



Telemedicine and Telehealth: The IDEATel Perspective

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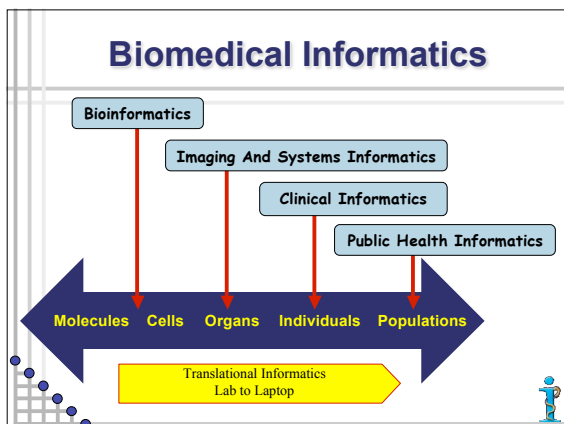


Acknowledgements

Laboratory for
Advanced
Translational
Informatics and
Clinical
Excellence

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*Deceased. **Current address: E. Tennessee State University (Johnson City, TN).



Outline

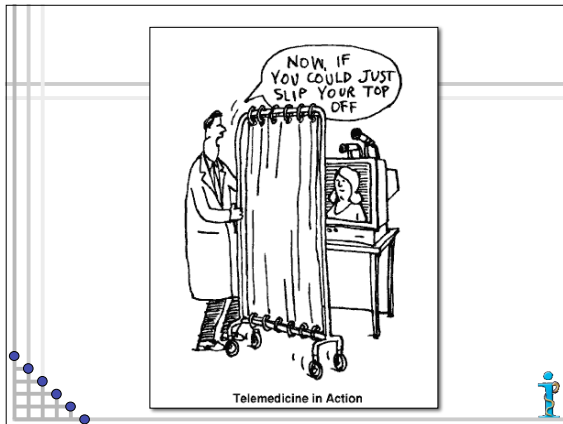
- What is Telemedicine?
- Types of Telemedicine (Technology)
- Applications of Telemedicine (Clinical)
- Benefits and Barriers
- Evaluating Telemedicine Systems
- The IDEATel Project
- What Next?

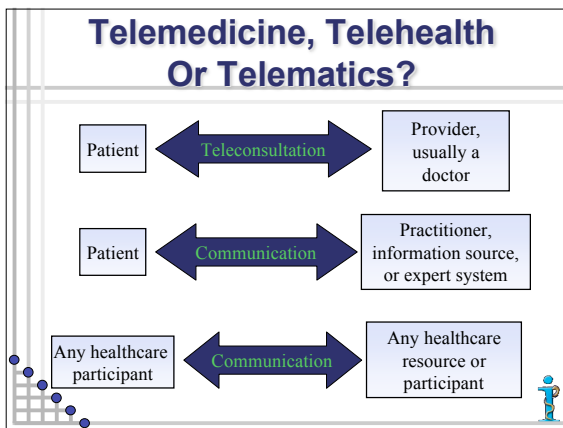
WHAT IS TELEMEDICINE?

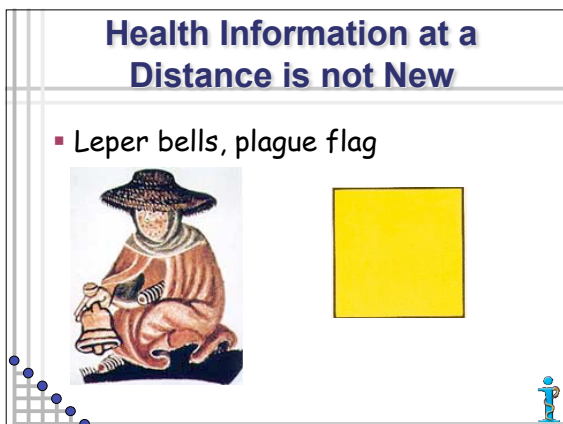
TELECOMMUNICATIONS
+
MEDICINE
+
BIOMEDICAL INFORMATICS

Biomedical Informatics Issues

- Data Capture and Display
- Databases
- Coded Vocabulary
- Artificial Intelligence
- Data Security
- Outpatient Clinical Systems
- Disease Management/Case Management

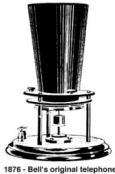




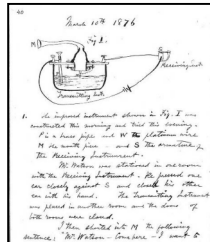


1876

- Watson come here I need you



1876 - Bell's original telephone



1879 Lancet

VERS TO CORRESPONDENTS. [Nov. 29, 1879. 819

PRACTICE BY TELEPHONE.

THE Yankees are rapidly finding out the benefits of the telephone. A newly made grandmamma, we are told, was recently awakened by the bell at midnight, and told by her inexperienced daughter, "Baby has the croup. What shall I do with it?" Grandmamma replied she would call the family doctor, and would be there in a minute. Grandmamma woke the doctor, and told him the terrible news. He in turn asked to be put in telephonic communication with the anxious mamma. "Lift the child to the telephone, and let me hear it cough," he commands. The child is lifted, and it coughs. "That's not the croup," he declares, and declines to leave his house on such small matters. He advises grandmamma also to stay in bed; and, all anxiety quieted, the trio settle down happy for the night.

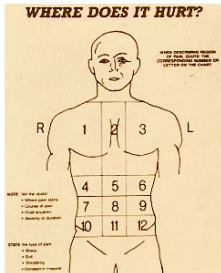


1920 Norway

- Haukeland hospital established a service for Health care support of ships by radiolinks



1928 Royal Flying Doctor Service



1948 - 1960

- 1948 First Teleradiology
- 1959 Nebraska Psych, single campus
- 1964 Remote Consultation
- 1965 First Telesurgery (broadcast)

1967 Logan Airport



1969 Baylor



1971 - Alaska Satellite Biomedical Demonstration



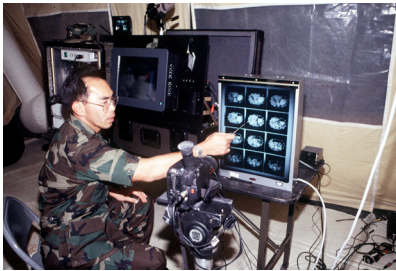
1971 - Alaska Satellite Biomedical Demonstration



1980's

- Little advance in US
- Norway establishes national network

1991 Desert Storm Teleradiology



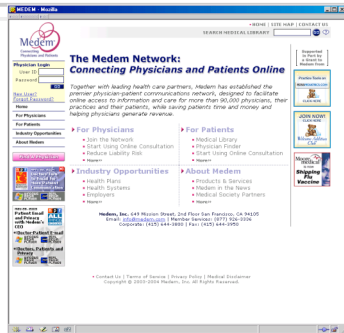
1992 - East Carolina Correctional Telehealth



1993 - Bosnia Military Video Telehealth



1999 Medem

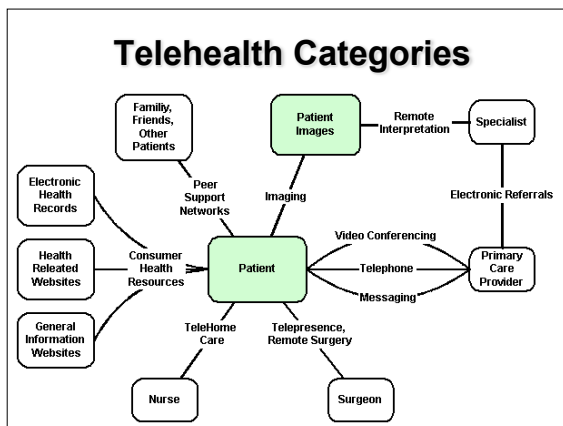


2001 First Transatlantic Surgery



Telehealth Categories

- Information Resources
- Messaging
- Telephone
- Remote monitoring
- Remote interpretation
- Electronic Referral / Teleconsultation
- Video consultation
- Haptics, Telepresence



Information Resources

- 73 million use Web for health or medical information (dec. 2002)
 - Up 59% since 2000
 - Is it Telehealth?
- Chat groups benefit patients
- Is EMR Telehealth?

Messaging

- Patients send doctors email
 - 90% of Pts want it - Harris 2002
- Medem
 - 45 Medical Societies
 - 90,000 Physicians
 - 500,000 Patients/mo.
- Some reimbursement



Web-based Messaging

The New York Times **Technology** Check out the new Radio 2002

[NYTimes Home](#) [Site Index](#) [Desktop](#) [Help](#) [Welcome](#) [About Us](#) [Member Center](#) [Logout](#)

[Technology Home](#) [Circuits](#) [Product Reviews](#) [How To's](#) [Deals](#)

Digital Rx: Take Two Aspirins and E-Mail Me in the Morning

By [MILT FRIEDENHEIM](#)
Published: March 2, 2005

Correction Appended

Doctors may no longer make house calls, but they are answering patient e-mail messages - and being paid for it.

In a move to improve efficiency and control costs, health plans and medical groups around the country are now beginning to pay doctors to reply by e-mail, just as they pay for office visits. While some computer-literate doctors have been using e-mail to communicate informally with patients for years, most have never been paid for that service.



Dr. Richard Levine, a Columbia University Medical Center ophthalmologist, advises patients by e-mail.



Telephone

- 150 - 300 Calls / wk.
- One sixth of ambulatory visits
- "No" reimbursement
- Virtually no training
- Protocol books
- Largest Telemedicine group is telephone-based



Remote Monitoring

- Pacemakers
- Glucose Meters
- Spirometry
- Coagulation - INR
- Thermometers
- Blood Pressure
- Often POTS-based



Monitoring Devices

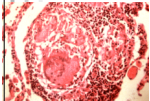
Remote Monitoring Issues

- Who watches the data?
- Economics
 - Who pays?
 - How much?
- Device maintenance
- Hawthorne effect

Remote Interpretation



- Mostly static images
- "Store-and-forward"
- Teleradiology
- Telepathology
- Teledermatology



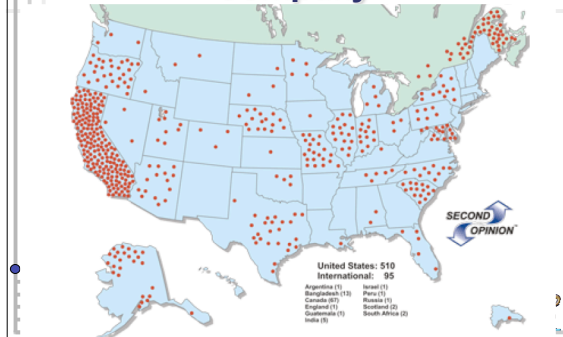
Remote Reading Questions

- When does radiology become "tele"?
- Economically or Quality driven?
 - Studies of "Off shore" reading

Electronic Referral or Consultation

- Store-and-Forward
- Multimedia capabilities vary
- Partners Telemedicine
- 2nd Opinion Software
- Economics improving, but still problematic

One Store and Forward Company



Video Consultation

- "Store-and-Forward"
 - Technician captures images and data
 - Later reviewed by Expert
- Synchronous Video
- Replaces patient transportation
 - Rural
 - Military
 - Prison
 - Home nursing

Store-and-Forward Video

- Not widely reimbursed
- Is it messaging?
- Widely used in Military

Synchronous Video

- "Traditional" Telehealth
- Most early Telehealth was synchronous
 - Kansas
 - Georgia
 - Bassett
- Typically high bandwidth
 - Dedicated networks
 - ISDN H.320
 - Satellite

"Traditional" Telemedicine

Rural

- Remote locations
- Low physician density
- Synchronous video reimbursed by HCFA
 - Low utilization
 - Many pilots closed

Military

- Funded largest US telemedicine projects
- Ship-board and battlefield
- Lack of physicians
- Much store-and-forward
 - Corpsmen collect data
- Transportation extremely expensive



Prison

- Large proportion of commercially viable telemedicine programs
- 30% of all teleconsultations (1998)
- Transportation is expensive
 - \$250 - >\$2000
- Security concerns
 - Patients, not data



TeleHome Nursing

- Monitoring, not diagnostics
- Early discharge
- Small, low-bandwidth units
- Integrated with devices
 - BP, glucose, Stethoscope, etc.
- Prospective Payment
- Nurse clinicians

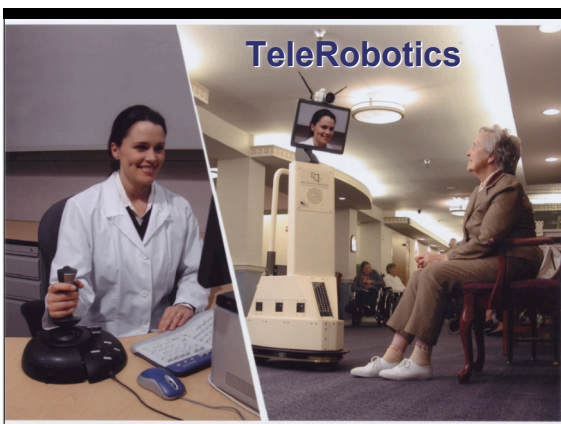




Telehome Nursing

Telepresence, Haptics

- Virtual Reality
- Force feedback
- Remote surgery
 - Minimally Invasive Surgery
 - Latency issues



TeleRobotics

Uses of Telemedicine

- Patient care
- Education
 - Patient and Professional
- Research
- Public health
 - Preventive care
 - Disease Management
- Health care administration




Telemedicine Benefits

- Improved care
 - Access to best care
 - Faster response
 - Reduced barriers to use
 - More frequent monitoring
- Reaching remote and under-served areas
- Cost savings
 - Transportation costs
 - Reduced complications






Telemedicine Barriers

- Acceptance
- Funding
- Convenience
- Legal
- Technology
- Security
- Standards



Evaluating Telemedicine

- Process of care
- Health outcomes
- Access to care
- Cost
 - Patients, providers, payers
- Perceptions

Telemedicine: A Guide to Assessing Telecommunications in Health Care, IOM

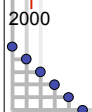
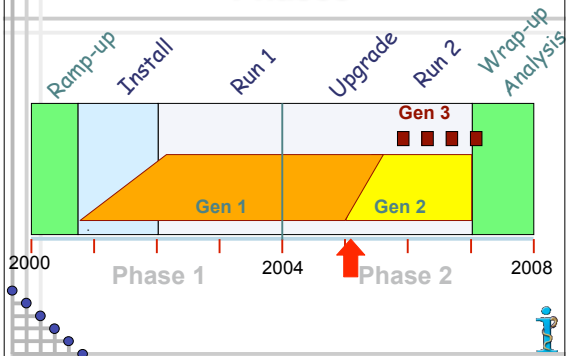


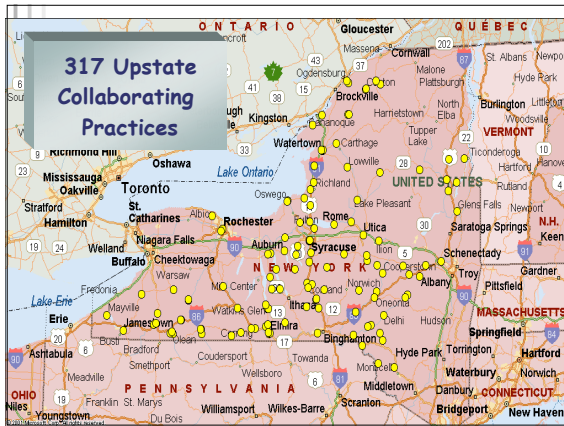
IDEATel

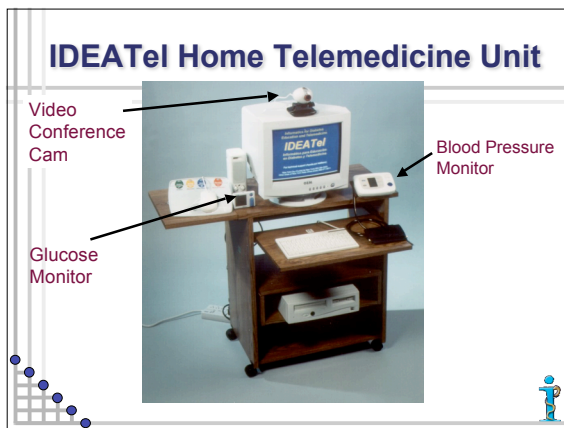
- Informatics for Diabetes Education And Telemedicine
- Large-scale home-based telemedicine project for medically-underserved diabetic patients
- Randomized controlled clinical trial (N≈1665+)
- Multi-site consortium
 - Columbia and New York Presbyterian Hospitals (Downstate)
 - SUNY Upstate Medical University-Syracuse

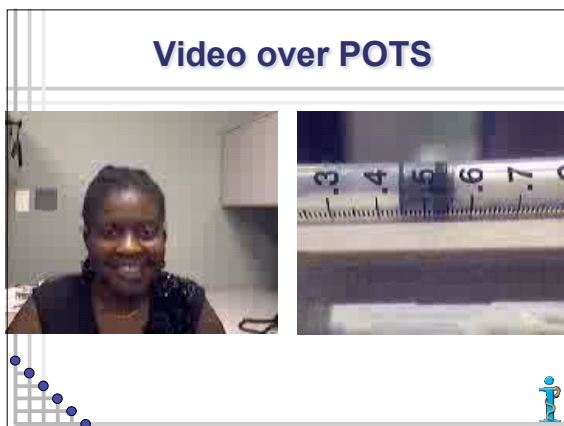


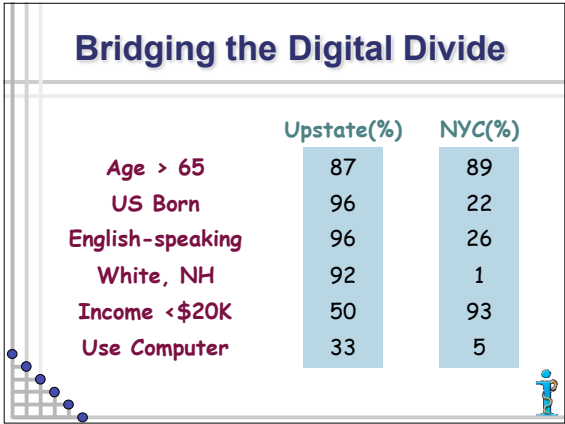
Phases

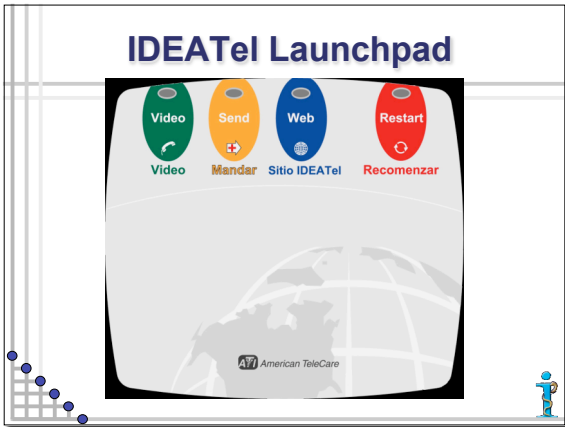


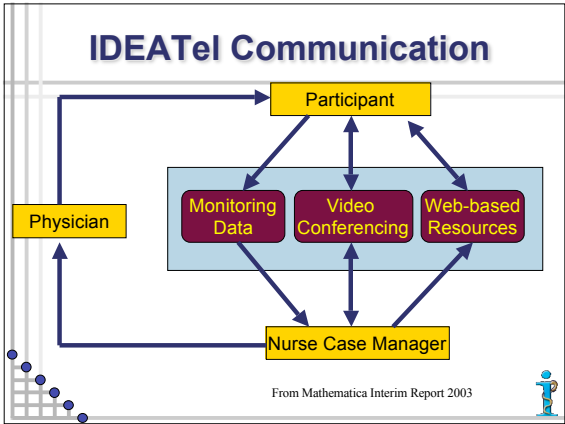


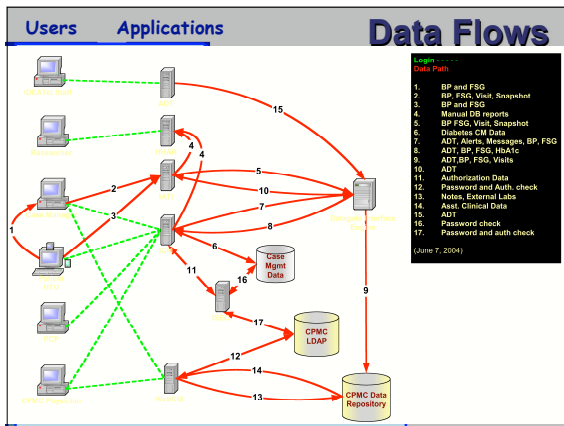


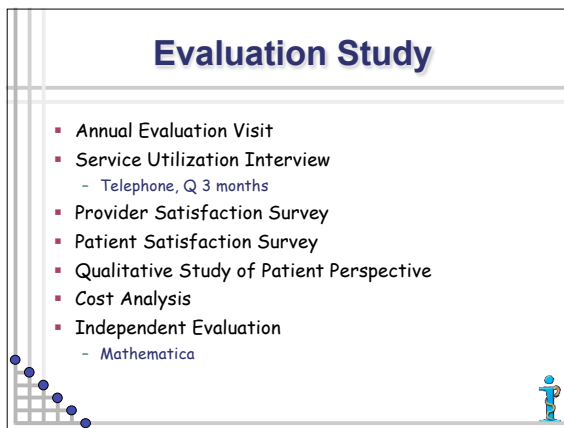


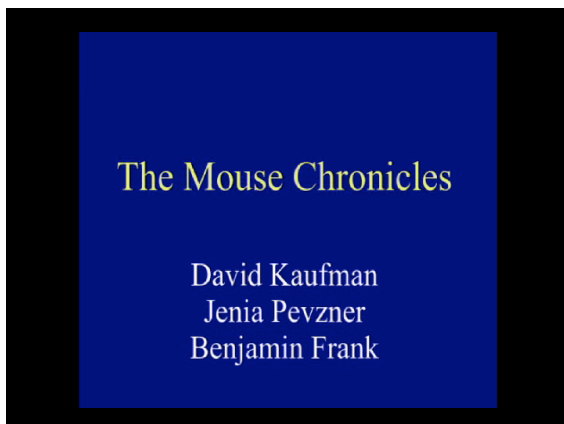


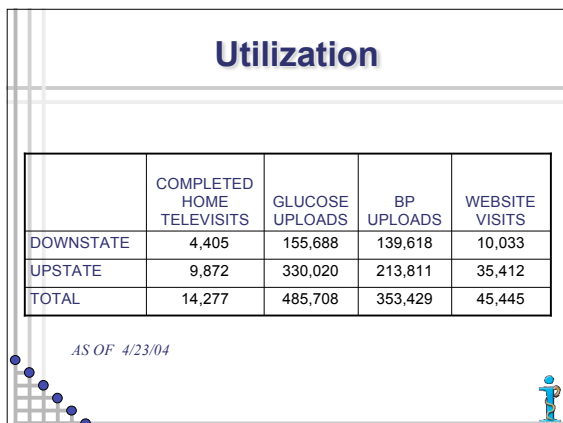


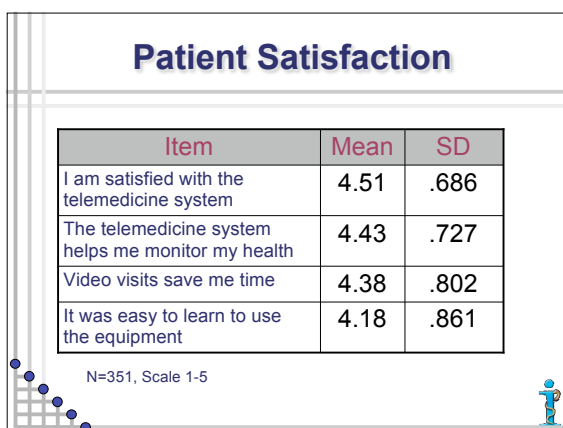


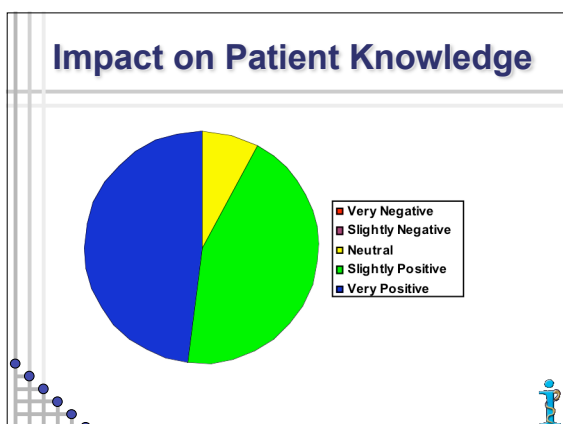


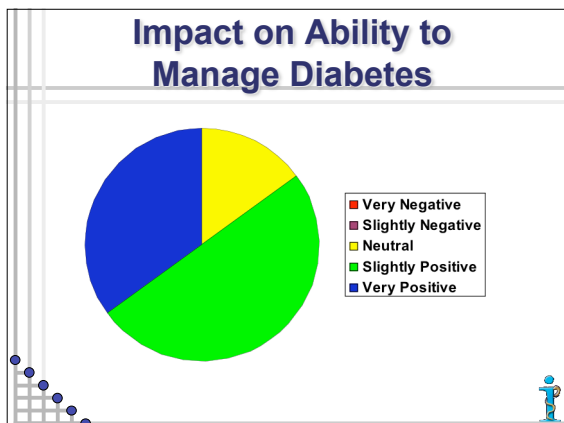












1 YEAR RESULTS

(N = 1,406)

	Control	Interven	Adj. Δ	P value
Glyc Hgb (%)	7.17	6.97	-0.18	0.006
*Glyc Hgb (%)	7.78	7.42	-0.32	0.002
Systolic BP (mmHg)	140.7	137.4	-3.4	0.001
Diastolic BP (mmHg)	70.1	68.4	-1.9	0.0001
Total cholesterol (mg/dl)	182.4	170.4	-11.1	<0.0001
TG (mg/dl)	171.8	154.7	-16.1	<0.0001
LDL cholesterol (mg/dl)	105.9	95.7	-9.5	<0.0001
HDL cholesterol (mg/dl)	48.6	47.9	-0.6	0.22

*N = 705 with baseline glyc hgb > 7.0%
 *adjusted for differences in baseline values.
 As of 10/31/2003





What does
the future
hold?



What is ~~coming?~~ ^{here?}

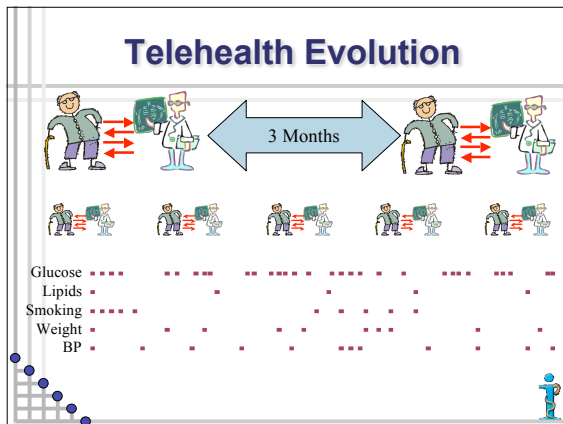
- Reimbursement for Electronic Messaging
- Section 728
- Continued Congressional Activity



Open Problems

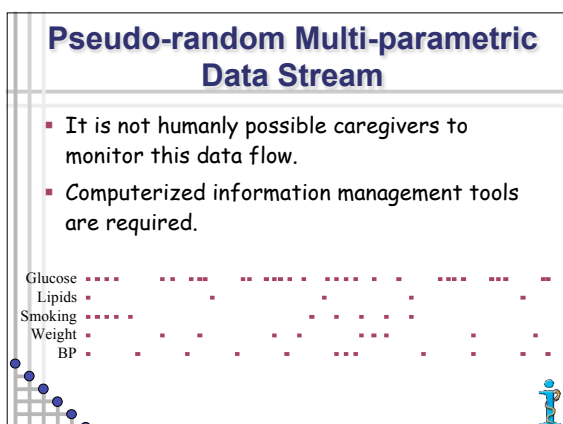
- Changing Telecom Environment
 - VOIP
 - Cellular
 - Broadband
- Inter-organizational System Integration
- Data overload





Remote Monitoring Load

	Prev.	Pts./MD	Freq.	Tests/d
Diabetes	6%	120	1	120
HTN	18%	360	0.2	72
Asthma/ COPD	8%	160	1.2	192
CHF	1%	20	1	20
Anticoag.	1%	20	0.2	4
				408



20 Patients

MRN	Name	DOB	Sex
3386531	GAGE, LINDA	1947-04-19	M
4141414	JOYCE, JAMES	1949-01-01	F
8888888	MOORE, DEMO	1980-11-15	F
3131313	SANDIEGO, CARMEN	1951-05-26	M
2121212	STAR, TREK	1966-09-01	F
3937549	STRANGE, BOB	2000-02-02	M
3931749	MOON, DOGGIE	1001-01-01	M
3386531	GAGE, LINDA	1947-04-19	M
4141414	JOYCE, JAMES	1949-01-01	F
8888888	MOORE, DEMO	1980-11-15	F
3131313	SANDIEGO, CARMEN	1951-05-26	M
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8888888	MOORE, DEMO	1980-11-15	F
3131313	SANDIEGO, CARMEN	1951-05-26	M

200 Patients

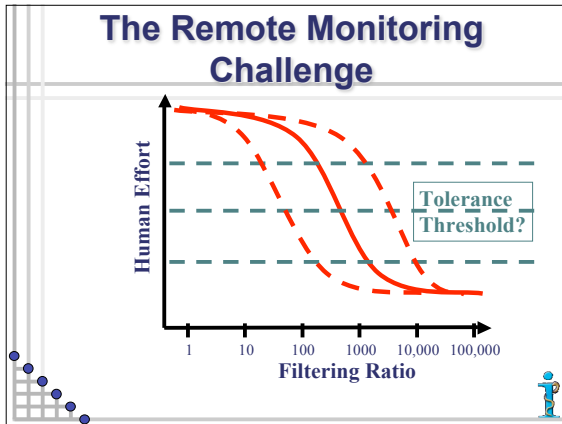
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2000 Patients

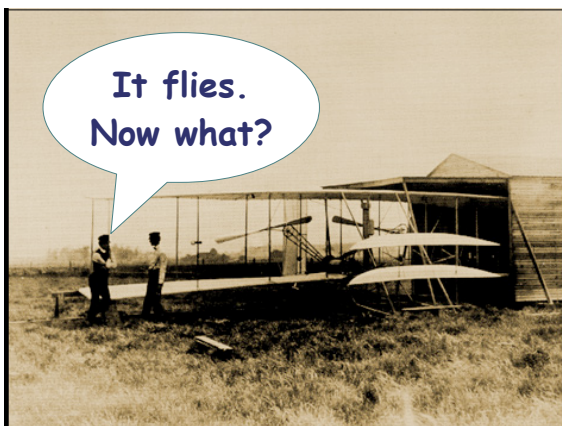
Icons to the Rescue?

Computerized alerts?

- **Limit Detectors**
 - High FP and FN rates
- **Statistical Process Control**
 - Acute changes
- **Outcome Models**
 - Statistical, not prescriptive
- **Physiologic Models**
 - Promising



- ### And now...?
- Intelligent filtering
 - Human Computer Interaction
 - Patients
 - Clinicians
 - Standards
 - Seamless communication
 - Message-based workflow



For more Information

- www.ideatel.org
 - Publications
 - Videos
 - Telemedicine Syllabus
 - Contact Information
- tie.telemed.org
 - Telemedicine Information Exchange