listed at the end. But it is important to recognize that in choosing between BoB and HIS vendors, much of that process will occur during the “sales process”. All too often vendors over-promise and under-deliver. When you hear “we do that”, make sure they do. When you hear “we can build that” make sure the delay in delivering that functionality is acceptable and you are prepared to assist in its development. For the foreseeable future, it appears no single vendor will meet all of the “wants”, and perhaps not even all the EDs “needs”. Ultimately you will likely have to select a “best fit” & work with that vendor to address any unmet functionality. The ability of a vendor to do so may become an overriding criterion in the decision process.

In selecting an EDIS, one must closely examine HIS vendors espousing the “single-source” solution. They may claim their solution provides the specific department functionality and workflow desired, when in reality they have simply “leveraged” their current in-patient system functionality in an attempt to make it fit in the ED. At the same time, one must ask tough questions from potential Best-of-Breed EDIS vendors regarding interfaces, vendor viability, support, functionality, efficiency, and return on investment.

There are renewed efforts by enterprise HIS vendors to address the EDIS market, but Best-of-Breed solutions continue to thrive and even expand. Regardless of the type of solution these three criteria must be considered:

- (1) Tangible return on investment
- (2) Implementation horizons of a few months
- (3) Functionality & workflow that truly meets the needs of ED managers & end-users

EDIS vendors fall into three basic business categories:

- (1) Large publicly traded companies (typically enterprise HIS vendors)
- (2) Venture capital companies (typically niche single product vendors)
- (3) Privately held companies (often multi-product vendors, i.e. ED plus other ancillary depts.)

The advantages and disadvantages of these business models will be discussed.

Advantages: BoB vs Enterprise HIS Vendors

The top 5 HIS vendors occupy the majority of hospital IS “shelf-space” & continue to push the single-source theme, while a passionate group of BoB systems continue to make inroads.

What is the viability of the BoB vendor?

Are they public or private?

The primary advantage of Best-of-Breed EDIS solutions is their ability to meet the unique workflow needs of the ED, provide a seamless view data from a variety of external systems, and greatly extend the capabilities through customization.

It can take years to customize HIS applications that best-of-breed solutions offer out-of-the-box.

How fast can the EDIS solution be deployed vs. time of custom coding of HIS software to meet these same needs?

Single-source HIS vendors often appear to have lower Total Cost of Ownership (TCO) by bundling departmental modules into the facility licensing. However, one must account for the cost of custom professional services necessary to ultimately meet the needs of the ED. HIS vendors often have a multi-year horizon on availability of new applications and functionality, so you may have to wait years for applications to be developed. Waiting equals lost revenue and productivity, adding to the hidden TCO.

Smaller projects have a greater chance of success.

Does the HIS vendor have evidence of dept-level success? e.g. demonstrated end-user acceptance & preference for their EDIS?

The “implementation that never ends” has emerged as a painful reality in the healthcare industry. Human nature responds to “quick wins” resulting in momentum for a new IT project. Best-of-Breed vendors are often more adept at matching this business need. With the necessary functionality already included “out-of-the-box”, more implementation time can be spent on mapping clinical and business processes to the software. The customer gets more value, hour for hour, for professional services provided.

Is the HIS vendor able to map business needs at the department level?

Best-of-breed vendors have complete domain expertise in the company & in the software.

HIS vendors tend to hire the “right credentials” just for the implementation, but Best-of-Breed vendors typically have domain expertise integrated into their product management and development teams. As a result they can be very responsive to changes in the core product roadmap vs. “one-off” customizations.

Does the HIS vendor have an accessible product management point-of-contact in communication with the ED?

Some HIS vendors acquire best-of-breed systems achieving “integration” into their enterprise product suite via product acquisition.

HIS vendors that promise a unified architecture across applications may not be the sole software vendor source in any one hospital-wide installation. Some “single source” vendors even offer to “private label” their best-of-breed application. Therefore, the same due diligence regarding integration and data flow must also be considered with regard to HIS vendors, just as it is for Best-of-Breed vendors.

Disadvantages: BoB vs HIS “Single Source” Vendors

Although many Best-of-Breed EDIS vendors have been successful for more than a decade, the fact new vendors continue to enter this market is an indication of their failure to fully meet the needs of EDIS customers. This has also given the HIS vendors a golden opportunity to enter the EDIS market with their own offerings.

The demise of a few venture-funded EDIS niche companies and difficulties with integration standards are the primary challenges for the Best-of-Breed strategy. However, one should not assume that Best-of-Breed vendors have substandard support, unreliable interfaces or will abandon the customer after the sale because research show that these issues are no more common with Best-of-Breed than with enterprise HIS vendors.

Satisfaction studies¹ indicate HIS vendors & Best-of-Breed vendors are on par regarding customer support & reliability.

**How does the BoB vendor structure its support?
What is the response and escalation model?**

In the 2003 Hospital CIO Survey, Bank of America Securities, the top 17 HIS vendors received an average of 6.57 for global satisfaction (1 to 10 scale). The individual scores for some of the most recognized vendors may surprise some, but this indicates that both HIS and Best-of-Breed vendors have a long way to go in the area of customer support and reliability.

How many ED personnel are required for implementation of the project plan?

HIS single-source proponents claim their strategy will result in less cost for maintenance and integration.

Before assuming a cost savings for maintenance and integration with an HIS enterprise solution, look closely at the system administration requirements of the Best-of-Breed application and interface/integration requirements. While there may be less cost for the HIS EDIS, the price to be paid may be in less functionality with an enterprise HIS vendor solution.

Is downtime in the ED acceptable?

Down time is “accepted”, but not “acceptable”.

A potential significant adverse impact of an HIS EDIS solution is scheduled and unscheduled downtime. This forces the ED to use alternate means of operation during downtime and then to re-input critical data at a later time. Using a Best-of-Breed system insulates the ED from this HIS vulnerability. In fact, some ED’s choose to use the Best-of-Breed EDIS as a backup registration system when the HIS is on downtime.

Many CIOs prefer a one vendor relationship, but in the EDIS market this may not be possible. Even if an EDIS module is available, it may not meet the needs of a particular ED.

Does the vendor offer standard, subscription and financed licensina models?

The hospital’s relationship with an enterprise HIS vendor and close alignment with a Best-of-Breed EDIS vendor does not have to be mutually exclusive. Best-of-Breed vendors often have a financial incentive to perform after the sale because they can be more easily replaced. Not always so with an enterprise HIS, that can “hold hostage” an entire hospital due to the cost and pain associated with a change in HIS vendors.

¹ Emergency Department Systems Study – Dec 2004 – KLAS Enterprises – www.healthcomputing.com

Best-of-Breed vendors focus on the ED. They have to - It's their specialty. Not necessarily so with HIS vendors who must manage multiple departments and competing interests both inside and outside of the company.

While healthcare IT is perhaps the last industry to be fully automated and it has clearly been a "laggard" in adopting technology, most other industries have already addressed the issue of "Best-of-Breed" vs. "Single Source" applications. Lessons from other industries indicate that HIS vendors will be fervent single-source proponents as long as integration & technology standards in healthcare are still being developed. It is important when considering a Best-of-Breed vendor that one validate that they have a forward-looking roadmap for adopting these standards. At the same time, other industries seem to indicate that, "single source" and "the safe choice" may not always belong in the same sentence.

Evidence shows that Best-of-Breed applications for Customer Relationship Management (CRM), Enterprise Resource Planning & Supply Chain Management (ERP/SCM), and Business Intelligence (BI), continue to thrive and are now preferred to those of "single-source" vendors among CIOs
- Bank of America Security ERP User Survey
January 2003

"if the trend continues. . .in a few years CIOs won't be buying any more tightly coupled, multi-million-dollar enterprise systems from just one vendor."

- Stephanie Overby

"This Could Be the Start of Something Small"

CIO, Feb 15, 2003, p.55

It appears in some other industries the pendulum has swung back in favor of Best-of-Breed systems due to the enterprise vendor's poor adoption, runaway costs and implementations that are so complex that they are essentially "never completed."

Finally, profitable privately held EDIS companies may be the "best of both worlds". They essentially have the financial stability of a publicly traded company, yet the flexibility and ability to focus on the customer of a niche vendor. Such attributes are rare in any industry and the EDIS market is no exception. At the same time, competing interests within a multi-product company and integration issues still may be factors.

Return of Investment Comparison

Return on Investment (ROI) analysis is fairly new to many in the healthcare industry and patient quality, satisfaction, and safety are often overriding objectives with any process redesign. However, hard financial numbers can assist in driving administrative efforts to improve patient care across the organization. In calculating ROI, facilities may use a borrowed cost of capital model to assume a baseline percentage that the project must meet or exceed to be considered a success, or for the project to be considered in the first place.

Does vendor provide a free in-depth ROI analysis during the sales process?

Is creating an ROI baseline for implementation part of the contract?

Hospitals may use a hurdle rate² in ROI analysis, a more aggressive assumption that compares the investment in the EDIS with a hypothetical investment of the available capital in securities.

Most hospital IT projects have multi-year ROI and are based on multi-year implementations. In the overcrowded, inefficient, poorly resourced hospital ED, the allure of an efficient well-

² The minimum amount of return required that will get "over the hurdle" to justify an invest.

designed EDIS becomes clear with an ROI analysis. Implementation in weeks, vs. months or years, provides a solid ROI at six to twelve months post-implementation, meeting the highest project acceptance standards. An assessment of the vendor's ability to meet this objective and performance guarantees in the contract is highly desirable.

Given available capital, hospitals may wish to take advantage of "smart investments" - wherever they occur.

What is the EDIS vendor's documented ROI field experience?

Broader organizational imperatives such as Error Reduction via Computer Provider Order Entry (CPOE), Leapfrog compliance or Electronic Medical Record (EMR) initiatives also create administrative ROI opportunities. Data mining this information may be difficult and hospitals simply may not have the resources to analyze metrics via existing manual processes. However, consideration of the ED as business unit or cost center, in addition to a patient care area, should prompt hospitals to investigate ROI. "Tangible" and "intangible" ROI can be assessed and a baseline established from published ED best practices (e.g. ED Benchmark Alliance³).

A recent trend has been for EDs to be forced to accept the existing enterprise HIS vendor's EDIS offering with little consideration for usability, functionality or potential productivity loss. An "apples-to-apples" ROI comparing the actual HIS vs. projected Best-of-Breed ROI after six months may reveal a compelling argument for one system over the other and convince the hospital to re-examine their strategy. Also, be careful of the "we can build that" promise that may cost thousands of professional services hours vs. the total cost of an EDIS solution that meets the EDs needs out of the box. The cost of time delay of implementation is a major factor in the "build as you go" strategy.

Forcing "solutions" onto end-users that do not fit the workflow invariably have an adverse effect on the ED. Some vendors assume that all hospital departments have the same workflow. This clearly shows a lack of expertise regarding ED processes - not to mention a disregard for best practices.

"Physicians & other caregivers often have been the rock that a CIO's IT dreams have crashed and broken upon."

- Greg Gillespie

**"CIOs Making Soft Sell When Calculating ROI"
Health Data Management - August 2002**

Vendors should take a personalized approach to maximize ROI and understand that you must fix poor manual processes, not just "computerize" them. So, the staff "efficiency return on time investment" must be considered in the overall design and implementation of an EDIS. To achieve true efficiency, the system must adapt to the user with minimal user adaptation to the system itself. Be careful of solutions that assume what works everywhere else in healthcare, will also work in the ED. Forcing an inadequate solution onto an ED creates an adverse cultural impact, that in turn, impacts acceptance of the system.

Workflow tailored to ED processes allows end-users to focus on treating patients. Vendor supported subject matter expertise to help create familiar reports, content, forms and templates, along with prepopulated databases can have an immediate impact and get users excited about using the system. ED managers need to feel like part of the team and get involved in the product development. End-users involvement is the best way to ensure the product evolves to meet needs of the department, without custom code development, professional service resources and core system upgrades.

³ Emergency Department Benchmarking Alliance, 332 Congress Park Drive, Dayton, OH 45459 - www.edbenchmarking.org

Compared to typical multi-million dollar, multi-year hospital IT projects, an EDIS can drive real results in a time horizon that demonstrates the investment of time & money is worthwhile to managers & end-users alike. Momentum such as this creates enviable adoption success & preference for system use vs the prior manual process, even by those not required to do so.

Does the vendor have evidence of >90% adoption and end-user preference of their EDIS vs manual systems at a client site?

Does the vendor have quantitative or qualitative evidence to support claims of increasing staff retention and productivity from use of their system?

Finally, the ED leadership should have direct access to vendor product managers and implementation specialists before, during and after deployment of the EDIS, benefiting from years of experience in the ED clinical information systems market. Training, support and user-group activities with vendor clinicians provides for networking and the ability for users to consult with peers on the efficient use of the EDIS.

The BoB vs Enterprise HIS Vendor Battle Continues in Healthcare . . .

Hospitals and ED managers that take the time to evaluate EDIS vendors and ask tough questions will be rewarded with an efficient system and a company that is a true partner, with a stake in the success of the emergency department.

When vendors claim “we can do that” or “we can build that” for the ED, CIOs and ED managers should consider total cost, return on investment, time to deployment, functional consequences, interface requirements, and cultural implications of both promises compared to using a solution that meets the ED needs today.

Summary

HIS enterprise vendors offer a compelling argument to CIO’s looking for a single source for all hospital clinical applications. Integration with current clinical applications is all but assured and reduced vendor relationship management enjoyed. The primary question to be considered: Does the existing HIS vendor’s EDIS offering substantially meet the needs of the ED? Only an in-depth analysis, to include a comprehensive installed-base assessment, will answer this question.

Best-of-Breed systems have been proven to coexist peacefully with HIS systems, often below the radar screen, hiding in the “all-eggs-in-one-basket” model. Their inherent ability to address the unique needs of the emergency department often greatly outweighs the institutional desire for a single source vendor. The primary question to be considered: Can the Best-of-Breed EDIS successfully interface with all necessary host systems and provide a single access point for clinical information?

Hospitals are often challenged with reducing costs, maintaining revenue stream, retaining staff, and enhancing efficiency. An EDIS can be a tool toward that end, if properly selected, implemented, and maintained. A careful analysis and comparison of an existing enterprise HIS vendor’s EDIS offering and Best-of-Breed solutions is often required to achieve this goal.

Additional Reading:

Taylor, TB Information Management in the ED. Emerg Med Clinics N Am 2004;22:241-257

Taylor, TB A View of the Emergency Department of the Future. ACEP Section for Emergency Medical Informatics 2000, Dallas, TX

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Information management in the emergency department

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Introduction

“If you cannot measure it, you cannot manage it”, trite, but true. Such is the state of many Emergency Departments (ED) – unmanageable due to a lack of valid measurable metrics of patient care. Even worse, often the information that *is* available is inaccurate, too little and too late to impact patient care on a real time basis. Such are the challenges for ED managers in the current healthcare environment. It would seem that technology would be a natural tool to fill this information gap. On the other hand, for technology to help, it must be usable, reliable, appropriate to the task, cost effective, improve efficiency of the ED, and be effectively implemented - a daunting task. There are perhaps few other initiatives in the ED that have such potential for good *and* harm as ED information systems (EDIS). This article will focus on the critical aspects of EDIS and offer suggestions for successful product selection and implementation.

ED Information System (EDIS): “Garbage in – Genius out?”

One of the more common mistakes when deciding to install an EDIS is assuming it will make a bad situation better. The best way to assess and implement an EDIS is to design a good process and then automate it. Otherwise, as has been said, “You do the same wrong things you have always done . . . only faster”¹

Many EDs, even on a good day, are dysfunctional and the reasons for this have been well documented². Just like adding a new baby to a dysfunctional marriage always make things worse, one should not assume that adding an EDIS will solve fundamental inadequacies of an already dysfunctional ED. In fact, doing so will undoubtedly exacerbate the situation.

Example #1: If identifying, repairing, and maintaining broken equipment in the ED is already a problem, adding 100’s of additional pieces of computer equipment will exacerbate the problem. When the EDIS depends upon having a functional “special” printer in each ED area and that printer fails, so will the EDIS. Planning for equipment redundancy for the EDIS is as important as other ED equipment.

Example #2: If patient throughput is a problem in the ED due to poor staffing or other reasons, adding the additional work required by an EDIS to already overworked staff will make the situation worse, perhaps much worse. In a large urban trauma center with 70,000 annual visits, Left Without Treatment (LWOT) increased by 100% in the first month after installation of a new triage/tracking EDIS³.

Therefore, in preparation for introducing an EDIS, one should first assess and repair the current ED processes and environment. Once implemented, the EDIS can then assist in refining these fundamental improvements, rather than merely illuminating, documenting, and exacerbating an already broken system.

The Interface – Making EDIS Work

EDIS will only reach its potential and offer a real opportunity for efficiency if it is integrated and properly interfaced with all necessary new and legacy hospital information systems. These interfaces include often-ignored equipment such as cardiac monitors, EKG machines, automated vital sign and pulse oximetry equipment. For the future, interfaces with community-wide and even nation-wide healthcare information networks will truly provide all of the information necessary to care for any patient at any time.

Most EDs rely on computer interfaces to hospital systems that are not totally reliable. Anyone who works the night shift knows how frustrating it is when the hospital system "goes down" for routine maintenance. During this down time, ED personnel are forced to fall back on archaic manual methods of information management. As a result, many EDs have acquired stand-alone, proprietary EDIS products that are difficult, if not impossible, to integrate into hospital-wide systems. At best, these stand-alone systems are transition technologies that serve limited functionality and will perhaps never meet all of the EDs information needs.

Efforts to redesign the information environment must go beyond simply automating paper flow in the ED. Instead, the goal should be to support the department's business plan with a design that combines productivity and profitability with the delivery of high-quality patient care. This can be best accomplished in a step-wise approach (Figure 1). This article will help begin that process and provide the tools necessary to implement a usable, functional, and efficient EDIS. For an expanded view of where EDIS should be, read "A View of the Emergency Department of the Future"⁴.

EDIS Functional Considerations

Remote Access

ED managers never really leave work and increasingly that is true of other staff as well. The need to remotely access data is a new healthcare reality and comes in a variety of forms. Medical records retrieval, on-line authorization (signature), staff scheduling management, e-mail advisories – the list may be endless. While perhaps intrusive into ones personal life, the efficiency gained by this functionality is enormous. The goal is to have the ability to securely access the EDIS from any web enabled computer worldwide.

Authorization & Identification Systems

The Health Insurance Portability and Accountability Act of 1996 (HIPAA) has forced many hospitals to reassess how Protected Health Information (PHI) is accessed. At the same time, it is an opportunity to apply new technology to what may seem an onerous mandate. Automated login/logout via infrared badges is one such solution. Regardless of the technology, the need to access multiple computers and information systems must be coordinated to avoid "password-bloat". Using the same technology, access to various hospital locations can be authorized and restricted for hospital personnel.

Positive identification of patients must also be addressed. The extension of "unsecured healthcare loans" under the guise of "you don't have to pay today, we will bill you", has become a severe financial strain on EDs. This is often due to inaccurate or even fraudulent information. Integrating demographic verification software and procedures is an often-missed opportunity for revenue capture in the ED⁵.

Patient Centered Automation

The electronic medical record (EMR) should be updated automatically as soon as the information becomes available.

New patients to a doctor's office spend the first several minutes completing medical history forms. This is not only a vital part of the medical database acquisition, but also important for coding and billing. Most EDs fail to take similar advantage of those patients who are capable of completing this part of their medical history on their own. Automating the process of registration, chief complaint, history of present illness, review of systems, family/social histories, medications, and allergies is a ripe opportunity to gain vital information and efficiency in the ED data collection process. Using a touch-screen computer (no keyboards) and scanner, most patients would be able, and perhaps be more than willing, to self-register and feel as if they are actively involved in the process.

Passive patient tracking (via infrared or radio frequency tracking devices) not only automatically tracks location, but also how long it takes to move through the ED. Such systems can also automatically log patients into the computer terminal closest to them and avoid misidentification. Tracking of staff using similar technology is somewhat controversial, but can provide invaluable data for staff management and productivity.

Computer-assisted triage protocols based on data input can help ancillary personnel to initiate diagnostic tests and necessary treatment from the moment of arrival. Artificial intelligence protocols have the potential to further automate the clinical decision-making process and provide enhanced ability for the ED staff to recognize common and not so common clinical syndromes. Prompting for diagnostic considerations and providing recommended treatment standards can greatly enhance staff efficiency and clinical accuracy.

Computerized Physician Order Entry (CPOE)

CPOE is the "latest" buzzword in EDIS. A landmark CPOE study⁶ from 1993 showed that physicians using a computerized order-writing system discharged patients on average 1 day earlier and with medical bills \$900 less than physicians using traditional order entry methods. The system also warned of potential drug interactions, patient allergies, and "expensive" treatments.

CPOE promises to be a key component to increasing patient safety, efficiency, and functionality in patient care, but research and development in this area is ongoing. While this aspect of EDIS will serve as an enhancement, it should not necessarily be considered a prerequisite to implementation of an EDIS. For more information: www.cpo.e.org

Consolidated Digitized Environment:

For an EDIS to be truly efficient, information must be in digital format. Any EDIS should keep digital information digital (CT scans\ultrasound\EKGs\cardiac monitoring\automated vital signs), transition analog information to digital (digital plain radiography), and digitize everything else (scan all paper). Prior to implementing the EDIS, every effort should be made to transition the entire ED to a digital environment. This will allow the Bill Gates concept of "Information at Your Fingertips" to become a reality in healthcare. The goal should be for all information necessary to manage patient care to be available at a single computer workstation or mobile terminal.

Digital radiography in the ED has been demonstrated to be as reliable as hard copy⁷. The advantage is widely distributed simultaneous accessibility and opportunities for contemporaneous reading by radiologists even at a remote site. Picture Archiving and Communication System (PACS) is becoming the standard in radiology for digital information management. Extending this to the ED is only logical and perhaps vital to an EDIS. Further, as the PACS can operate over the hospital TCP/IP network, the PCAS workstation can also be used as the emergency physician primary workstation for all other computer functions. This concept reduces the number of necessary workstations saving space and capital investment.

Scanning technology is inexpensive and reliable. Barcoding every piece of paper used in the ED allows for automatic archiving of digitized material and reduces the need to manage paper. The cost savings by eliminating NCR (no carbon required) paper alone often pays for such systems in short order.

Other digital opportunities such as digital photographs and video are made possible due to the digital environment, but not required for implementation of the EDIS.

Patient Safety

The opportunities for patient safety systems in the digital ED abound. Computerized alerts for abnormal values (symptom recognition, laboratory values, vital signs, wait times, syndromic surveillance, etc.), drug-drug or drug-syndrome interactions, and patient monitoring (pulse oximetry, CO₂ monitoring, etc.) are but a few of the many opportunities.

Coordination of Care

Automated notification of specialists, primary care physician, ancillary services (respiratory care), radiology technician, housekeeping, admitting department, insurance plans, etc. are but a few of the opportunities available with EDIS. Further, exchange of patient data easily becomes HIPAA complaint, immediate and inexpensive using encrypted or secure internet transmission. Nursing report for admitted patients can become an automated process. Documentation is completed simultaneously with patient care, so delays due to documentation completion are eliminated.

Automated alerts can easily be transmitted to staff via pager or cell phone, such that workflow is not interrupted simply looking for data. For example, ordering a small volume nebulizer (SVN) treatment automatically notifies the physician for reevaluation 10 minutes after completion. Automatic notification of laboratory and radiology results, etc. are automatically transmitted to the ordering physician.

Content

Computer systems are of limited value without reliable up-to-date evidence-based clinical content. This may very well be the greatest future challenge for EDIS. While most currently available EDIS provide adequate technical infrastructure necessary to manage data, the technical aspect of a comprehensive EDIS may be the easy part. The real challenge is to provide high quality clinical content that will enhance the clinical staff's ability to make better clinical decisions and focus on patient care.

For example, discharge planning. A recent survey⁸ revealed that there is no currently available peer reviewed evidence-based discharge instruction content. Further, the content that *is* available is often presented to patients in a non-user friendly way (i.e. unformatted plain text).

Clinical content is also often lacking. Web links to emergency medicine web sites such as the National Center for Emergency Medical Informatics (NCEMI) are helpful, but often require searching for useful information. Integration of clinical content into the EDIS is essential in order to achieve the full potential of such systems.

Regulatory & Liability Considerations: When does an EDIS become a “medical device”?

As ED information systems become more sophisticated and take on larger roles in patient monitoring and care management, they have the potential to create new opportunities for introducing error or fostering complacency among the ED staff. Reliability testing and perhaps even Food and Drug Administration (FDA) approval may become necessary. In the short term, these considerations may limit technology advancement or require frequent human acknowledgment of data input.

Summary

There are many obvious advantages to EDIS. The staff can spend time caring for and talking with patients instead of shuffling paperwork. Physician support is enhanced by the availability of remote specialists in real time who directly assist in making diagnoses. The EDIS also aids in diagnosis, so less time is spent wondering what you may have missed. Patients receive optimal care regardless of time of day. Updated medical records are distributed to appropriate parties instantly.

There are also some not-so-obvious advantages. Clinical information is captured in local and national databases would allow real-time CQI/QA and opportunities for national data mining for research. Patient tracking identifies inefficiencies in department processes and enhances ED management. Staff productivity can be monitored in real time. Family members can be kept informed even from remote places.

There are many hurdles yet to overcome and perhaps hurdles not as yet realized. Nevertheless, the technology necessary to implement basic systems is now available and future enhancements can be added as they are developed. The possibilities are limited only by our imaginations.

Strategies for Emergency Department Information Systems Planning⁹

Establish planning parameters

A management steering committee should be established and charged with overall project oversight. This oversight should include seeking input from stakeholders, integrating input into strategic objectives, and implementing the project in accordance with the agreed plan and timeline. The committee should include clinicians, information systems consultants, local experts in the field of emergency medical informatics, and information systems personnel. It is important at this stage to develop the emergency department's strategic objectives supported by well-defined goals and potential benefits of the project (Table 1). The list of goals should be developed from stakeholder input and may be extensive depending on the scope of the project. It is the steering committee's duty to develop objectives based on these stated goals and justify them by identifying benefits. The objectives should be reviewed by a broad range of stakeholders (management, physicians, nurses, security and pharmacy personnel, etc.) for additional input and revisions. Capital allocation funding is key to the success of the project and should be addressed and committed at an early stage.

Assess the current information environment

It is important to define the current information environment; otherwise there is little chance of knowing where you want to go. Current software, hardware, network, and operating systems need to be inventoried. Understanding how these systems are currently integrated with the hospital's main computer is critical. Since many emergency departments have only limited automation in place, this step may be easier than anticipated.

A crucial decision at this juncture is whether current systems can be upgraded or whether a completely new system will be installed. Due to the rapid pace of technological advances, this is often a difficult decision. The multimillion-dollar system of 5 years ago may be worth only a few thousand dollars today. A final decision will often be based on whether it is more cost effective to upgrade, adapt the current system or simply start over. A new system usually provides more flexibility and can integrate the latest technologies but will be more expensive and often more difficult to implement.

It is also important to decide at this point whether the emergency department system will be a stand-alone system or be integrated into (or part of) a hospital-wide system. A hospital-wide information system redesign is a huge project but solves the most frequent cause of failure of stand-alone emergency department systems—the interface (sharing data between incompatible systems).

A stand-alone system is designed to perform specific functions (e.g., patient triage or tracking) only within the emergency department. When planning or deciding on a standalone emergency department system, you should consider how it will interface with the current (and future) hospital system.^{10,11} The EDIS must interface with pharmacy, laboratory, radiology, ICU/medical/surgical units, registration/admitting, general accounting/billing offices, medical records, dictation/transcription, staff management systems, and facility maintenance, as well as, information sources outside the hospital. The cost of creating these sometimes-complex interfaces can be prohibitive. But without such interfaces, the EDIS will ultimately fail to reach its potential and become an island of information cut off from the outside world.

The analysis at this stage should delineate information flow (what, when, where, and by whom) in the emergency department and hospital-wide. This will allow identification of current information issues and areas of potential improvement in terms of quality of care, staff productivity, and cost effectiveness. It is important that key personnel in each functional area be involved in this analysis to identify the pertinent activities for their areas and document the flow of information. A case scenario approach that follows the paper trail may be useful.

Propose a concept for a new information environment

Using the information obtained in the previous steps, a core group will then need to develop a plan for a new information environment. This may take the form of a flow chart that acts as a blueprint for future planning. Emphasis should be placed on improving quality of care and productivity, reducing operating costs, decreasing inefficiency and redundancy, decreasing errors of omission and commission, and increasing the availability of information necessary for effective decision making. Again, input should be solicited from all parties involved.

Investigate potential solutions

At this stage a decision must be made whether to develop a proprietary system from the bottom up or investigate commercially available systems that may meet the identified needs. Proprietary bottom-up system development requires many more resources and likely a longer development time. Its advantage is flexibility and an almost guaranteed ability to interface with existing systems. However, depending on the resources available, such an approach may not necessarily result in the most robust of systems.

Several commercially available products have been developed in recent years and vary considerably in features, compatibility (ability to interface with existing systems), flexibility (modular versus packaged), and price. Depending upon the hospital's main computer system, an ED module may be available from the current enterprise-wide vendor. If so, this vendor should be a major consideration and the possibility of building upon the current system investigated.

Resource information on vendors include ACEP's Directory of Software in Emergency Medicine¹², MD Computing's Annual Medical Hardware & Software Buyer's Guide¹³ and commercial consulting resources such as the KLAS Enterprise ED Systems Study¹⁴. See table 2.

Although software decisions are typically made first, hardware and connectivity infrastructure (e.g. wiring) are likely to significantly affect the total system cost and should be considered together. How the final product is selected will depend on the corporate structure. A request for proposal (RFP) is often formulated and sent to several contractors, but forming a group to simply shop around may be equally effective. A model RFP is available from the author¹⁵.

Regardless of how the vendor is selected, it is important to set performance and milestone parameters in the final contract to ensure that promises made in the selection process will be honored during installation and implementation. Payment for the system should be graduated and predicated on the vendor meeting these criteria. If possible, define critical criteria that if not met would result in a full refund. These might include a guarantee of a workable hospital-emergency department system interface, system fault tolerance (i.e., limited downtime), and system support.

The fiscal health of the vendor should be ascertained. Most emergency department system vendors are venture capital businesses and do not have the fiscal robustness of a publicly traded company. Seeking information on current installations is critical; do not rely on the vendor-provided referral list alone. The ACEP Section for Emergency Medical Informatics list server¹⁶ can be a valuable tool for finding current and former installation sites for real user experiences. Telephone contact and/or onsite visits of current and former clients are valuable in determining vendor reliability.

Software vs. Hardware Selection

Depending upon the vendor, the hardware and software may come as package or may require independent selection and purchase. Failing to appropriately investigate and plan for hardware is a prescription for failure. Large CRT monitors that do not fit on a counter; small LCD monitors that are difficult to read and require constant scrolling to view information; slow printers that frequently run out of paper; slow computers/networks that delay information access; insufficient number of workstations; non-standard equipment (i.e. rollerball mice without a scroll wheel or keyboards in atypical layouts); poorly placed workstations; computers, battery backups, power strips, cords lying on the floor, etc. are all examples of hardware foibles. Table 3 lists several hardware considerations.

Also, depending upon the current ED space environment, a redesign of work areas may be necessary to allow for efficient use of the new system. Few EDs have ever been constructed with enough counter space to accommodate all the typical equipment necessary. Adding an EDIS will complicate the space crunch. Consolidating work functions into single workstations may help, but significant forethought as to the location and type of equipment is essential to a successful implementation of an EDIS.

Implementation

Buying something that no one will use accomplishes nothing.

Implementation is the most crucial stage of the process with the most opportunity for failure. Twenty-five to 50% of the cost of the system may need to be reserved for implementation. Besides initial training costs, additional on-site clinical and clerical staff may be necessary during the rollout to assure as little impact on patient care as possible. Additional unplanned expenditure for equipment and infrastructure will be necessary. Retraining and ongoing training should also be anticipated.

A phase-in or modular approach to implementing the new system will allow incremental learning and adaptation with less impact on patient care during the transition. Where to begin will depend upon the priorities set by the steering committee, but starting with the simplest and most efficient part of the system is recommended. A sample implementation schedule is outlined in Figure 2.

Physician charting has traditionally been touted as an area with great potential for cost savings (“return on investment”) and is often implemented first. Unfortunately, physician charting is the most difficult module to implement because it requires a fundamental change in the way physicians accomplish their work. In addition, this part of the patient information system has almost infinite variability and makes charting system design very difficult.

Efficiencies in the physician charting component will only be realized once all of the other components of the system have been fully implemented. Ideally, in order to gain sufficient efficiency to make physician computer charting viable, elements of the Chief Complaint, History of Present Illness, Past Medical History, Social History, Family History, Current Medications, Allergies, Review of System, laboratory/diagnostic imaging/EKG, and demographic information would be collected for the physician and automatically integrated into the chart. Only the physical examination, medical decision making, disposition, and final diagnosis would then be required to be completed by the physician. Even so, one should expect resistance from the physicians as virtually any system will take more time to accomplish charting. Gaining early efficiencies (pay back) is crucial to EDIS acceptance.

As an interim short-term charting solution, some facilities have implemented a blend of computer-based and traditional dictation. Most emergency departments are better served by continuing their current charting method (e.g., paper-based template or transcription) until more usable computerized solutions are proven to work efficiently.

Finally, the first and last stages of implementation process are critical. A reliable interface with the hospital's main computer through an ATD (Admit\Transfer\Discharge) interface is essential. This interface captures patient demographic information and supplies data to multiple sites throughout the EDIS. On the back end, "charge capture, coding, and billing," if properly implemented, can reap many benefits and help offset the initial and ongoing cost of a totally integrated system. As noted in Figure 2, billing, as well as other processes, may need to continue independently until all the pieces are in place. Billing is particularly dependent upon the availability of information collected by other subsystems.

EDIS Return on Investment (ROI)

An entire paper or even a novel could be written on this topic. Suffice it to say, ROI is always done in the EDIS selection process and is nearly always wrong. In EDIS and information technology in general, computers rarely save time or money. What they *do* is allow you to do things that were previously not possible; often taking more time and costing more money. Nevertheless, the advances in medical care demand better and more available computer systems. Imagine trying to fly a Boeing 737 without a computer. It was computer technology that allowed such a plane to be designed *and* to fly. EDs are no different, but have been slow to adapt computer technology to the work environment. So, when considering the EDIS ROI, staff efficiency, ability to gather data for ED management, patient safety, improved data distribution/access/archiving, workflow automation, and the many other benefits discussed are the true “return” on the EDIS investment. Cost savings on transcription, presumed ability to reduce staffing, and other “hard” cost savings are probably not realistic.

How to develop an action plan

The final blueprint should include a step-by-step project management scheme and cost-benefit analysis. Once this plan has been reviewed and approved by the entire team, it is validated against the business objectives. A vendor is selected to either develop or supply the system, and final decisions are made regarding hardware and software. The plan is not static and should be reviewed periodically (perhaps quarterly initially then annually) even after the immediate project has been completed.

Emergency department automation is challenging and often fraught with pitfalls. EDIS consultants may bring valuable expertise to the process, but the success of the project will depend greatly on the commitment of the development team and a willingness to dedicate adequate resources to the goal.

Summary

Information system planning for the emergency department is complex and relatively new to emergency medicine despite the fact that it has been used in other industries for many years. It has been estimated that less than 15% of ED have comprehensive EDIS in place¹⁷. The manner in which administration is approached will, in large part, determine the success in obtaining appropriate institutional support for an EDIS.⁷ Active physician and nurse involvement is essential in the process if the new system is to be accepted at the user level.

In the ED, large volumes of information are collected, collated, interpreted, and acted upon immediately. Therefore, effective information management is key to the successful operation of any ED. Although computerized information systems have tremendous potential for improving information management, such systems are often underutilized or implemented in such a way that they increase the workload on caregivers and staff. This is counterproductive and should be avoided.

In developing and implementing EDIS one should be careful not to automate poorly designed manual processes. Examples are ED tracking systems that require staff to manually relocate patients in the system. This task probably will be completed only when the ED volume is low and "worked around" when the department is busy. Information from such a system is, therefore, flawed, at best useless and at worst counterproductive. Alternatively, systems are available that can automatically track patients through the ED via infrared sensors similar to those used in baggage-tracking systems that have been in place in airports for years.

In the automated (computerized) emergency department, we must have zero-fault-tolerant enterprise-wide hospital information networked systems that prevent unnecessary duplication of tasks, assist in tracking and entering data, and ultimately help analyze the information on a minute-to-minute basis. Such systems will only reach their potential when they are fully integrated, including legacy systems, rather than stand-alone proprietary EDIS. Further, a modular approach where individual components are connected to a flexible computer backbone is ideal.

Finally, good clinical content is key to virtually every aspect of the EDIS. Much of this content is yet to be developed and what *is* available still needs to be adapted to the EDIS environment.

Daunting as it may be, an EDIS implementation properly accomplished will result in better patient care, improved staff productivity, and a satisfying work environment.

Pearls and Pitfalls

- EDIS to address the enterprise-wide information management problem are only now beginning to become available.
- Consider transition (temporary) systems as a 3-year to 5-year solution that will likely need to be totally replaced when enterprise-wide hospital systems become readily available in the next few years.
- Fix other aspects of the ED environment before implementing an EDIS.
- Be careful not to develop or purchase systems that merely automate poor manual processes. The less a system requires human input the better; consider systems that automatically capture data already available on the hospital main system and systems that automatically track patients through the ED.
- Phase in the installation in a modular approach and be sure to obtain a guarantee of milestone implementation, (i.e. a money-back guarantee if the EDIS cannot ultimately integrate with the hospital's main system.)
- Spend as much time selecting hardware as the software and in planning its deployment in an already crowded work environment.
- Decide what it is you need then decide what it is you want. What you end up with should be somewhere in the middle.
- Be willing to fail and change course if necessary. Forcing a square, inadequate system into a round hole will end in disaster.
- Waiting for the ultimate solution is no solution.

Figure 1

Strategic information systems planning overview

Step 1: Establish planning parameters

Step 2: Assess the current information environment

Step 3: Propose a new conceptual information environment

Step 4: Investigate potential solutions

Step 5: Plan implementation strategies

Step 6: Develop action plan

Figure 2

Recommended steps for implementing a modular emergency department automation system*

Phase 1: ED patient log/ATD interface

Phase 2: Patient tracking

Phase 3: Triage

Phase 4: Results-In interfaces (lab, rad, etc)

Phase 5: Computer Provider Order Entry (CPOE)

Phase 6: Clinician documentation

Phase 7: Physician charting

Phase 8: Discharge planning integration *

Phase 9: Charge capture, coding, billing *

** These items refer to a totally integrated system. Some of these items may continue to be used as stand-alone modules during the integration process but brought online in the proper order. Some early phases may also be grouped (ex. Phases 1, 2, 3 are often implemented together)*

Table 1: Example of goals, strategic objectives, & potential benefits of an integrated EDIS

| Goal | Objective | Benefit |
|--|---|--|
| Minimize redundant input | Automate ATD input into ED system Automate laboratory, ECG, radiology, and ancillary reports into the emergency department record. Integrate discharge instructions and prescriptions into chart and automate output for patient | Saves staff time |
| Improve tracking of patients, equipment, and staff | Obtain a passive tracking system that will automatically track department assets and provide regular status reports | Saves time and provides information on productivity and efficiency |
| Provide cost-effective physician charting | Investigate methods of physician charting to determine if better alternative available | Productivity may not provide any additional benefit over current charting method |
| Provide digital ("filmless") radiology | Investigate digital radiography systems | Allows immediate access to and archiving of radiographs, may be cost prohibitive |

Table 2: EDIS Vendor Contact Information (Updated December 2007)

| Product Name | Vendor | Website |
|--------------------------------------|---------------------------------------|--|
| Niche Vendors | <i>Alphabetical by Company Name</i> | |
| HealthMatics ED, EMSTAT | Allscripts (Former A4 Health Systems) | www.allscripts.com/products/hospitals/edis/default.asp |
| ED Information Manager (EDIM) | EDIMS (Alpha Physicians Resources) | www.edims.net/edim.php |
| Codonix ED System | Codonix | www.codonix.com |
| CMR (Complete Medical Record) | CMR | www.cmr-med.com |
| EmergisoftED | Emergisoft | www.emergisoft.com |
| EmpOWER Systems | Emergency Care Doc Systems | www.ecds.md |
| PulseCheck | IBEX (A Picis Company) | www.picis.com/products/emergency-department/default.cfm |
| OnTrack, CHECKOUT, PET | LogiCare | www.logicare.com |
| ED Management System (EDMS) | MedHost | www.medhost.com |
| ALERT EDIS | ALERT Life Sciences Computing | www.alert-er.com |
| NWS/EDS | New Wave Software | www.newwavesoft.com |
| AmeliorED | Patient Care Technology Systems | www.pcts.com/Home/ed_solutions.asp |
| NavigatorWeb | The Poseidon Group | www.poseidongroup.com |
| T-SystemEV | T-System | www.tsystem.com/ED-Information-System/features.asp |
| Wellssoft EDIS | Wellssoft | www.wellssoft.com |
| Enterprise Vendors | <i>Alphabetical by Company Name</i> | |
| FirstNet | Cerner | www.cerner.com/public/Cerner_3.asp?id=184 |
| Sunrise Emergency Care | Eclipsys | www.eclipsys.com/solutions/emergency_care.asp |
| ASAP EDIS | EPIC | www.epicsystems.com/Software/SDA.php#ED |
| Centricity Emergency | GE Healthcare | gehealthcare.com/it_solutions/clinical/ed.html |
| Horizon Emergency Care | McKesson\HBOC | www.mckesson.com |
| ED Management Application | Meditech | www.meditech.com/ProductBriefs/pages/ProductBriefsCSEDM.htm |
| Azyxxi (hospital & cross-enterprise) | Microsoft Health Solutions Group | www.azyxxi.com or www.microsoft.com/hsg |

Table 3: Suggested Hardware Minimum Standards for EDIS

| Item | Considerations |
|---------------------------------|---|
| File Server | Standard configuration sufficient to handle the anticipated network traffic with high fault-tolerant redundancy. Dual redundant servers ideal. |
| Workstations (CPU) | Faster is better, but also space is a major consideration. Small compact “brick” computers amenable to attaching to the wall under a desk are ideal. In most EDIS installations, the only functions necessary is TCP/IP, video, mouse, & keyboard outputs. If a local floppy or even hard drive is not required, it is better to not have it as a potential hardware failure point. |
| Mobile\Wireless Workstations | Certain applications may be amendable to portable wireless workstations. Until recently the hardware for these devices has been heavy, expensive, not rugged enough, and ill-suited to the task. New technology has emerged that moves the video & input functions to the mobile device making them much more usable. [EX: <i>Panasonic Toughbook MDWD (mobile digital wireless device) – various models including a “brick” computer</i>] |
| Monitors | LCD monitors 19”-21” diagonal size range is ideal. Anything less than 17” is unusable. Lightweight and thin is best. Certain applications may benefit from monitors capable of being rotated to portrait orientation [EX: <i>Samsung SyncMaster 191T</i>]. Unless sound is required, integrated speaker only add to the bulk. CRT monitors are generally not a viable option. |
| Printers | Minimum 35ppm with 1000-1500 page capacity. Duplex & dual paper trays may add additional functionality. [EX: <i>HP 4200 or 4300 series</i>] |
| Keyboard | No frills, rugged, standard 101 layout keyboards are ideal. Specialty keyboards (ex. Microsoft “Natural Keyboard”) and non-standard layouts are problematic. |
| Mice | Simple, reliable, optical, no frills, standard mice. [EX: <i>MS Standard USB WheelMouse Optical (Part #X08-40764)</i>] |
| Battery backup\Surge Protection | Ideal solution to avoid mishaps. Must be mounted off the floor to avoid damage. |
| Power strips and cords | If necessary, in lieu of battery backup, must also be mounted off the floor to avoid damage and mishaps. |
| TCP/IP Network | 100 Mbit or better speed |
| Workstation Environment | Each workstation must be ergonomic and suited to the task. Nothing should be left lying on the floor including power cords & network cables. |
| Large Tracking Monitors | Large plasma screens may be useful in certain environments, but with adequate and well-placed workstations this money may be better spent elsewhere. |
| Redundancy | Things break – in EDs they break often. Standardizing the workstations will allow for “plug and play” replacement when failures occur. One redundant printer for every 4 and 1 redundant complete workstation for every 10 is ideal. |
| Supplies | Do not forget to establish a system for replenishment of consumables such as toner cartridges, special safety paper for prescriptions, etc. |

Additional Reading

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- ⁵ Taylor TB. A Solution for the Emergency Medicine Conundrum: Point of Service Revenue Capture Program (aka The “Turnstile” ED & Charity Care Program). Publication pending. For a pre-publication copy send an e-mail request to: tbtmdaz@cox.net.
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- ⁷ Kundel HL, et al. Reliability of soft-copy versus hard-copy interpretation of emergency department radiographs: a prototype study. *AJR Am J Roentgenol*. 2001 Sep;177(3):525-8
- ⁸ Survey conducted by the author summer 2003 via an internet list service – unpublished data.
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- ¹¹ Bleich HL, Slack WV. Designing a hospital information system: a comparison of interfaced and integrated systems. *MD Computing*. 1992;9(5):293-296.
- ¹² American College of Emergency Physicians, Section for Emergency Medical Informatics. *Directory of Software in Emergency Medicine*. Dallas, TX: American College of Emergency Physicians; 1996.
- ¹³ Annual Medical Hardware & Software Buyer’s Guide. *MD Computing*
- ¹⁴ Emergency Department Systems Study. July 2003. KLAS Enterprises, 207 E. 860 S., OREM, UT 84058, (801) 226-5120 www.healthcomputing.com
- ¹⁵ Model EDIS RFP – For a copy, send an e-mail request to: tbtmdaz@cox.net
- ¹⁶ American College of Emergency Physicians, Section for Computers in Emergency Medicine, Dallas, TX.
- ¹⁷ Proprietary data from market research known to the author.

Membership Section

Emergency Medical Informatics

Newsletter from the American College of Emergency Physicians

A View of the Emergency Department of the Future

Adapted from: *Strategic Information Systems Planning for Emergency Medicine*

It's 5pm, you just woke up, and you're between night shifts. You go to get your "mail", but not to the post office box – to your computer. The computer announces "You have new mail": several personal messages, a notice that next month's schedule is now available on your group's web site, follow-up on patients you admitted last night, and a list of available shifts for next month at an ED where you moonlight. After downloading your schedule you note a conflict. No problem. You go to the web site, check that day, and note 4 others are available to work the shift. A click of the mouse notifies each that you need to trade. The moonlighting hospital has no shifts that you can work, so you send out a broadcast message to anyone wanting to give up shifts for next month. Business done, you have a peaceful meal with family & get ready for work.

At 7pm your pager notifies you the ED is becoming very busy and requesting you to come in an hour early. You check the web site. It reveals several ambulances are expected from an MVA. The video option allows you to "look around" the ED from home. Yup, it's busy alright! You also check the city-wide EMS and hospital status system. Looks like everyone's busy tonight. Off to work!

As you enter the ED the computer status board lists 8 patients waiting to be seen, 4 in triage, and 3 more expected from an MVA. Each are automatically prioritized and you are directed to an elderly man in obvious respiratory distress, diaphoretic and complaining of chest pressure. Classic triage dictates you care for sickest person with chest pain and the others wait. But this is the future and the routine has changed. The triage nurse has directed the other patients to appropriate treatment areas. Most patients are registered via a national database that automatically enters demographic and medical information into the system after authorization via fingerprint identification. Anyone not already in the system is "self-registered" using a touch screen computer and scanner. Use of keyboards are virtually eliminated. Managed care plans, PCP's, and specialists are automatically notified when appropriate. Each patient is "tagged" with an automatic tracking device that not only tracks their location and how long it took to move through the system, but also automatically logs the patient into the computer terminal closest to them. The computerized medical record is completed automatically from information as it becomes available. Meanwhile those "waiting to be seen" are *not* waiting. Advanced computer assisted triage protocols help initiate diagnostic tests (i.e. x-rays, labs, etc.) and necessary treatment (i.e. SVN's, O₂, etc.).

Back in the treatment area, the elderly man with

respiratory distress is placed on an oxygen mask that senses end expiratory CO₂ levels, a cardiac monitor, blood pressure, and pulse oximetry. A nurse initiates lab work and an IV. As you examine the patient, you order blood work, an EKG, CXR, Lasix and nitropaste all at the bedside via a hand held computer linked to the main system by wireless remote. No one need leave the room to notify radiology or the EKG technician. The computer system continuously monitors all inputs (cardiac monitor, pulse oximetry, etc.) and time stamps each event. You use the bedside computer to confirm the automatically recorded readings. You document the history and physical via a hand held touch screen computer that helps prompt you for the necessary items to attain the appropriate coding level. The CXR & EKG results are digitized and included as part of the computerized record. A copy of the old EKG is immediately available from the national database & computerized comparison is automatically performed. An optional "visual record" (video camera) is also added to the medical record to view patient status and for delayed documentation.

The computer prompts that the patient's end expiratory CO₂ is rising, the oxygen saturation is falling, and asks if you should consider assisted ventilation. The patient is intubated and arrangements are made for admission to the ICU. A touch of the computer screen automatically pages the PCP, notifies admitting, and the managed care plan. The completed medical record (history, exam, & treatment) is immediately available to the ICU staff and sent to the admitting physician's office & home by e-mail. "Calling report" is simplified and communications are more efficient. Documentation is completed simultaneously with patient care letting physicians and nurses move on to care for others.

A young child with a wrist injury has not waited for treatment. Nurses, using artificial intelligence protocols, have initiated evaluation and treatment using bedside computer prompted history and physical exam items. A digitized radiograph is obtained and sent to a remote radiology site where a staff radiologist is available 24 hours for real-time evaluation. He indicates on his screen with an arrow his concern about a subtle fracture. The report is completed in real time, sent back to the medical record, and awaits your attention.

Your role as an emergency physician has been transformed. You are no longer a collector of mundane information. The patient &/or more cost effective workers now collect this with automated information systems. You are the director of care, interpreter of data, and teacher. You are not pressed for time to obtain unessential information necessary to complete the medical record.

Documentation for the wrist injury is confirmed at the bedside, printed discharge instructions are produced and a splint is applied. Since the patient lives in another state, a copy of the record with the digitized radiograph is added the national database for review by the orthopedic surgeon.

Next, a patient with the persistent cough is examined and note is made from the history already entered by the patient that she has been pale and complained of weakness. A CXR is obtained and read as "unchanged" by the remote radiologist who compared it with her old films available by digitized record. A CBC is drawn and tagged with a bar coded label and is analyzed within minutes by the ED lab. The hemoglobin, hematocrit, and platelets are noted to be low. A Giemsa-Wright stain is prepared by the main lab and a digitized microscopic image is sent to a remote pathologist for interpretation. The printed report is returned within minutes and available at any terminal. A computer generated differential diagnosis is formulated based on the available clinical information. A peculiar diagnosis prompts further investigation via the Internet. The search reveals a short summary and additional resources. No time to read it all now, but a click of the mouse and it is forwarded to your home computer for reading later. You can now spend time reviewing the information with the patient instead of sorting and collecting data. Discharge instructions, medical records, and referral to a hematologist are automatically arranged. The national database is also updated for future reference.

There are obvious advantages to such a system. The staff can spend time caring and talking with patients instead of shuffling paperwork. Physician support is enhanced by the availability of remote specialists in real-time that directly assist in the diagnosis. The computer also aids in the diagnosis so less time is spent scratching your head wondering what you may have missed. Patients happily receive the best care regardless of day or night. Medical records are distributed timely to all parties.

There are also some not so obvious advantages. Clinical information is captured in a database that allows real time CQI/QA. Patient tracking identifies the weak links in the system and enhances ED management. Research possibilities are limitless as all clinical data is in database format.

This is not a dream. The technologies mentioned here are all currently available. They are admittedly not well organized. This is what the Emergency Department of the Future Project hopes to bring into reality. For more information read on

Emergency Department of the Future: Introduction

The Emergency Department of the Future (EDOF) project represents our ideas and wishes for an emergency department that automates as many tasks as possible without burdening staff with mundane procedures such as data entry and patient tracking. Our goals are not lofty. While this project has been named Emergency Department of the *Future*, we do not expect a department that is not achievable with current technology assuming unlimited financial resources. We are not looking for a Star Trek type of plan, however, some of these ideas have been born from similar futuristic thinking.

Within this document is a schematic that is a loose representation of patient flow through the EDOF. It does not represent physical space, but the basic components of each area in the EDOF. In the following paragraphs are more detailed explanations and ideas that correlate with the numbers on the schematic. Please note that this plan is far from complete. The ideas presented here are a compilation of a few years of planning primarily by one group. It is now your turn to review and add ideas. We hope you will review this information and send your written ideas to the ACEP Section for Emergency Medical Informatics. You may mail your comments to ACEP at the usual address or e-mail to: informatics.section@acep.org. Also check out our web site at: <http://www.acep.org/about/index.cfm/pid/48htm>. Let your imaginations run wild. We will try to integrate any feasible ideas into the plan.

Communication and distribution of medical and demographic information through national network would be ideal. Confidentiality problems still need to be addressed and may require government regulation. But with the introduction of Internet "E-commerce" these barriers seem less problematic. We are all plagued by the ED hoppers that seek multiple evaluation for the same problem or simply go to a different ED when they do not improve. A significant amount of wasted resources could be saved by immediate availability of distributed medical information. This would also subvert drug seeking behavior from the midnight marauders. Few other systems seem as plausible (including "medical ID cards" or fax-back systems) as an Internet Medical Record System.

<1> Main & Ambulance Entrance

Security issues are of great concern.¹ ED's will continue to experience increasing violence as our society wrestles with the American love affair with weapons. A classic study done at Henry Ford Hospital² using a metal detector shows us the magnitude of the problem. In the four year study period nearly 17,000 weapons were identified! To ignore security procedures in the EDOF is to create an environment that is unsafe and unusable. An airport security model may be ideal for an EDOF and consultants in this area may be a valuable resource.

¹Goetz RR, Bloom JD, Chenell SL, Moorhead JC: Weapons Possession by Patients in a University Emergency Department. *Ann Emerg Med* January 1991;20:8-10

²Thompson BM, Nunn JC, Kramer TL: Incidence and Type of Hazardous Objects Found Among Patients and Visitors Screened by Magnetometer in an Urban Emergency Center. *Ann Emerg Med* May 1992;21:618-619.

Limited Access: As few entrances to the EDOF as possible. Preferably ALL (including hospital personnel) would enter through the Main Entrance and go through security procedures. Acts of violence are as likely to be committed by current or former employees as gang members. The only other entrance should be an ambulance entrance with similar, although modified, security procedures to permit rapid access. No other outside access should be allowed and fire doors should be alarmed to prevent unauthorized access. Hospital access should also be minimized and preferably kept to one corridor with equal security to the main entrance. If independent access is necessary, "scanning finger print" or other "biometric identification technology, if possible, for positive identification. Access patterns should be monitored for recapitulation should an incident occur. Access code numbers and card swipe security procedures are easily flawed and do not represent the desired technology of the EDOF.

Metal Detectors: These are an unfortunate reality in our society. Bullet proof glass at the registration area is more intrusive and does not stop the real problem. ALL individuals entering the department should be screened for weapons. Weapon lockers and checking procedures should be in place.

Manned Security Posts: Each entrance should be manned with 24 hour security personnel. The issue of arming security is more difficult and will need to be individualized. ED's with more than 25,000 visits and/or those in urban setting should seriously consider armed security. ACEP has recommended a police substation for ED's with more than 50,000 visits.³

³American College of Emergency Physicians: Protection from physical violence in the emergency department. *Ann Emerg Med* October 1993;22:1651.

Video Surveillance & Panic Buttons: Locations need individual attention, but consideration needs to be given for all EDOF.

<2> Triage

This area has the most potential for immediate implementation of automated procedures. Several systems have already been developed that address the special needs of the triage process.

Information Exchange: Insurance cards or "medical ID cards" have the potential for containing at least basic information about the patient. While "RAM card" technology has the potential to contain the entire medical record and demographics in a credit card size package, updating this information and reaching critical mass to make it effective is problematic. Such technology is better utilized for security procedures and to "point" to an internet site where continually updated information would always be available since the Internet has already established information exchange and security protocol standards. Electronic photo ID is also possible. Such technology would help control healthcare fraud and at the same time help with insurance "notification" nightmares. Wouldn't it be great to simply log onto a national web site, authorize access via fingerprint identification, download medical and demographic information and then upload the appropriate medical information to the insurance carrier via electronic communication?

Electronic ID Bracelet: Tagging each patient with an electronic ID badge as they enter the EDOF would allow automatic tracking by infrared or radio frequency as they make their way through the EDOF. The system would tell you where everyone is at any moment. The model is the Federal Express barcode tracking. If they can tell me where my package is among the 2 million they deliver each day, why can't I tell a family where their loved one is or if they have even been seen? Better yet the system should be able to look over your shoulder and tell you when delays at certain stages are excessive. Such systems are already being used in other industries.

Triage Information: Vitals Signs can automatically be entered into the system with integration of electronic BP, temperature, HR, RR, pulse oximetry, and weight. Chief complaint can be entered via standard template categories that assist in prioritizing patients and assigning resources and bed space. Examples: "Ankle Injury" would prompt for a triage order of an X-ray. Fevers noted by the system would prompt for acetaminophen administration and calculate the dose by weight.

This process begins the electronic chart and all the information is immediately available to the system and even outside the system for "notification" procedures with managed care plans.

<3> Waiting Room of the Future:

The EDOF reminds one of Disney World where you pay \$100 for the privilege to wait in a two hour line for a 10 minute ride. Why do million of Americans enjoy this? They are entertained every minute of the wait. Granted sickness is not conducive to entertainment/enjoyment, but we can do a better job than a blaring TV in a room with 50 people and screaming children.

Segregation of Children: Those with children should suffer together! If you have ever sat on an airplane with a 5 year old seated behind you, you know the aggravation of the noise and kicking of the seat. Should ill and injured adults be subjected to this torture in the EDOF? Somehow parents with children seem to be immune to this torture. Let them suffer together. It also allows the ED "entertainment" to be tailored to the age group.

ED "Edutainment":

Appropriate to age, it can range from toys for children to individual interactive TVs for adults. This would allow a variety of programming to be available including a vast array of medical educational programs. The Disney metaphor lends great potential in this area.

General Information: A general information video could play at regular intervals explaining the ED process. A variety of ways of presenting the same material should be done to avoid boredom. i.e. The same information would be presented by a cartoon video, then a comedian, then from "the eyes of a child", etc. I am reminded of the presentation of cartooning at MGM studios at Disney World with Robin Williams & Walter Cronkite.

Specific Information: Various videos on a variety of medical topics that could be selected from a menu.

Status Board: Either by interactive TV, large monitor, or high tech board, the status of patients could be monitored by their loved ones using an ID code. It would keep them apprised of what stage of the process the patient is in. Examples: "Waiting to be Seen by Doctor", "Waiting for Lab Work", "Please Contact the Nurse", etc.

<5> Attended Registration:

Some patients will require the personal attention of "live" registration personnel. However, this role should be expanded into obtaining the basic medical information mentioned in the "Self Registration" section.

Mobile Registration: Hand held units or computer carts would allow registration to take place at the bedside for more critically ill patients or all patients anywhere in the ED.

Pre-Registration: An effort should be made to pre-register patients. This could be done through a marketing campaign and would benefit the hospital by attracting patients already registered when the need arises for emergency care. Free offers to place medical information on "medical information cards" would encourage participation.

<4> Self Registration:

Society has accepted banking machines, voice mail routing systems, and point of sale charging systems. It is time to introduce "self registration". Level 3 & 4 (non-critical) patients & \or their families can easily be guided through self registration via prompted computer questions. The area will still require a hospital attendant to be available but the vast majority of information can be obtained through an appropriate computer interface. This interface is important and simplicity should be paramount. A touch screen or voice recognition solution would be ideal.

- The Basics Are Outlined Below -

Demographics: Access to the system could be initiated by "card swipe", "RAM card", or fingerprint identification as mentioned above. If current demographic information is present (via "RAM card" or prior registration) then only confirmation would be necessary (Is the information correct? Yes or No). Truly new patients may require assistance.

Medical Information

Much of this information is amenable to prompted acquisition and can be retained within the system for future visits. In addition, pre-registration information could include much of this and make the process simpler at the time of need. A series of Yes\No questions (either read off the screen or spoken by the computer) would be asked to build this database.

HPI (history of present illness): This would be driven from the Chief Complaint obtained at triage by the nurse. Simple questions would be asked such as when, where, how long ago, etc. This information would be supplemented by the physician later.

ROS (review of systems): One screen with fancy icons for nausea\vomiting, diarrhea, fever, chills, cough, etc. The patient would select all the appropriate icons for ROS. These would then be noted on the "History Work Sheet" for the physician to address during the face to face interview.

Medications: Alphabetical and categorical listing with icons and possibly pictures of the medication. A barcode on medication bottle labels allowing scanning would be ideal or identification by number printed on the medication.

Immunizations: Simple questions about tetanus, etc.

FH (family history) & SOC (social history): Obtained as mentioned above.

Photo ID: A digitized photo could be recorded on the "RAM card" or embossed on the ID card. Also a photo could be obtained for the medical record at the time of registration. During my residency I recall "one" patient who had 3 different blood types recorded in the medical record. Further investigation revealed the same Medicaid card had been used for at least three different individuals over a period of time. Positive ID via picture (or other biometric means such as finger print scan) is a needed addition to the medical record.

<6> Treatment Area - Non-Critical Patients:

The emphasis should be on "point of service". Patient data is entered at the bedside through computer wall units or hand held computers. As much information should be automatically entered as possible. Vital signs can be captured by the automatic blood pressure cuff, cardiac\respiratory monitor, and temperature at set intervals. Data would then be confirmed by the nurse before being logged into the system. Tracking of patients is done automatically by the system and progress through the department is recorded for CQI\QA and to improve efficiency. In addition, the system should be able to identify patients in which a particular phase of their treatment falls outside of set norms. For example, if lab turn around takes longer than 90 minutes a flag would be sent to check on the patient. Specifics are outlined below.

<6A> Discharge Planning & Education:

This should begin when the patient reaches the treatment area or even sooner. Subject matter would be driven by chief complaint. Example One: Laceration - A video could be shown outlining the laceration repair procedure and wound care for discharge planning. Example Two: Asthma - A video explaining the causes of asthma and usual treatments. Discharge instructions could also be included. Written or computer interactive responses could also be obtained and retained in the medical record to document patient understanding. Several methods for conducting this could be used including regular video, video computer interactive, or simple written true/false responses.

<6B> History Work Sheet:

This replaces the usual "face sheet" with scrawled C\C, VS, meds, etc. All of the current information in the system is either printed on the sheet in an organized manner or available on a hand held computer. Certain items can be mandatory entry before you can move on. For example: "Laceration" would require tetanus status to be entered.

Items included are C\C, HPI, ROS, Meds, Immunizations, FH, and SOC. Availability of this information will allow the physician to quickly scan the data sheet and address the specifics at the face to face interview. The work sheet could also include physical exam check off boxes & a "notes area" where written notes could be recorded in "electronic ink". This work sheet could even become the physician's medical record if all details are complete or it could simply be used as notes for later dictation.

<6C> Treatment Phase:

Treatment, medication, lab\X-ray, & patient education orders are entered via the bedside terminal or hand held computer. These orders are tracked by the system for expected completion time and prompting for re-evaluation. Treatment protocols are available based on chief complaint to speed order entry. Artificial intelligence systems can even be integrated to suggest differential working diagnosis and treatment strategies. Continuous monitoring by the systems takes place during the entire treatment phase.

<6D> Computer Hardware:

A variety of hardware and interface types are needed to meet the varied needs of all ED personnel. Desk top terminals currently used in most ED's will still be needed, but the majority of work will take place "point of service" at the bedside (wall mounted touch screen) or mobile (hand held pen or touch screen). Mobile units can be connected to the system by a "wireless local area network" and should have docking bays to allow for recharging. Size of these units will vary from the small PDA (personal digital assistant) to tablet size (8½ by 11 inches). Desk top terminals can also be redesigned to be more ergonomic by mounting them inside the desk or panel similar to the wall mounted units.

<6E> Re-Evaluation:

Ongoing vital signs are logged automatically with parameters to warn of abnormal or inaccurate findings. Confirmation should be required before this information is permanently recorded into the system. Re-checks can be noted with a simple touch of the screen and prompting for re-evaluation and lab review is automatic.

<6F> Medical Decision Making:

(a.k.a. Computer Assisted Thinking)

Check lists prompt you with a differential diagnosis based on all the clinical information in the system and might also suggest lab tests or treatment protocols. Systems such as "Chart Checker" can review your transcribed record for adequate documentation. This one area has a vast amount of potential and may require more sophistication than the whole EDOF project combined.

<6G> Discharge:

Many discharge products already exists, but few are integrated and none can produce publication quality output. As mentioned above, video will play a major role in discharge planning. However, the ability to produce publication quality, patient specific, and multilingual printed instructions are a necessity. Information on the diagnosis, medication prescribed, and follow up information is imperative. The system could also provide map instructions on how to get to a particular doctor's office or local pharmacy. With the prevalence of managed care, information on the patient's health plan and pharmacy formulary will also be useful. Prescription writing should be integrated and trigger the appropriate discharge medication information. Allergy checking and routine diagnosis driven prescribing options should be available.

<6H> Data Transfer:

Once all of the information has been collected it should serve more than a legal record. It can obviously be retained in a printed or electronic format for the hospital, but automatic distribution to the referred physician by fax\modem\Internet, to the health plan, and coding\billing company is also important. Data could also be transferred to a national data bank to allow access by other hospitals, physicians, etc.

<7> Treatment Area - Critical Patients:

Many of the same principles apply to this area as in the non-critical area. The difference being most of the activities (registration, history data base, etc.) will take place at the bedside and will require personal attention by the staff. Also, critical patients often do not fit well into a structured system and therefore allowances will need to be made for this specialized care.

<7A> History Base:

See <6B>

<7B> Treatment Protocols:

Critically ill patients often fall into general categories and therefore treatment protocols can be used to save time and be more efficient. Many hospitals currently use similar protocols at level one trauma and chest pain centers.

<7C> Level One Patients:

Many trauma centers already use video to critique their trauma resuscitations. Beyond this, video could also be used to simply record the events for delayed charting. Medication administration could be recorded on-line with time stamp, but other details could be reviewed later by video. How often have you lost track of the number of times you defibrillated a patient during a cardiac resuscitation?

<7D> Smart Beds:

Why do we place a patient on mobile bed and then hook them to the wall? When they need to be moved we hook them to a portable monitor and then back to the wall. Beds should be designed with monitor wiring and power supply built-in. Portable units could then be attached when monitoring is necessary and an RF\telemetry device used to transmit data to a central monitoring system. Hydraulics should be designed to allow quick and easy adjustment.

<9> Emergency Department Lab:

80% of the labs done in the ED are those listed. New technologies are emerging that will finally make a satellite ED lab possible. The ISTAT is an example. It provides the same information as an BMP and H&H (Na⁺, K⁺, Cl⁻, CO₂, BUN, Glu, HGB, HCT) in a 2 minute test for a cost of about \$7.50. The unit interfaces directly with the hospital main frame computer recording the results automatically. Reliability test at Good Samaritan Hospital in Phoenix, Arizona (beta test site) have shown it to be as accurate (excluding CO₂ and pH) and more consistent than the BMP instrument in the main lab. Arterial blood gas modules are also available with the same and other similar instruments. This technology also has the potential to provide a number of drug levels (i.e. theophylline). Monoclonal antibody technology has provided a rapid and reliable drugs of abuse urine screen and pregnancy tests. Reduced lab turn around time equals increased efficiency.

<8> Computer System:

Affordable computer systems are already available that are capable of handling the EDOF. The missing technology is the software innovation and integration.

Central File Server:

A graphical object-oriented operating system is a must and several operating systems are vying for supremacy. Any system must provide the highest level of security and fault tolerance. There can be no down time. Large amounts of data must be available on-line and may require use of multiple CD-ROM/DVD technology. The most difficult part is often interfacing with current hospital information systems that have lagged far behind other industries. The EDOF would fit best in a hospital that has a vision of the "Hospital of the Future".

Bedside Wall Units:

Touch screen wall units are readily available and have been used in other industries for years. The advantage in health care is that they eliminate the keyboard (a deterrent to use) and are less of a dirt collector. Bedside computing is not as practical with a keyboard system. Each patient room needs a unit dedicated to that patient. The main screen shows the patient status and tracks movement through the department. Each terminal should also have the capability to monitor all other patients and the main system screen.

Hand Held PDA (personal digital assistant):

This technology has finally come of age with the introduction of Windows CE and the PalmPilot. Lightweight and connected via RF local area wireless networks, these portable computers allow you to compute where you work. They are best suited to check off boxes, but can also be adapted to written "electronic ink", handwriting recognition, and voice recording/recognition. Battery life is improving, but docking stations will be required for recharging.

Hand Held Tablet:

Registration may find a larger portable tablet computer or mobile laptop computer workstations more useful for entering larger amounts of data. These would have the same functional purpose as the PDA but a larger interface.

Desk Mounted Units:

These could be the same wall mounted touch screen units inserted into a desk top or desk panel. Others may require a key board for special purposes.

<10> Patient Rooms:

This box summarizes the additional items needed in the EDOF for patient's rooms.

Credits

Ideas presented in this document are credited to:
*The ACEP Section for Emergency Medical Informatics
 Emergency Department of the Future Committee*

This document was written and produced by:
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Special Section: The Internet & The EDOF

The Internet

The Internet (a.k.a. the Information Superhighway) is transforming our lives at home and work. It is now becoming clear that the Internet will be the solution to many of our personal and professional information problems. Why? Because it simply works and, for the most part, it is FREE. It has the potential to have a greater effect on society than the invention of the telephone, the automobile, and the airplane. The telephone allowed us to speak without going and the automobile/airplane allowed us to go when necessary. The Internet eliminates the need to speak and to go! It also allows us to collate disparate information from multiple sources to a single location without human interaction. Businesses (including medical businesses such as information systems vendors, hospitals, and physician groups) that are not embracing the Internet will have difficulty surviving in the "Internet Age". Much of what we will do in the future will be dependent on this technology and that has never been more true than in the medical arena.

What is the Internet?

The Internet is like a telephone system optimized for computer-to-computer interaction rather than for voice communications. Originally designed for the military, the National Science Foundation transformed it into a way for scientists to access the few supercomputers that existed in the 1970's. With the advent of the personal computer, the Internet evolved into a tool for everyday use. Quite simply it is a way to access the vast array of digital information available throughout the world. While this information remains relatively disorganized, software called Internet browsers (eg. Netscape's Navigator and Microsoft's Explorer) make sense of this formally archaic system. They make connecting and getting around the Internet easy and fun.

Getting Connected

Anyone with a modem capable personal computer (PC compatible or a Macintosh) and a Internet Service Provider (ISP) can connect to the Internet. The ISP is your gateway or "on-ramp" to the Internet. They sell access to subscribers for a flat monthly fee or time based rate. There are hundreds of commercial ISP's (CompuServe, America-On-Line, Prodigy, Juno, PSInet, MSN) and a number of other sources of connections that may be cheaper or even free.

What Can the Internet Do?

The possibilities of the Internet are expanding every day. It has become much more than a place to look for information. It is quickly becoming a mechanism for commerce (i.e. shopping, stock trading, product information, advertising etc.); personal communication through electronic mail services; video conferencing; and data exchange (i.e. transferring a computer file from one place to another). Traditional forms of Internet communication such as "newsgroups" or "chat" (an Internet location for groups of people with similar interests to interact) remain prominent and are probably the best source of medical information. In a newsgroup, you can post a question and receive answers from others with an interest in that topic or browse other consolidated information on a particular topic. There are more than 11,000 different newsgroups with more being added every day.

E-mail "list servers" allow communication with large numbers of people with the click of a mouse. You can also subscribe to "clipping service" that will seek out information that you want and deliver it at your convenience. Truly "information at your fingertips"

The World Wide Web (WWW)

The World Wide Web is the information age come to life. Although computers have been around for more than 50 years with vast quantities of information, until now there has been no easy way for the individual to access the information. This has radically changed with the WWW. The WWW uses "hypertext" to allow graphics, sounds, and even video to be sent and displayed over regular phone lines to your computer. Hypertext is a computer language that allows cross-linking of related information. Key words are highlighted and by clicking with a mouse you are immediately sent to the information related to that word within the same document or to another computer around the world. For example, if you are reading a description about fractures, there may be a hot link that will display the corresponding x-ray. The beauty of the WWW is that this is all transparent and you can move back and forth with ease.

The Future for Internet Medical Computing

There are thousands of medical sites on the WWW although much of it is still poorly organized. That will certainly change in the near future and will alter the way we think about continuing medical education (CME), medical resource material, consultation, medical periodicals, and every other aspect of our practice.

CME: Instead of paying thousands of dollars to attend a medical conference, you will be able to enjoy it from the comfort of you own home and still be able to interact with the speaker by asking questions over the Internet. In fact, you may get more out of the experience since your question is more likely to be answered albeit perhaps after the fact. In addition, you will no longer have to choose between one session or another as all sessions will be available to you on-line and eliminate the need to listen to audio tapes.

Telemedicine ("Internet Medicine"): The internet may be the thing that make telemedicine affordable for the masses. Teleconferencing is already a reality and a short step to telemedicine. HCFA is also addressing how physicians might get paid for this unique service.

Data Retrieval and Exchange: This is the Internet's real strength – a standard for information exchange. Disparate information can be collated and delivered in a consistent format. Examples include: Patient Records/Demographics, Business Management Information, and Professional Communication via E-mail. Software vendors such as Microsoft are making their products HTML (internet language) compatible. Physician scheduling programs should be made "web-enabled" to allow work schedules to be on your group's web site.

The Internet is limited only by your time and imagination.

➤ Listed below are a few interesting web sites you may want to try ◀

National Center for Emergency Medical Informatics: <http://www.ncemi.org/>

EmedHome: www.EMedHome.com

Radiology Department at the University of Washington
<http://www.rad.washington.edu/AnatomyModuleList.html>

The Virtual Hospital at the University of Iowa
<http://indy.radiology.uiowa.edu/VirtualHospital.html>

"Dermatology On-Line Atlas"
<http://www.rrze.uni-erlangen.de/docs/FAU/fakultaet/med/kli/derma/bilddb/db.htm>

"Normal & Abnormal Heart Sounds" collection at the University of Alberta
<http://synapse.uah.ualberta.ca/synapse/00b10000.htm>

The "Virtual Medical Center" at the University of California-Irvine
<http://www-sci.lib.uci.edu/~martindale/Medical.html>

American College of Emergency Physicians: <http://www.acep.org>

Society for Academic Emergency Medicine: <http://www.saem.org>

2000 Section Report: Emergency Department of the Future

It seems like only yesterday that the ACEP Computer Section was born, but it has almost been 10 years. The Section has completed and continues to revise several publications related to computer technology. These are available by request.

- ◆ A View of the Emergency Department of the Future
- ◆ Preparing for the Emergency Department of the Future: *Strategic Information Systems Planning for Emergency Medicine*
- ◆ Directory of Software for Emergency Medicine
- ◆ Emergency Department Management Systems - Model Request for Proposal (RFP) & Vendor Information List

The Computer Section's objective of enhancing computerized technology in emergency medicine continues gain momentum. The ACEP appointed a "Technology Committee" that produced a report on current technology and how ACEP might best use it (available for ACEP). The ACEP Web Site continues to grow and take on new roles within the College.

Our dream of an EDOF exhibit was realized at the 1996 Scientific Assembly in New Orleans, but the work continues. The EDOF lecture series outlining the Emergency Department of the Future continues to be presented world-wide including Spain and Israel in the last several months. The Section will continue to define our vision of the Emergency Department of the Future by utilizing computerized technologies to improve our delivery of emergency care. The revised description provided in this issue is just a place to start. Feel free to contact us with your ideas of how our vision can be improved.

Emergency Medical Informatics is the newsletter of the Section of Emergency Medical Informatics of the American College of Emergency Physicians. Opinions expressed do not necessarily reflect the College's point of view.

Editorial Policies

Typed submissions or ASCII text on DOS format disk.
Submitted material may be edited.
Similar submissions are at the discretion of the editor.
Deadline for submissions is 30 days prior to publication.

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EDOF Goes International

Excitement about the Emergency Department of the Future continues to grow. In 1999 it went international and was presented at the 2nd International EPES Forum in Magala, Spain on October 28, 1999. It was also presented in March at the 7th Annual Scientific Assembly of the Israeli Association for Emergency Medicine along with several other informatics topics.



Todd B. Taylor, MD, FACEP presents the EDOF at the 2nd International EPES Forum in Magala, Spain.

Suggested Reading & References:

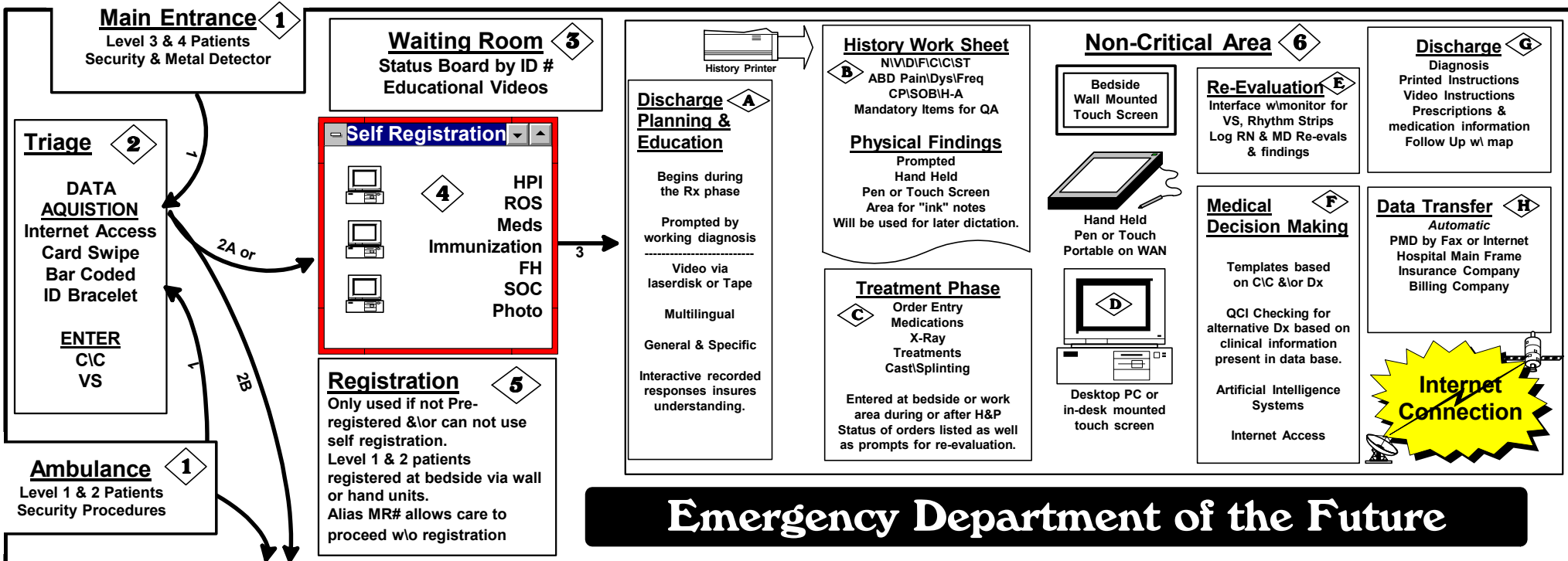
- 1) Preparing for the Emergency Department of the Future: Strategic Information Systems Planning for Emergency Medicine, ACEP Publication.
- 2) Directory of Software for Emergency Medicine, ACEP Publication
- 3) ACEP Section for Computers in Emergency Medicine Newsletter and Software Reviews, ACEP Publication
- 4) Personal Medical Computing by William Cordell, MD, FACEP
- 5) Topics in Emergency Medicine, "Emergency Department Informatics: An Overview (Dec 95) & Management Systems (Mar 96)" editors: Todd Taylor, MD, FACEP; Vickey Bradley, MS, RN, CEN; Karen Sue Hoyt, MN, RN, CEN.
- 6) Emergency Medicine: The Core Curriculum: Automation & Informatics by Todd Taylor, pp. 1317-24, ed. Richard Aghababian, pub. by Lippincott-Raven 1998
- 7) Smith MS, Feied CF: The Next-Generation Emergency Department. *Ann Emerg Med* 1998;32:65-77

The Emergency Department of the Future (EDOF) Video

May be purchased from Visual Eyes for \$25.00 (includes shipping). The EDOF video was produced with a grant from the Health Information Network and cosponsored by the Defense Advanced Research Projects Agency and by the American College of Emergency Physicians. Make your check payable to: "Visual Eyes - EDOF" for \$25.00 (credit cards NOT accepted). Don't forget to include a ship to name and address.

International: PAL version available upon request. Shipping extra. Call or e-mail for pricing

Visual Eyes - 31320 Via Collinas #118 - Westlake Village, CA, USA 91362
Contact Charla: charla@visualeyes.com Studio: 818-707-9922 Fax: 818-707-2393



Emergency Department of the Future

See Non-Critical Area
Many of the same principles apply to this area depending on the complexity & critical nature of the patients.

History Base **A**
Obtained at bedside by RN or Tech. & confirm any pre-registration information already in system.

Treatment Protocols
Battery of tests & procedures driven by CIC & working diagnosis.
Example: Cardiac Chest Pain Oxygen, Cardiac Monitor, IV, Draw bloods, BP monitor, VS q15' until evaluation, EKG.

Level One **C**
Available use of video/visual record with time stamp to be used later to record written record of events.

Critical Care Area **7**

Smart Beds **D**
Self contained carts with state of the art hydraulics allowing you to set various positions with auto adjust. i.e. Trendelenburg.
All monitoring circuits built in such that BP, cardiac monitor, temp, respiratory monitor, pulse oximeter contained within the bed. Data is transferred via RF to central & bedside mounted monitors.
No matter where the patient goes in the ED they are monitored and locations are noted with time stamp.

| Room | Patient Name | PMD | CIC | LAB |
|------|-----------------|-----|-----|-----|
| A | Polly Uria | | | |
| B | Abby Normal | | | |
| C | Freddy Krugger | | | |
| D | Fred Flintstone | | | |
| E | Barney Rubble | | | |
| F | Tim Allen | | | |
| G | Judy Jetson | | | |
| H | George Jetson | | | |
| I | Mr. Spacley | | | |
| J | Ed Barthell | | | |
| K | Jack Brown | | | |
| L | OPEN | | | |
| M | OPEN | | | |
| N | OPEN | | | |
| O | OPEN | | | |
| P | OPEN | | | |
| Q | OPEN | | | |

Schematic & Text by Todd B. Taylor, MD, FACEP
Produced with VISIO 2.0 by Shapeware Corporation

Computer System **8**

Central File Server:
Graphical Operating System (i.e. Windows NT)
High Level of Security (RAID & User)
Interface with current hospital systems

Bedside Wall Units: (each room)
Touch Screen
Shows patient status and VS asking for confirmation and set intervals.
Automatically track patient movement through ED via IR or RF ID badge..

Hand Held PDA:
Pen or touch screen
WAN connectivity
Primarily used with check off lists

Hand Held Tablet:
As above, but used when more information needed to be viewed on screen at once

Desk Mounted Units:
May have keyboards for lengthy input.
Still have touch screen for routine use.

ED Lab **9**

Available Items: (May need lab tech)
ABG
BMP
CBC
Urine Drugs of Abuse
Serum Pregnancy Test (Quantitative)
Certain Drug Levels

Patient Rooms **10**

Available Items:
Monitor w/ Interactive Video Interface
Video for documentation
Computer Wall Unit
Smart Bed w/ monitoring equipment
Bedside ultrasound

Pennsylvania ACEP Emergency Department Information System Requirements - Vendor Score Sheet

S= Standard & in live use at 2 Clients
B= Beta Testing with at least ONE client
C= Customized

P= Planned rollout in less than
F= Future > 12 months
NA= Not Available

| EMERGENCY DEPARTMENT INFORMATION SYSTEM VENDOR | #1 | #2 | #3 | #4 | #5 |
|---|----|----|----|----|----|
| Registration | | | | | |
| Is there a quick registration? | | | | | |
| Is there an anonymous registration? | | | | | |
| Are you able to merge a quick / anonymous registration with a final/full registration? | | | | | |
| Triage - Documentation | | | | | |
| Does the Triage module document the acuity/treatment priority? | | | | | |
| How are nursing assessment and charting entered in the module? | | | | | |
| Does the software use the triage information to assist with patient flow & practitioner workload? | | | | | |
| Patient Status (Status Board) Patient Tracking | | | | | |
| Ability to track patients by location? | | | | | |
| Ability to track patient-physician relationships? | | | | | |
| Can the system show where the patient is? | | | | | |
| Can the system show what the patient is waiting for? | | | | | |
| Does the system automatically track wait times (for room assignment, diagnostic test) and flag the staff when limits are reached? | | | | | |
| Does system use patient tracking information to deliver alerts & time warnings to assist in patient flow & movement? | | | | | |
| Order Entry | | | | | |
| Does the system have physician order entry? | | | | | |
| Does the system have order sets? | | | | | |
| Can the order sets be customized by individual care giver? | | | | | |
| Handle free text orders (i.e., strange verbal orders from MD's). | | | | | |
| Automatically trigger orders from clinical path in the appropriate path day/date and time. | | | | | |
| Notify or page physician based on documentation that addresses specific standards &/or patient-specific call orders. | | | | | |

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| EMERGENCY DEPARTMENT INFORMATION SYSTEM VENDOR | #1 | #2 | #3 | #4 | #5 |
|--|----|----|----|----|----|
| Correspondence | | | | | |
| Document communication between hospital, individuals and external organizations. | | | | | |
| Use internet technology to share information (e.g., pulling in a little used procedure from P&P book into the path of the particular patient). | | | | | |
| Supports Advanced directives across continuum | | | | | |
| Flag patients with special needs | | | | | |
| Order entry and documentation supports academic environments (i.e. unverified orders or documentation of medical staff or nursing students) | | | | | |
| Use alias' or hide patient's identity. | | | | | |
| Alerts for practice standards | | | | | |
| Send HL/7 formatted information (send/receive ADT, orders and results, documentation) to other systems. | | | | | |
| Medications are passed from inpatient to outpatient system | | | | | |
| Critical Pathways | | | | | |
| Critical Pathways is incorporated into system-user can design and/or modify | | | | | |
| Ability to document against the pathway | | | | | |
| Medication Administration | | | | | |
| Chart medications, including IV's on-line | | | | | |
| Calculate medication doses | | | | | |
| Flag abnormal or critical information, such as lab values | | | | | |
| Alert nursing staff of medications that are due or not charted | | | | | |
| Print appropriate order requisitions in all departments, when/if needed | | | | | |
| Generate work lists by caregiver, by station, by shift | | | | | |
| Produce on-line Medication/IV Administration Guides | | | | | |
| On-line access to patient education databases | | | | | |
| Document patient education | | | | | |
| Print medication information, discharge instructions, etc. | | | | | |
| Display and print an individual patient census by physician | | | | | |
| Display and print patient demographic data | | | | | |
| Documentation of observations/assessments/ treatments | | | | | |
| Nursing Quality Assurance | | | | | |

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| EMERGENCY DEPARTMENT INFORMATION SYSTEM VENDOR | #1 | #2 | #3 | #4 | #5 |
|--|----|----|----|----|----|
| Equipment Interfaces | | | | | |
| Critical Care monitoring devices | | | | | |
| Ventilators | | | | | |
| IV rate control device | | | | | |
| Pulse oximeters | | | | | |
| Fetal monitors | | | | | |
| Provides access to national clinical databases such as the Medline database | | | | | |
| Grateful Med | | | | | |
| on-line drug information | | | | | |
| Micromedix | | | | | |
| CDC, NCHS, etc. | | | | | |
| Automatically generates notification of attending, consulting and interpreting physicians of admit/discharge dates and final diagnosis | | | | | |
| DATA ISSUES | | | | | |
| What vocabulary standards are used for drugs, problems, labs, etc.? | | | | | |
| Order Communications | | | | | |
| Does the system also do order communication to other systems and other departments? | | | | | |
| Produce laboratory specimen transmittals for nurse collected specimens | | | | | |
| What on-line alerts are provided in the system for the following interactions? | | | | | |
| Does your system check dose ranges (based on weight, body surface area, renal and liver function) | | | | | |
| How could orders which are considered inappropriate according to hospital-defined protocols be identified? | | | | | |
| Results Reporting | | | | | |
| Displays results and vital signs in graphical format (trends over time) as well as numeric and textual formats. | | | | | |
| System stores impressions and full text results. | | | | | |
| System highlights critical/panic values and abnormal results. | | | | | |
| How does the system provide the capability for results to be incorporated into letters to referring physicians? | | | | | |
| How does the system provide electronic signature capability for approving results, discharge summaries, etc.? | | | | | |
| Does the system handle charting of in-dept lab work (i-Stat, Pregnancy, UA)? | | | | | |

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| EMERGENCY DEPARTMENT INFORMATION SYSTEM VENDOR | #1 | #2 | #3 | #4 | #5 |
|---|----|----|----|----|----|
| Physician Charting | | | | | |
| Is there a physician charting section? | | | | | |
| Does the system import dictation results? | | | | | |
| Are there user-defined risk management protocols by chief complaint? | | | | | |
| Can a copy of the ED chart be transmitted (fax, modem, etc.) to the patient's physician? | | | | | |
| Pre-Hospital Assessment | | | | | |
| Interfaces exist for pre-hospital assessment tool? | | | | | |
| Is there a method for documentation of pre-hospital severity classification? | | | | | |
| Nurse Charting | | | | | |
| What is the method of documenting nursing assessment? | | | | | |
| What standard flow sheet exist? (trauma, cardiac, minor trauma etc.) | | | | | |
| Are standardized Nursing Data Classification supported? (Nursing Diagnosis, Nursing Intervention Classification System, Nursing Outcomes Classification) | | | | | |
| Does interface exist for automated medication dispensing equipment? | | | | | |
| Can information be viewed by nurses in other departments such as CCU? | | | | | |
| How are supplies documented and orders made for restocking? | | | | | |
| Discharge Instructions | | | | | |
| How are referral instructions given? | | | | | |
| Are 2 copies automatically generated (one for patient, one for chart which is signed) | | | | | |
| Can prescriptions be written and printed? | | | | | |
| Does the work/school release accompany the release instructions? | | | | | |
| Does discharge instructions interface with ADT system for physician name, address, etc. | | | | | |
| Can the system coordinate follow-up visits within the hospital? MD offices? | | | | | |
| Discharge instructions with multiple languages? | | | | | |
| Charge Capture | | | | | |
| Can a charge be automatically generated from the clinical data? | | | | | |
| Does the charge correlate with documentation? Does it comply with RBRVS standards (Resource Based Relative Value Scale) or identify associated ICD-9-CM to avoid abstracting efforts? | | | | | |
| Real time interface with which physician billing systems? | | | | | |

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| EMERGENCY DEPARTMENT INFORMATION SYSTEM VENDOR | #1 | #2 | #3 | #4 | #5 |
|--|----|----|----|----|----|
| Quality Assurance | | | | | |
| Is there a quality assurance component? | | | | | |
| Can the ED visit be linked and brought forward to an inpatient visit? | | | | | |
| What quality control indicators can be entered into your system? | | | | | |
| Describe how your system processes sentinel events to trigger further review. | | | | | |
| Risk Management | | | | | |
| Describe how the system supports flagging patient who are potentially a high risk for lawsuits. Can the user be prompted when that patient presents again? | | | | | |
| Integration Issues | | | | | |
| Integrated with Multi-disciplinary, enterprise-wide networked CIS? | | | | | |
| Non-proprietary operating system? | | | | | |
| Standards compliant (POSIX, HL7, P1073)? | | | | | |
| Links to interface engine? | | | | | |
| Links to clinic, office, home (up/downloading) | | | | | |
| Links to remote databases (WAN, Internet) | | | | | |
| No downtime (redundancy, mirroring, instant rerouting) | | | | | |
| Standby off-site disaster recovery | | | | | |
| Sub-second response time (1-2 seconds maximum) | | | | | |
| Multi-media clinical workstation (GUI, easy to use) | | | | | |
| E-mail messaging (non-urgent notes, follow-up, referrals, suggestions) | | | | | |
| Mouse, trackball, handheld devices, scanners, penputing | | | | | |
| voice recognition | | | | | |
| automated data input from invasive and non-invasive hemodynamic monitors | | | | | |
| Is there security to prevent unauthorized 'browsing' of patient information? | | | | | |
| How can hospital use your IS to track physician profiles, but restrict MD access to any economic credentialing and/or other physician revenue? | | | | | |
| Physician Billing | | | | | |
| Is there the capability to interface to third party physician billing systems. | | | | | |
| Ability to print clinical information in offices and ambulatory clinics | | | | | |
| Allows physicians to communicate electronically (mail message). | | | | | |

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| EMERGENCY DEPARTMENT INFORMATION SYSTEM VENDOR | #1 | #2 | #3 | #4 | #5 |
|---|----|----|----|----|----|
| ED Report Writing | | | | | |
| Can reports be generated from the system? | | | | | |
| Death reports? | | | | | |
| Trauma registry? AMA log? Admission log? | | | | | |
| Return visits? | | | | | |
| Reportable diseases? | | | | | |
| Work flow analysis? | | | | | |
| JCAHO reporting for the department? Service indicators? | | | | | |
| Continuous quality improvement data collection? | | | | | |
| Medication history for patients | | | | | |
| Does it provide generic vs. brand name medication cost-comparison alerts? | | | | | |
| What tools are provided to satisfy COBRA regulations with respect to patient teaching and counseling? Can these be modified by the users? | | | | | |
| In which languages do you provide patient education? | | | | | |
| Are there drug/disease alerts? | | | | | |
| Reference Material | | | | | |
| How is reference material accessed? | | | | | |
| GRAND TOTAL for Emergency Dept. | | | | | |