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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, O_2, etc.).

Back in the treatment area, the elderly man with respiratory distress is placed on an oxygen mask that senses end expiratory CO_2 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 CO_2 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 &\or 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 Hospital [2] 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.

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

[2] Thompson 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]

[3] American 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 exits, 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^-, CO_2, 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 CO_2 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:
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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 a "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 long 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 publication 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 continue 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 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.

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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

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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

Main Entrance 1
Level 3 & 4 Patients
Security & Metal Detector

Ambulance 1
Level 1 & 2 Patients
Security Procedures

Triage 2
DATA AQUISTION
Internet Access
Card Swipe
Bar Coded
ID Bracelet

ENTER
C\C
VS

1
2A or
2B
1

Waiting Room 3
Status Board by ID #
Educational Videos

Self Registration 4
HPI
ROS
Meds
Immunization
FH
SOC
Photo

3

Registration 5
Only used if not Pre-registered &\or can not use self registration.
Level 1 & 2 patients registered at bedside via wall or hand units.
Alias MR# allows care to proceed w\o registration

Non-Critical Area 6

History Printer

Discharge Planning & Education (A)
Begins during the Rx phase

Prompted by working diagnosis

Video via laserdisk or Tape

Multilingual

General & Specific

Interactive recorded responses insures understanding.

History Work Sheet (B)
N\V\D\F\C\C\ST
ABD Pain\Dys\Freq
CP\SOB\H-A
Mandatory Items for QA

Physical Findings
Prompted
Hand Held
Pen or Touch Screen
Area for "ink" notes
Will be used for later dictation.

Treatment Phase (C)
Order Entry
Medications
X-Ray
Treatments
Cast\Splinting

Entered at bedside or work area during or after H&P
Status of orders listed as well as prompts for re-evaluation.

Bedside Wall Mounted Touch Screen

Hand Held
Pen or Touch
Portable on WAN

(D)
Desktop PC or in-desk mounted touch screen

Re-Evaluation (E)
Interface w\monitor for VS, Rhythm Strips
Log RN & MD Re-evals & findings

Medical Decision Making (F)
Templates based on C\C &\or Dx

QCI Checking for alternative Dx based on clinical information present in data base.

Artificial Intelligence Systems

Internet Access

Discharge (G)
Diagnosis
Printed Instructions
Video Instructions
Prescriptions & medication information
Follow Up w\ map

Data Transfer (H)
Automatic
PMD by Fax or Internet
Hospital Main Frame
Insurance Company
Billing Company

Internet Connection

Critical Care Area 7

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 (B)
Battery of tests & procedures driven by C\C & 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.

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	C\C	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