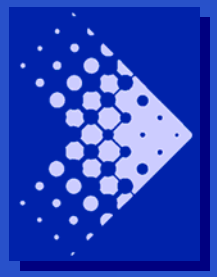


Cybermedicine

Warner V. Slack, M.D.

Center for Clinical Computing,
Harvard Medical School, and
Beth Israel Deaconess Medical Center

Cybermedicine and the Issue of Privacy

- In our effort to preserve privacy by protecting confidentiality, we assume that there is information worth protecting, which is not always the case with medical computing.

Cybermedicine and the Issue of Privacy

- There is a direct relationship between the usefulness of a medical record and the potential for unwarranted disclosure.

Cybermedicine and the Issue of Privacy

- Thus, too little protection will compromise a person's privacy as a patient, but too much will compromise the quality of care.

Seven Principles of Cybermedicine

- Information should be captured directly at computer terminals located at the point of each transaction, not on pieces of paper.

Seven Principles of Cybermedicine

- Information captured at a terminal or automated device anywhere in the hospital or clinic should be available immediately, if needed, at any other terminal.

Seven Principles of Cybermedicine

- The response time of the computer should be rapid.

Seven Principles of Cybermedicine

- The computer should be reliable and accurate.

Seven Principles of Cybermedicine

- The computer programs should be friendly to the user and reinforce the user's behavior.

Seven Principles of Cybermedicine

- There should be a common registry for all patients.

Seven Principles of Cybermedicine

- Privacy should be protected.

Cybermedicine

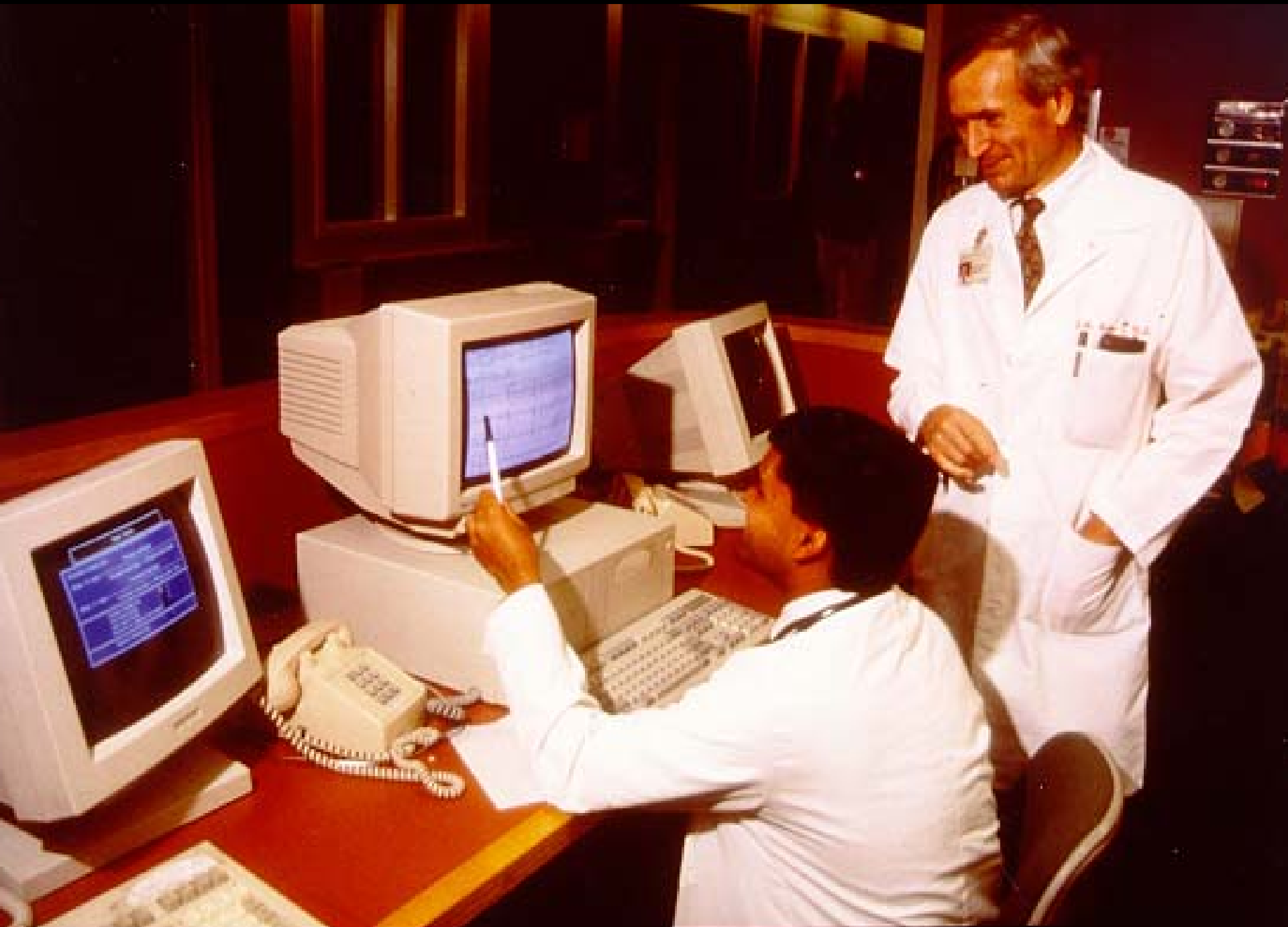
- Registration
- Laboratories
- Clinical Departments
- Finance
- Clinical use

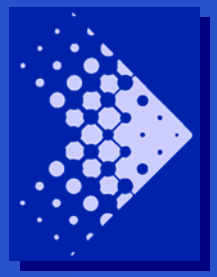
Clinical Use

- Provides clinical information upon reques
- Gives support with decisions
- Assists with communication
- Assists with clinical practice
- Assists with education

Clinical Use

- Provides clinical information upon request

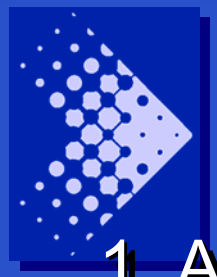




Patient ID: Poxtun, Monnotte

9999999 Paxton,Minnette 04/21/03 F 97 111-11-1111
(Access Restricted)
Arthur Marguetite Richard M Townsend

OK? Y //



00000000 Doe, John 3/21/70 31M

1. All Labs
2. Blood Bank
3. Blood Gas
4. Cardiology
5. Chemistry
6. Cytogenics
7. Cytology
8. Demographics
9. Electrocardiograms
10. Hematology
11. Result Over Time
12. Microbiology
13. Neurophysiology
14. Online Medical Record
15. Outside/Lexington Lab
16. **Pharmacy**
17. Pulmonary Function
18. Radiology
19. Clinical Pathology
20. Urinalysis

00000 Admitted: 03/13 Room: 12R-1275
d
Current Medications

dication	Dose	Route	Schedule	Start (-End)
---------- IV's and injectibles ----------				
azolin	2 GM	IV PIGGY	QBH	08/16
---------- PO and Non-injectibles ----------				
clovir	200 MG	PO CAP	SX/D	08/13
trimazole	10 MG	PO TAB TC	QID	08/13
assium Chloride	40 MEQ	PO TAB	QD	08/19
---------- PRN, Let-call, and Single dose----------				
taminophen	650 MG	PO TAB	FS Q4H"24HR	08/13
acodyl	10 ML	PR SUPP	FS PRN	08/18
tzer's Solution	100 ML	IRR IRR	LC	08/13
tatin	6000 UNITS	PO SUSP	LC PRN QID	08/13
chorperazine	10 MG	PO TAB	PRN Q6H	08/13

Clinical Use

- Gives support with decisions

Clinical Use

- Gives support with decisions
  - Advice and consultation

Clinical Use

- Gives support with decisions
  - Advice and consultation

    Acid-Base Evaluation

ELECTROLYTE AND ACID-BASE EVALUATION:

Saturday March 17, 2001 2:37 pm

To enter your own values, enter "_" (underscore)

Patient ID:

Clinical Use

- Gives support with decisions
  - Advice and consultation
    - Acid-Base Evaluation
    - Drug Information

Drug Information

- Hospital Formulary Information
- Infectious Disease - Therapy and Guidelines
- Medications - Descriptions, Interactions, Costs
- Physician Desk Reference - PDR

For Prozac

1. Description
2. Clinical Pharmacology
3. Indications and Usage
4. Contraindications
5. Warnings
6. Precautions
7. Drug Interactions
8. Adverse Reactions
9. Drug Abuse
10. Overdosage
11. Dosage
12. How Supplied

Clinical Use

- Gives support with decisions
  - Advice and consultation
    - Acid-Base Evaluation
    - Drug Information
    - Clinical Formulas

Clinical Formulas

1. Alveolar-Arterial Oxygen Difference
2. Free Water Deficit or Sodium Deficit
3. Calcium Correction for Hypoalbuminemia
4. Creatinine Clearance
5. Fractional Excretion of Sodium
6. QT Interval Correction
7. Body surface Area and Body Mass Index
8. Hemodynamics
9. Bayes' Theorem

Free Water Deficit or Sodium Deficit

Free H20 Deficit = TBW -TBW x (Desired Na/Measured Na)
NA Deficit = TBW x (Desired NA - Measured Na)
TBW = WGT X [0.6 (Male) or 0.5 (Female)]

Weight =		lbs or	57 kg
Male or Female?			Female
Current Serum Na	=		160 mEq/L
Desired Na	=		140 mEq/L

Free H20 Deficit = 3.6 Liters

Notes:
1) Correct about half of total deficit in first 24 hours
2) Correction rate should be 0.5 mEq/L/hr (12 mEq/day)
3) Recompile deficit frequently
4) Add insensible fluid losses to computed values

Look at References? N

Clinical Use

- Gives support with decisions
  - Advice and consultation

Acid-Base Evaluation

Drug Information

Clinical Formulas

HIV ProtoCall

Welcome to ***HIV ProtoCall***

An information guide to research drugs for human immunodeficienvy virus infection and associated opportunistic infections.

Press <Enter>

Clinical Use

- Gives support with decisions
  - Advice and consultation
    - **Acid-Base Evaluation**
    - **Drug Information**
    - **Clinical Formulas**
    - **HIV ProtoCall**
    - **Withdrawal of therapy**

Withdrawal of Therapy

Life-Sustaining Treatment Guidelines

1. Overview
2. Definitions
3. Treatment Options
4. Documentation

Please choose and option:

Withdrawal of Therapy

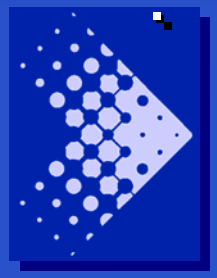
Overview

1. Policy Statement
2. DNR vs. CPR not Indicated
3. Withholding/Withdrawing Other Treatment
4. Support and Counseling

Choose option(s), or ‘A’ for All:

Clinical Use

- Gives support with decisions
  - Advice and consultation
  - Bibliographic retrieval (PaperChase)



PaperChase

(MEDLINE now has over nine million references to articles from ove
forty-three hundred journals)

LOOK FOR:

For HELP, type ? and press <ENTER>

Clinical Use

- Gives support with decisions
  - Advice and consultation
  - Bibliographic retrieval (PaperChase)
  - Searching the clinical database

ClinQuery Sat Mar 17, 2001 3:07 pm

ClinQuery covers 495,448 admissions from 1984 through
01/31/01.

Please enter the year or range of years (e.g. 85-90) you a
going to search.

Year(s): 1999

ClinQuery Year 99 Sat Mar 17, 2001 3:09 pm

Look For: age

1. Admin/Demography
2. Laboratory Results
3. Blood Bank
4. Medications
5. Surgical Pathology
6. Radiology
7. Cardiac Cath
8. Outpatient
9. Diagnosis/procedure
10. DRG

Or enter ? for more information

ClinQuery Year 1999 Sat Mar 17, 2001 3:09 pm

Age

Choice	Values	Admissions
1)	<--- .9	5145
2)	1.0-9.9	1
3)	10.0-17.9	91
4)	18.0-19.9	261
5)	20.0-29.9	2723
6)	30.0-39.9	5614
7)	40.0-49.9	3427
8)	50.0-59.9	3602
9)	60.0-64.9	1847
A)	65.0-69.9	2009
B)	70.0-79.9	4278
C)	80.0 --->	3961

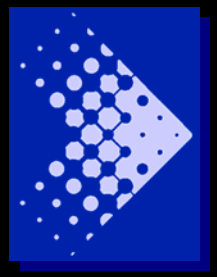
Choices:

Clinical Use

- Gives support with decisions
  - Advice and consultation
  - Bibliographic retrieval (PaperChase)
  - Searching the clinical database
  - Alerts and reminders

Clinical Use

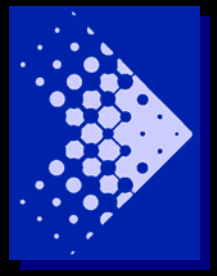
- Assists with communication



E-Mail

Inquire If Message Read

Read Mail
Write Message
Retract Mail
Inquire If Message Read
Personal Menu
Help



E-Mail

Retract Mail

Read Mail
Write Message
Retract Mail
Inquire If Message Read
Personal Menu
Help

Clinical Use

- Assists with clinical practice

Clinician's Option:

1. Admissions or Labs by Service, Firm or Team
2. Adverse Drug Reaction Reporting
3. Confidential Counseling for House Staff
4. Cross Coverage Options
5. Incomplete Medical Records
6. Personal Patient Lookup
7. Resident/Medical Student Log
8. View Clinician's Hospitalized Patients

Clinician's Options

- Confidential counseling for house staff

House Staff Support and Consultation

rom time to time a House Officer or Fellow may have a persona
natter that motivates him or her to seek professional counseling

sychiatric consultation and referral that is confidential and
ndependent of administrative reporting is readily available.

lease feel free to call or page any of the psychiatrists listed on
ext screen.

our call will remain confidential.

Confidential Counseling for House Staff

Academic Year	Accesses
1995	388
1996	380
1997	382
1998	424
1999	330
2000	287

Clinical Use

- Assists with education

Clinical Use

- Assists with education
  - -ECG case of the week

*** Select ECG case of the week

1. 12/30/96

   First line of description

   83 yr old woman with CHF. What is the likely etiology? Clue : axis

2. 12/30/96

   First line of description

   86 yr old man with slow pulse.

3. 12/30/96

   First line of description

   29 yr old man with chest pain/dyspnea. Diagnosis still possible despite artifact.

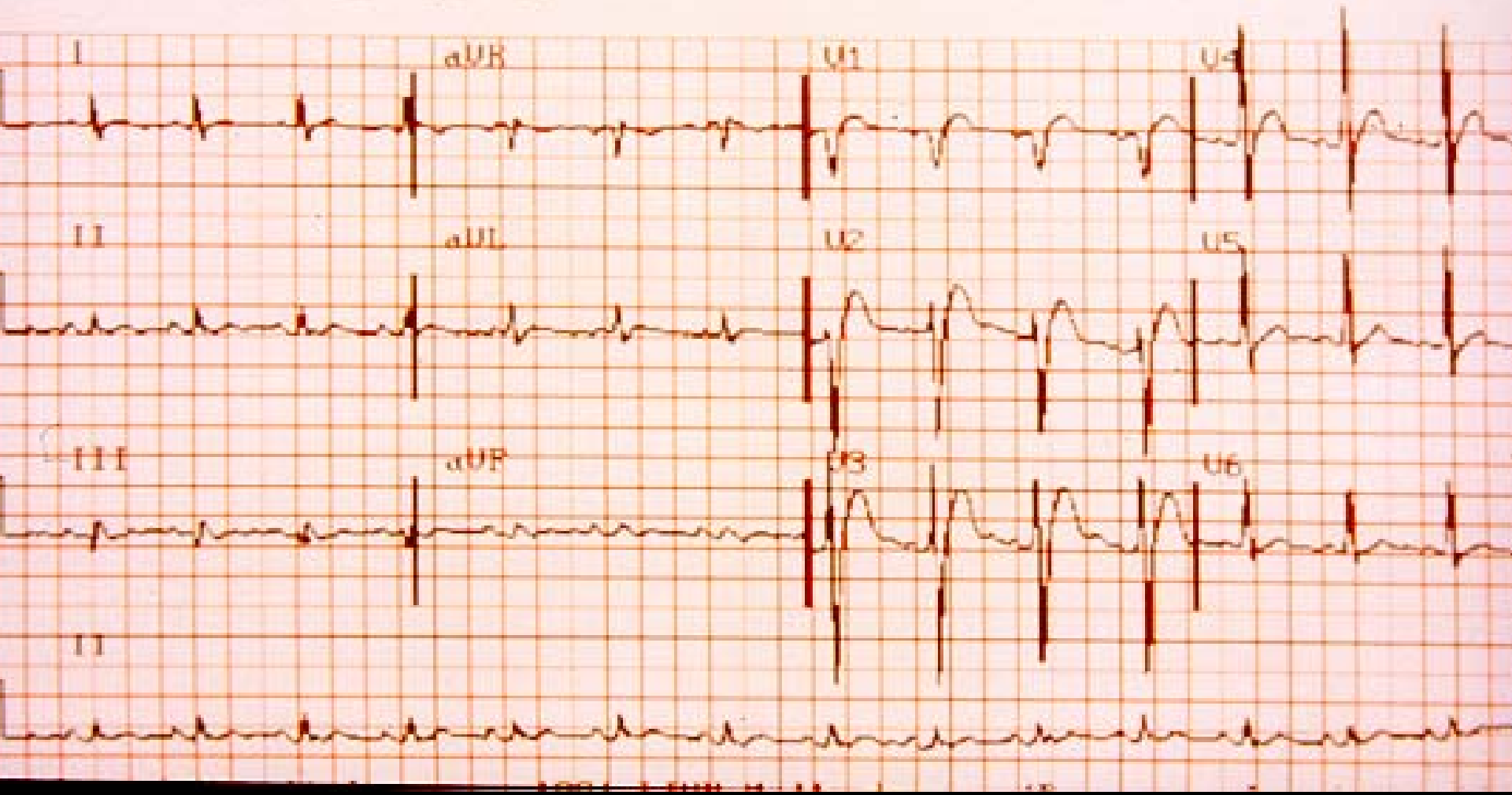
Description :

The patient is an elderly woman with a known history of left bundle branch block who presented to the emergency ward with shortness of breath.

Do you wish to view the wave format (approx 30 seconds)? (Y/N) Y//

4 08/02/93

Intervals			Axes		
PR	QRS	QT/QTc	P	QRS	T
48	116	344/390	51	26	73



ANSWER TO THIS QUIZ

DX: Sinus bradycardia, LBBB with primary st-t wave changes

The ECG demonstrates a left bundle branch block morphology with primary biphasic and inverted t waves in leads 2,3, and F. Uncomplicated bundle branch blocks should have "seconday" t wave changes. That is the stt waves should be opposite in direction to the major vector of the QRS. For example, if this ECG with LBBB was uncomplicated the stt waves in the inferior leads would be upright. This patient has inverted t waves suggesting that a "primary" or ischenic process is evolving in the inferior distribution.

She did in fact rule in for a myocardial infarction with a CK of 700 and 21% MB fraction. This message is that ischemic ECG changes can be read in the presence of a bundle branch block

Clinical Use

- Assists with education
  - -ECG case of the week
  - -Universal precautions

Standard/Universal Precautions

Welcome to your training in

standard/universal precautions

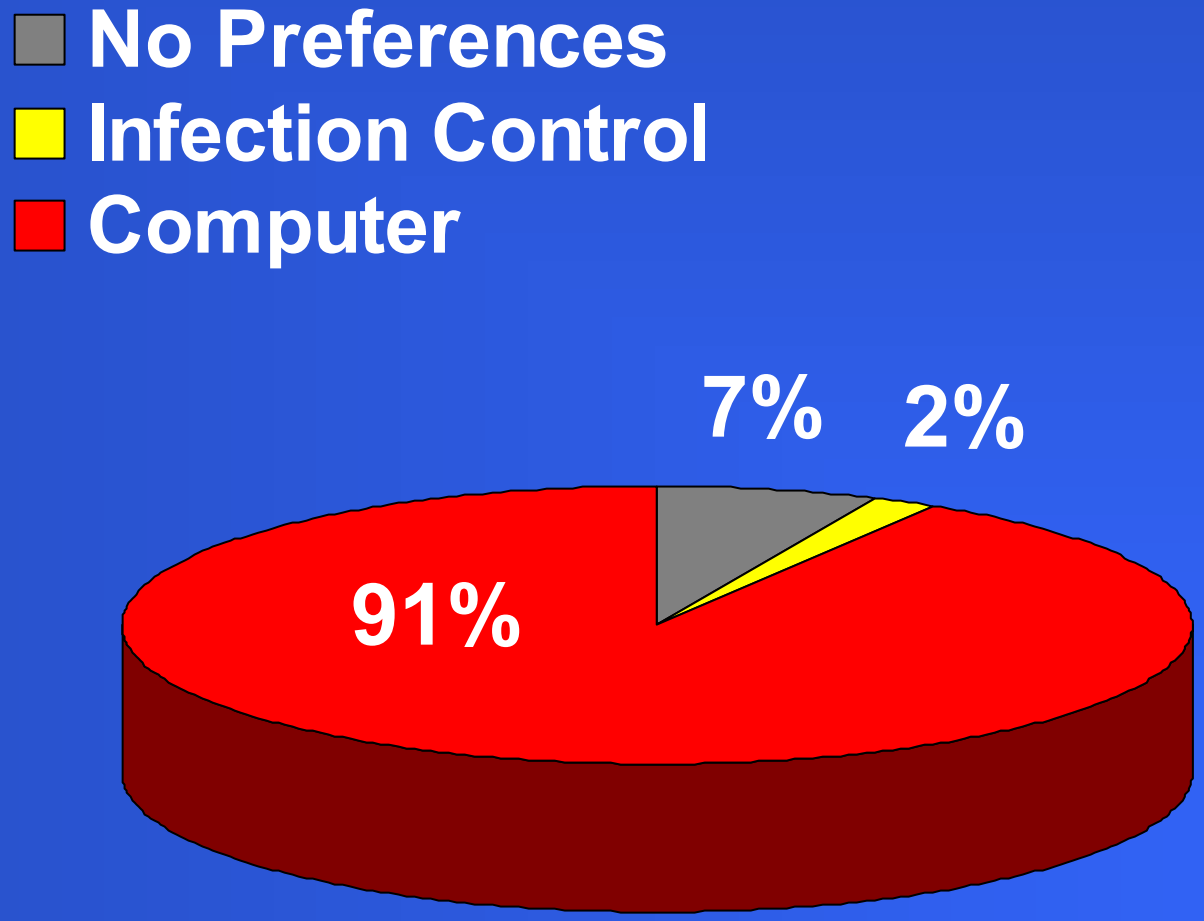
To quit <tab>

To continue <enter>

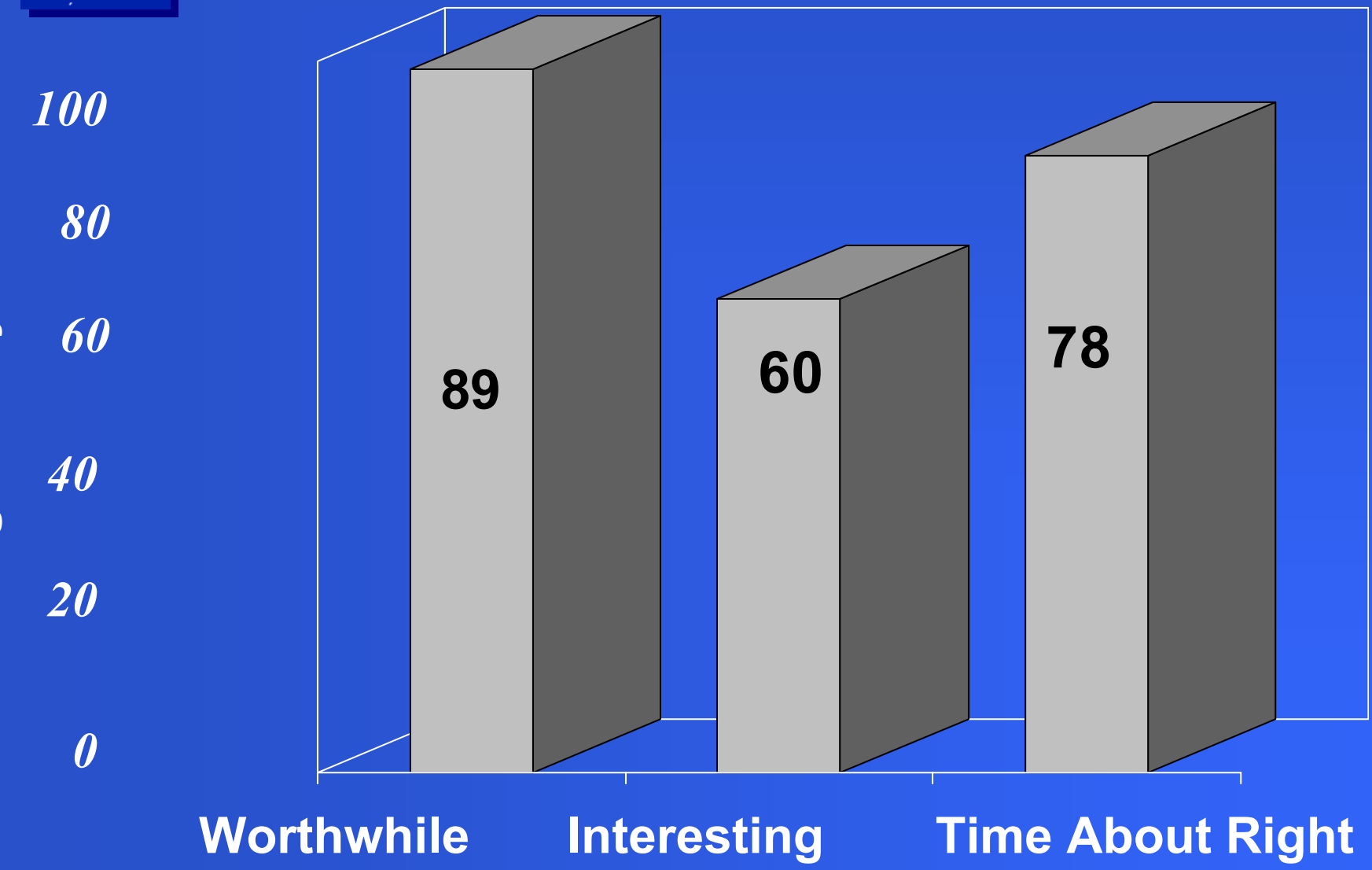
Successful Completion

First time	881 (89%)
At a later date	70 (7%)

Preference - Computer vs. Infection Control Personnel



Reaction to Computer Interview



Cybermedicine for Nurses

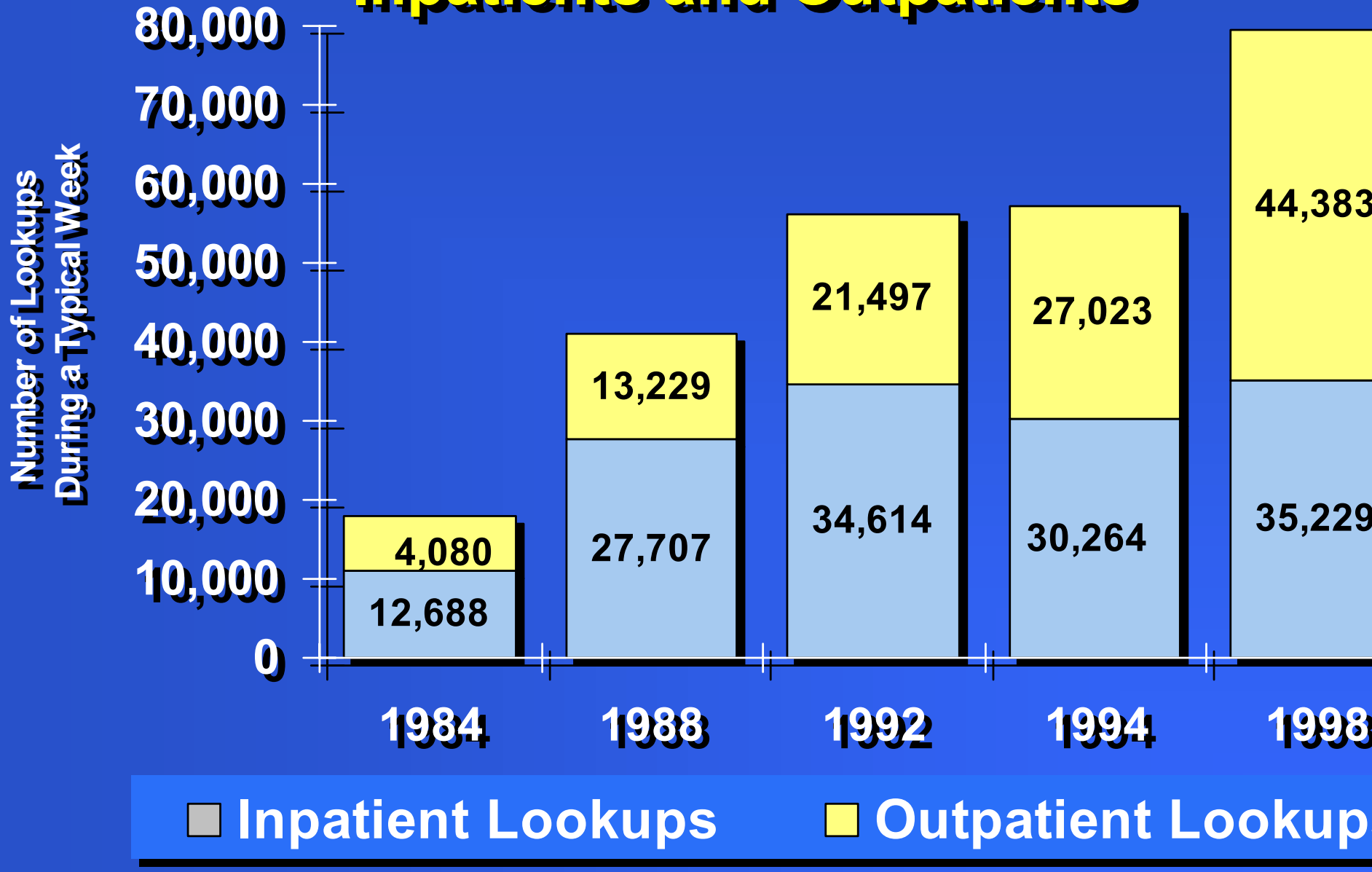
Nursing Option

1. Condition Display
2. Dietary Orders
3. Functional Health Pattern Assessment
4. Last Primary Nurse
5. Patient Classification System
6. Pre-operative Telephonic Enter/Edit

Evaluating Cybermedicine

- Use of the system by voluntary users

Beth Israel Deaconess Use of Patient Looku
Inpatients and Outpatients



Use of Patient Lookup According to Type of Inquiry at Beth Israel Deaconess, April 27-May 3, 1998

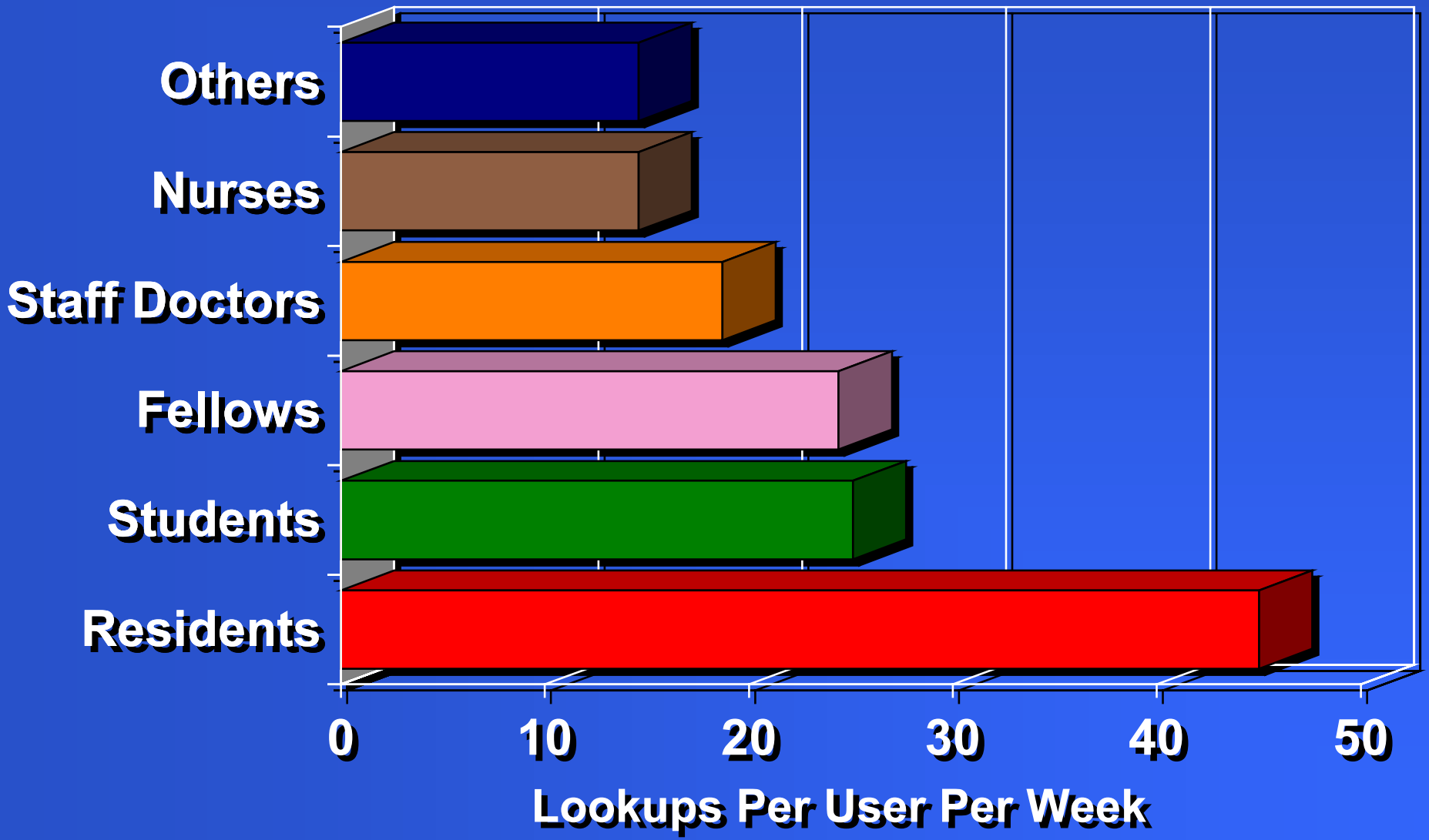
	Inpatients	Outpatients	Tot
All Labs – Most Recent Results	17,018	10,044	27,0
Demographics	3,277	9,420	12,6
Chemistry	4,310	4,793	9,1
Radiology	2,681	6,028	8,7
Narrative Notes	1,163	3,893	5,0
Cardiology	1,548	2,697	4,2
Pathology	528	3,562	4,0
Microbiology	1,990	1,001	2,9
Hematology	1,014	1,786	2,8
Blood Bank	743	439	1,1
Pharmacy	753	282	1,0
Neurophysiology	96	251	3
Pulmonary Function	108	187	2
Total	35,229	44,383	79,6

Passwords to the CCC Cybermedicine System at Beth Israel Deaconess

(winter 2000/2001)

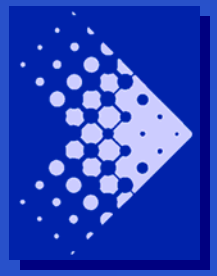
Staff Physicians	1,034
Nurses	1,983
Clinical Fellows	258
House Officers	630
Medical Students	395

Use of Patient Lookup



Electronic Mailbox

Students	2,134
Residents	9,385
Fellows	1,396
Staff	2,455
Nurses	10,980
Others	3,650
Total	30,000



- Use of the system by voluntary users
- Attitude toward the system

Effect on Work

	Accuracy	Speed	Ease	Interest
Definitely worse	4	15	8	3
Probably worse	13	24	13	10
No difference	88	54	48	147
Probably better	204	192	182	190
Definitely better	236	260	294	195
Total	545	545	545	545

E-mail Questionnaire Results

- 89% felt e-mail made life easier
- 11% felt e-mail made life harder
- 61% felt e-mail had a humanizing influence
- 13% felt e-mail had a dehumanizing influence

- Use of the system by voluntary users
- Attitude toward the system
- Effect of the system on the quality of medical care

Indirect Evidence

If it can be agreed that doctors for the most part engage in their diagnostic efforts with good reason and good will and with beneficial results for their patients…

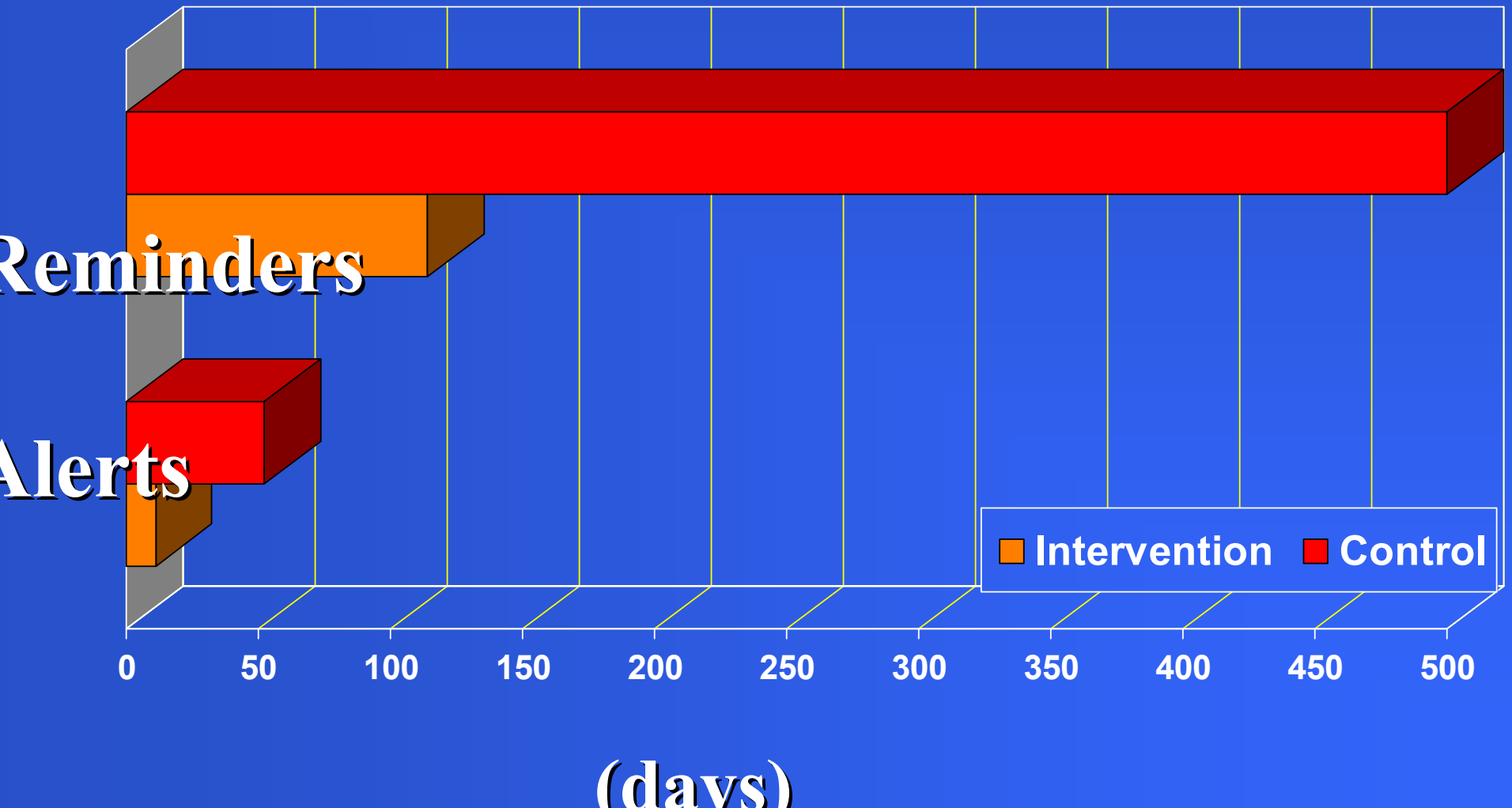
- Indirect Evidence

…then the computing system that offers them the information they have requested , with more ease, speed reliability, and accuracy than is otherwise possible, is improving the quality of care.

- Direct Evidence

The time to act on important clinical events, such as the need for a vaccination or change in a medication causing adverse side effects is significantly reduced when the physician is reminded or alerted by the computer of the need to act.

Clinician Response Time



- Direct Evidence

Bates, Kuperman, Teich, et al:

Physicians at BWH now routinely use the computing system to order laboratory tests and prescribe medications…

- Direct Evidence

Bates, Kuperman, Teich, et al:

Errors have been dramatically reduced at BWH with their order entry and alerting system; e.g., serious errors in medications have been reduced by *55 percent*.

- ERRORS IN MEDICINE

To Err is Human

(Institute of Medicine Report, fall 1999)

"…as many as 98,000 people die in any given year from medical errors that occur in hospitals."

- Errors in Medicine

The extent of the problem is debatable but

Most would agree there is a problem

- Errors in Medicine

Two approaches to mistakes by doctors:

To expose and criticize

or, far better,

To make it as easy as possible for the doctor to practice good medicine

- Errors in Medicine

My argument: We know enough already to reduce substantially important errors in medicine through the good use of cybermedicine.

- Errors in Medicine

If the cybermedicine programs provide the results of diagnostic studies immediately upon request, with abnormal and critical values highlighted to avoid their being overlooked;

- Errors in Medicine

If the cybermedicine programs offer unsolicited alerts and reminders about clinical events that need attention, either immediately or in the near future;

- Errors in Medicine

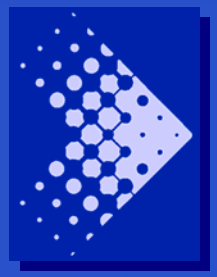
If the cybermedicine programs offer advice and consultation, when requested, about diagnosis and treatment;

- Errors in Medicine

If the cybermedicine programs offer ready access to current, reliable medical literature;

Errors in Medicine

If the cybermedicine programs offer access to information about the diagnosis and treatment of patients from the past (with protection of confidentiality) for comparison with the diagnosis and treatment of patients in the present;



- Errors in Medicine

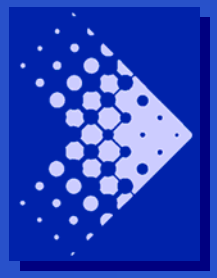
If the cybermedicine programs assist with (or better, eliminate) administrative chores, thereby freeing more time for medical matters,

- Errors in Medicine

And if the cybermedicine programs have educational value,

- Errors in Medicine

Then the doctor is far less likely to make mistakes in the practice of medicine.



- Use of the system by voluntary users
- Attitude toward the system
- Effect of the system on the quality of medical care
- The Teaching Power of Cybermedicine

- Teaching

In the tradition of John Dewey, who advocated “learning by doing,” cybermedicine promotes learning in the context of caring for real patient

- Teaching

e.g., if a medical student caring for an elderly man is informed by the compute that the patient has a low serum Na, a low BUN, and a chest film that shows hilar adenopathy with pleural effusion...

- Teaching

the student can request computer-based consultation on diagnosis an treatment (data from the labs are transferred to the consultation programs automatically)…

- Teaching

and discover (or be reminded) that
the findings are suggestive of oat c
carcinoma of the lung with
inappropriate secretion of antidiuret
hormone…

- Teaching

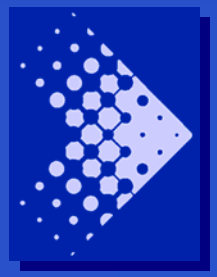
and then use ClinQuery to find information on other patients with these abnormalities…

- Teaching

use PaperChase to search for related articles in the medical literature…

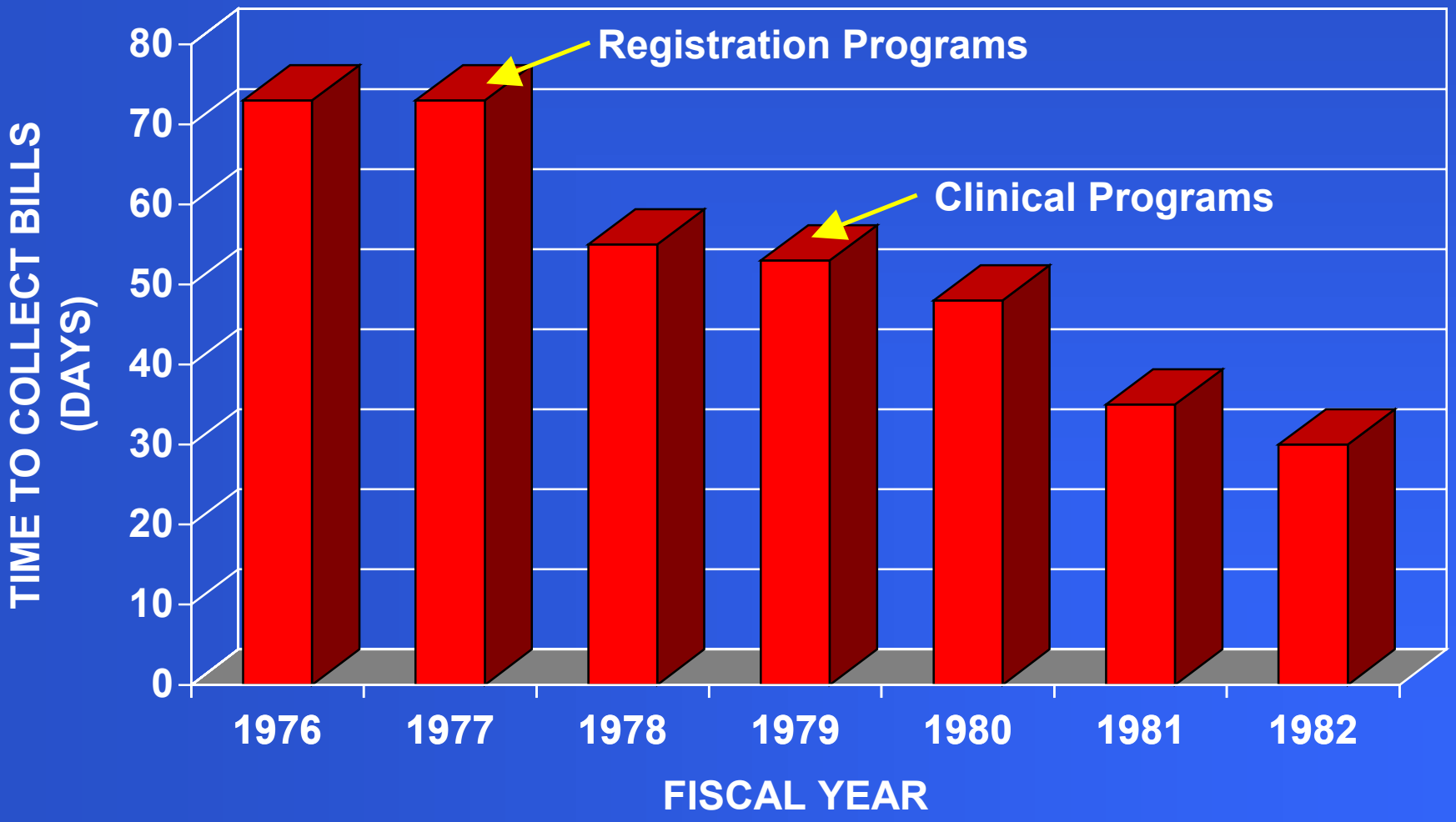
- Teaching

and use electronic mail to communicate with other students, house officers, or staff physicians, all from the same computer terminal.

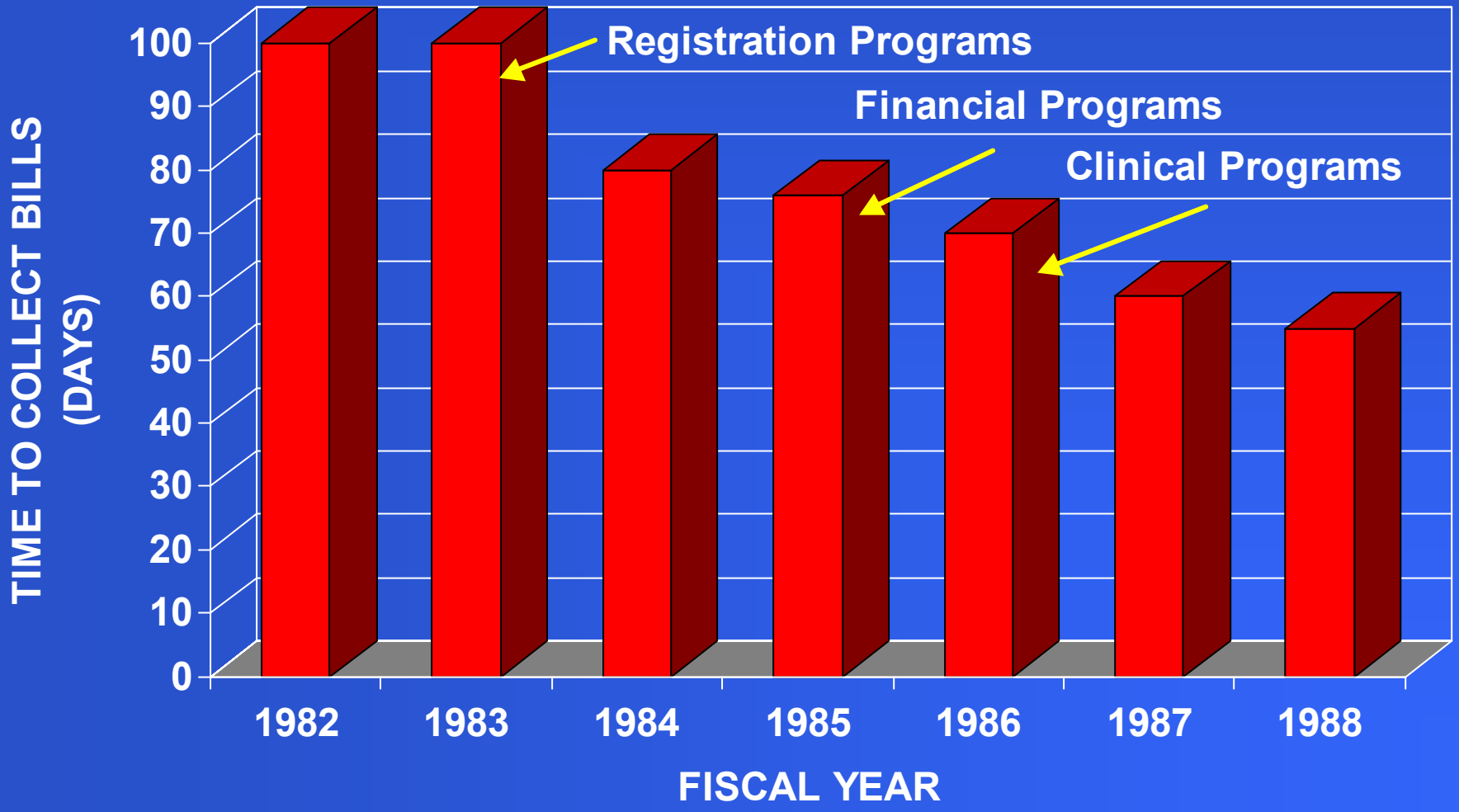


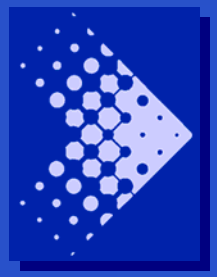
- Use of the system by voluntary users
- Attitude toward the system
- Effect of the system on the quality of medical care
- The Teaching Power of Cybermedicine
- Effect of the System on Hospital Finances

Time needed to collect bills in relation to use computing programs at Beth Israel Hospital



Time needed to collect bills in relation to use o computing programs at Brigham & Women's Hospital





- Use of the system by voluntary users
- Attitude toward the system
- Effect of the system on the quality of medical care
- The Teaching Power of Cybermedicine
- Effect of the System on Hospital Finances
- Cost of the System

Cybermedicine and Privacy

- We have done our best to find the optimal compromise between privacy (protecting confidentiality) and quality of care (helping with the practice of medicine).

Measures in Use for Protection of Patient Confidentiality

- All users are told that the password is equivalent to a legal signature, and that under no circumstances should it be shared with anyone.

Measures in Use for Protection of Patient Confidentiality

- Access can be restricted by password and by terminal location.

Measures in Use for Protection of Patient Confidentiality

- Physicians' passwords are issued by the Executive Director's office when the physician is given hospital credentials.

Individuals who have access to the Beth Israel Deaconess computerized patient
ormation system can obtain records pertaining to the care and treatm
nospital patients. Under Massachusetts law and the hospital's patien
confidentiality policy, such records are confidential.

We ask you to sign the following agreement.

Press <Enter>

Measures in Use for Protection of Patient Confidentiality

- Terminals are frozen if illegal passwords are entered a few times.

Measures in Use for Protection of Patient Confidentiality

- Users are automatically signed off after a time-out period of approximately five minutes.

Measures in Use for Protection of Patient Confidentiality

- Access from home by telephone dial-up requires a second password.

Measures in Use for Protection of Patient Confidentiality

- The computer system stores each access to patient information indexed by person, professional role (staff doctor, nurse, resident, student, other), location, type of information retrieved, date, and time.

Measures in Use for Protection of Patient Confidentiality

- All patients (and their doctors) can request a list of persons who have looked at their records.

Measures in Use for Protection of Patient Confidentiality

- Employees who use the computer system have an option under Utilities that displays the names of persons who have looked at their electronic record.

Utility Options

Telephone Directory	462
Doctor's Office Directory	182
View Lookups of Own File	176
How to use the Computer Terminal	46

Measures in Use for Protection of Patient Confidentiality

- Terminals automatically display confidentiality warnings if a user looks at a record of a VIP.
- Terminals randomly display confidentiality warnings from time to time for all patients.

Beth Israel Deaconess Patient Lookup
Tues Mar 20, 2001 3:29 pm

End response by pressing return key. For help type ?

Patient ID: Townsend,Minnette

999999 Paxton,Minnette 04/21/03 F 97 111-11-1111

(Access Restricted)

Arthur Marguetite Richard M Townsend

OK? Y //

To protect each patient's confidentiality only those who are esponsible for a patient's care should use this option. We recor he identity of each user of patient lookup and will give this nformation to the patient or the patient's physician upon reques

Type 'Y'es to proceed, otherwise press return. N//

Measures in Use for Protection of Patient Confidentiality

- We have also relied on personal accountability and trust, and this has proved to be justified.

In the Hands of Strangers

For purposes of reimbursement, hospitals and clinics are now required to send confidential clinical information, linked to charges, to a broad array of third-party payers - - strangers who are beyond the control of the hospital, clinic, doctor, or patients. Are they to be trusted?

In the Hands of Strangers

Third party payers, in turn, often send this information to yet another agency—the *Medical Information Bureau*—which in turn shares this information among payers for their clandestine use without the consent of the patient.

In the Hands of Strangers

The stated purpose of placing medical information in the hands of payers is to enable them to verify the legitimacy of financial claims. Little is known, however, about how the agencies use this information and how they protect confidentiality. Who within and without *their* walls has access to private information once it is in their computers? What are their procedures for protecting confidentiality? I have been unable to get answers to these questions.

A Modest Proposal for the Protection of Privacy

It is time to achieve a better balance between the financial interests of the payer and privacy interests of the patient.

We can stop sending confidential information to third party payers, government or private.

A Modest Proposal for the Protection of Privacy

There is no a priori reason for charges to be linked to clinical information once they leave the clinical facility. Appropriate charges can be determined within the walls of the clinic, with internal checks for accuracy and honesty.

A Modest Proposal for the Protection of Privacy

Provisions can be established for external review by independent auditors. These could be chosen from respected members of the medical and business communities, who would visit the clinical facility to ensure the legitimacy of the charges, with scrutiny for accuracy, fairness, and honesty.

A Modest Proposal for the Protection of Privacy

If the auditors certify that the clinic's records tell the truth, this would be accepted. If not, the charges would be adjusted within the clinical facility. But no confidential information would leave the facility unless under the direction of the patient or an authorized surrogate.

A Modest Proposal for the Protection of Privacy

Third party payers will object, and there will be hurdles along the way. But there are formidable advantages:

1. Privacy would be protected.
2. No additional legislation needed.
3. Money would be saved
4. No need to investigate the Medical Information Bureau

ANNOUNCING THE ONLY FOOLPROOF, GUARANTEED INDECIPHERABLE, ABSOLUTELY CONFIDENTIAL HOSPITAL RECORDS SECURITY SYSTEM:

DOCSCRIPT!