Maimonides Medical Center
Makes a Quantum Leap with Advanced Computerized Patient Record Technology

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Maimonides Medical Center Makes a Quantum Leap with Advanced Computerized Patient Record Technology

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CPR System Planning
The Medical Center

Top 100 Cardiovascular Hospitals (Solucient)
Top 100 Most Wired Hospitals (H&HN) 2000, 2001, 2002
1998 Computerworld Smithsonian Award - Medicine

- 36,861 Inpatients
- 5.05 Length of Stay
- 1.87 CMI
- 253,316 Outpatients
- 77,118 Emergency Visits

- $564.5 Million Revenue
- 4,612 Employees
- 277 Employed Physicians
- 401 Residents
- 978 Community Physicians
CPR System Planning

Vision…

To improve the quality and effectiveness of patient care by providing real time access to comprehensive clinical information wherever and whenever needed.
CPR System Planning
Strategic Priorities

- Clinical excellence & patient safety
- Humane, patient focused, patient centered care
- Strengthen physician collaboration & effective communication
- Supportive environment for physicians
- Fiscal viability
- . . .
CPR System Planning
Leadership and Governance

- CEO firmly committed to project & necessary organizational change
  - Leadership, financial, medical staff
- Communicate process & project status
- Financial commitment includes all ongoing support
CPR System Planning
Needs Assessment

- “Stuck in key punch era”
- New York State’s deregulation
- Strategic priorities necessitate state-of-the-art IT
- Departmental-specific CPRs
CPR System Planning
System Acquisition

- Inpatient CPR was purchased in 1992 deployed in 1996
- Patient safety and outcome initiatives required CPRs with knowledge-based decision support
- Targeted an integrated single vendor CPR solution
No supplier could deliver
Clinical Department’s diverse requirements were best addressed by CPRs from different vendors
Modified “Best of Breed” approach with vendors who conformed with our technology standards
CPR System Planning
Business Case for CPR

- Complexity and expense of implementation
- User, workflow committees, task forces, HIS executive committee identify capital initiatives that meet hospital-wide, departmental and individual needs
- Gained buy-in throughout organization
CPR System Planning
Business Case for CPR (continued)

- Strategic priorities yielded investment of $43.909 million
- Continuing annual request for $30 million
- Metrics tie to business return
- Required technology supports strategic priorities
Capital Allocation and Prioritization

- **Systems** *(example)*
  - Ambulatory, Eclipsys enhancements, ED, document imaging, medication administration, etc.

- User wants
- Clinical success factors
- System priorities
- Economic priorities
Project Risk Management
Timeliness, Budget, Completion

- Risk reduction strategies
  - Implementation credibility
  - Resistance to workflow changes
  - Managing vendor relationships
  - Lack of technology infrastructure
  - Uncertainty of success with CPOE with community physicians
Implementation Planning and Process

- **Infrastructure**
  - ATM enterprise network
  - Leonia, NJ, data center
  - OS 390/2.5 mainframe
  - OC48 Sonet ring
  - 2300+ desktops and wireless devices
  - 113 servers
  - New MIS site
Implementation Planning and Process (continued)

Simultaneous applications and upgrades 1996–1998

- Radiology Information System
- PACS
- Voice Recognition
- Document Imaging
- Transcription
- Blood Bank Laboratory
- Anatomical Pathology
- Patient Registration
- Master Person Index
- Patient Accounting
- Financial/HR/Payroll
- Decision Support
Implementation
Planning and Process (continued)

- Physicians sought knowledge-based decision support (1999)
- Eclipsys SCM to replace E7000
- Purchased A4HealthSystems HMED CPR; NextGen CPR – Ambulatory and Faculty Practices; E&C Intelligent Patient Record for Obstetrics
Implementation
Planning and Process (continued)

- Data collection, workflow modifications, application screen design
- Integrated testing of applications and interfaces
- Downtime procedures, workflow and user access policies
- Roll forward approaches
- “Just-in-Time” Training
- System “Go Live” support
Implementation—Project Governance
“Right” Planning Environment

- HIS Executive Committee
- Physician Task Force
- Nursing Council
- Project sponsors break down barriers
- Project Teams -> user committees
- Technology Infrastructure—command center, training, etc.
Implementation
Project Staffing

- Maimonides physicians, nurses, pharmacists, lab and radiology technicians
  - Knowledge of hospital culture, formal and informal organization, institutional memory and medical staff relationships
  - IT skill mix broadened by adding clinicians
  - IT technologists broadened skill mix
Impact on Operations
Successful System Implementation

- Minimize adverse impact on hospital operations
- Three to six weeks of go-live support
- Closely managed phased approach based on user tolerance
  - “Big Bang” not possible
- Patients come first!
Evaluation of Management of CPR Effort
Lessons Learned—the Don’ts

- Two or more CPRs at the same time
- “Go Lives” in peak census periods
- “Go Live” without full volume load integrated testing
Evaluation of Management of CPR Effort
Lessons Learned (continued)

- Backload data from paper charts
- Customized order sets require physician consensus
- Train around the clock with clinicians who understand the specialty and workflow
Evaluation of Management of CPR Effort
Lessons Learned (continued)

- Standardize alert levels among CPRs
- Monitor interfaces 24x7
- Evaluate and adjust downtime procedures post implementation—Do they really work?
- **Double** testing time
- **Quadruple** support for full CPR’s
Functionality
Managing Paper—Ongoing for Years

- Scanning forms & documents; signature pads
- Balance computerized and paper-based data
- Chart Content Committee:
  - CPR content
  - Printing for internal chart review
  - Standardized paper chart for external review
Functionality
Knowledge-Based Prompting

- Drug-Drug Interaction Checking
  - Perinatal- FDB Version “S”
  - Ambulatory- FDB Version “T”
  - ED – FDB Version “U”
  - Inpatient – FDB Version “V”
  - Eclipsys SCM - Multum
Functionality
Knowledge-Based Prompting (continued)

- Treatment/Monitoring Recommendations
  - Perinatal – Yes
  - Ambulatory – Yes
  - ED – No
  - Inpatient – No
  - Eclipsys SCM – Yes
Functionality
Order / Clinical Practice Standardization

- MACS guides caregivers, speeding order entry and clinical documentation

- MACS Perinatal includes:
  - Order sets and note templates
  - Clinical pathways
  - Care plans based on risk or population group
  - Clinicians common choices and preferences (individual and departmental)
Patient Decision Support
Recognizing when patient education is needed
Workflow and Communication

In this example the tracking board is sorted by acuity. Color coding denotes acuity level. Those whose acuity is unassigned are at the top in Teal. **Black** is the most acute, followed by **red**, **blue**, **olive** and **green**.

To access the patient record, the user selects the desired patient – highlighting the row. The user selects from the tabs at the top.

Placing the pointer over an icon produces a pop up window giving the user more information at a glance.


The 2nd column displays patient name, total time in the ED, and chief complaint.

Patient location is displayed in the 1st column.

Age, sex, and visit type are in the 3rd column.

The users select from radio buttons at the bottom to update status and reset the timer in the 4th column.
Communication Tools
Pregnant patient arrives at triage and is registered.

H&P reveals a 32y patient, GA 41w+6d, G5 P2022, whose chief complaint included contractions and lower abdominal pain.

Streamed-in data from previous visits included OB US with BPP data suggesting Polyhydramnios.
Data streamed from previous visits

Demographics

Admission Information

Dating / # of Fetuses
- Working gestational age is 41 weeks + 6 days.
  - Expected date of delivery: 10/18/2002.

Chief Complaint
- The patient was assessed in triage due to contractions, lower abdominal pain.

Obstetric History
- Formula: G 5, P 2 0 2 2.
  - G - 5, Parity - 2, Term - 2, Preterm - 0, Ab - 2, LC - 2, CS - 0.

Current Pregnancy
- Obstetrical US was performed.

Gynecological History
- No known gynecological problems.

Medical History
- No known diseases at present.

Surgical History
- Past surgery: No surgery in the past.

Social History
- No social concerns.

Medications/Allergies/Immun.
- No known allergies.

Review of Systems

Family History
- No significant disease in the family.
The following ESSENTIAL items were presented (indicating the essential documentation items missing in this specific case):

- Gynecological History: No known gynecological problems.
- Medical History: No known diseases at present.
- Surgical History: Past surgery: No surgery in the past.
- Social History: No social concerns.
- Medications/Allergies/Immun.: No known allergies.

Essentials:
- BPP
- Clinical EFV
- EFM
- Current Pregnancy Serology
- Pelvic Exam
- US
- Pap Smear
- Type And Screen
- Physical Examination
presentation. BPP: fetal body-limb movements = 2, fetal tone = 2, fetal breathing movements = 2, (AFI = 21.8 cm, deepest pocket: vertical - 7.8 cm) subjective: mild polyhydramnios.

Gynecological History
- No known gynecological problems.

Medical History
- No known diseases at present.

Surgical History
- Past surgery: No surgery in the past.

Social History
- No social concerns.

Medications/Allergies/Immun.
- No known allergies

Problems
- Suggested problems:
  - Active Labor
  - Polyhydramnios

'Exists' button was pressed to the two
Suggested Problems

Diagnosed problems
- Contractions (term)
- Post Date
Thursday, October 31, 2002

- 15:25 Contractions (term) exists
- 15:25 Post Date exists
- 17:53 Active Labor exists
- 17:54 Polyhydramnios exists

Prompted after Done Sequence in completed
J. C. - Case Study

- EFM was entered = Reactive, Reassuring
- Blood Type and Screen was ordered
- Pelvic Exam was entered = Dilatation: 4 cm; SROM; Light Meconeum

The following was then presented:

![Alert: consider problem existence]

- Protracted/Arrested Dilatation: exist
- Meconium: exist

[OK] [Cancel]
Thursday, October 31, 2002

- 15:25 Contractions (term) exists
- 15:25 Post Date exists
- 17:53 Active Labor exists

Follow up

Actions & Orders

- Oxytocin Augmentation
- Continuous Monitor by Protocol

Findings
Technology

Philosophy:

- **Flexibility** (Modified “Best of Breed”)
  - Applications chosen by users, *with MIS guidance*
  - Integration, Communication, and Security are back-end standard deliverables

- **Accountability**
  - Technical Personnel assigned to applications, not technologies
  - Technical Managers responsible for insuring application support coverage
Technology

- **Philosophy:**
  - **Scalability**
    - Rolling 3 year capacity planning for all systems
    - Experience shows almost impossible to over spec storage, memory, or CPU
  - **Transferability**
    - “No Fault” Post implementation analysis
    - No single success, all projects part of evolutionary process improvement
    - Involvement from all disciplines at all phases
Technology

- De-Mystifying: The driver is healthcare solutions, not technology

- Interface Engine
- SAN (Storage Area Network)
- Enterprise Network
  - LAN
  - WAN
  - Wireless
- Intrusion Detection Systems

- Clustering
- Inter-System Communication
- Large storage
- Communications
- Security
- Redundancy
Technology

- How to deliver orders, results, & clinical information to all departments quickly and securely
- How to provide 99.999% information availability
- Data Security
- System Integrity

- Interface Engine
- Enterprise Network
  - LAN
  - WAN
  - Wireless
- SAN (Storage Area Network)
- Intrusion Detection Systems
- Clustering
Technology

- Standardization: a means to an end
- Constantly evaluating flexibility vs. supportability
- It cannot be achieved 100%
  - The process of asking the question does yield improvement in efficiency of technology support
- It’s touch can be seen in all MMC systems
- Standardization creates an inverse relationship between complexity and Total Cost of Ownership
CPR Value

- Prove return on investment:
  - Demonstrate value of the application
  - Provide qualitative and quantitative benefit statements
  - Promote awareness of process redesign, cultural and organizational issues
  - Integrate people, process and technology
  - Initiate a smarter implementation

- Organizational objectives:
  - Patient safety – clinical excellence
  - Humane, patient-focused, patient-centered care
  - Strengthen physician collaboration through effective communication
  - Supportive environment for physicians
  - Strengthen teaching and research
  - Fiscal viability
## CPR Return on Investment

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPR’s Ancillary; Enterprise Network Interface Engine</td>
<td>$43,909</td>
</tr>
<tr>
<td>Capital Reimbursement</td>
<td>$(7,250)</td>
</tr>
<tr>
<td>Grants</td>
<td>$(4,962)</td>
</tr>
<tr>
<td>Net Cost</td>
<td>$31,697</td>
</tr>
<tr>
<td>Ongoing Expenses</td>
<td>$58,086</td>
</tr>
<tr>
<td>Savings and Efficiencies</td>
<td>$75,876</td>
</tr>
<tr>
<td>Payback (years)</td>
<td>3.84</td>
</tr>
<tr>
<td>ROI</td>
<td>9.4%</td>
</tr>
</tbody>
</table>
CPR Return on Investment

- **Patient Safety**
  - Warns clinicians of safety checks required for High Alert medications
  - Ensures safe selection of confusing look-a-like, sound-a-like drug names
  - Verifies the selection of the correct patient
  - Reduces the number of adverse drug reactions
  - Improve medication turnaround time
  - Reduces pharmacy’s drug expenditure; drug spending for 1999-2002 has remained below National Average
The prescriber is required to check the patient’s serum creatinine and age.

After review of the serum creatinine and age, the prescriber may safely proceed to order Metformin.
Patient Safety – High alert medication, *cont.*

- Pharmacists similarly review patient’s serum creatinine and age, intervening with prescriber if necessary.
When viewing the medication index, look-a-like, sound-a-like medications are highlighted in different colors.

<table>
<thead>
<tr>
<th>HYCODAN</th>
<th>HYDROXYUREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYDERGINE LC</td>
<td>HYDROXYZINE</td>
</tr>
<tr>
<td>HYDRAZIDE</td>
<td>HYGROTON</td>
</tr>
<tr>
<td>HYDREA</td>
<td>HYPERALIMENTATION</td>
</tr>
<tr>
<td>HYDROCICHALIC ACID</td>
<td>HYPO-TEARS</td>
</tr>
<tr>
<td>HYDROCHLOROTHIAZIDE</td>
<td>HYSKON</td>
</tr>
<tr>
<td>HYDROCIL</td>
<td>HYTAKEROL</td>
</tr>
<tr>
<td>HYDROCODONE</td>
<td>HYTONE</td>
</tr>
<tr>
<td>HYDROCORTISONE</td>
<td>HYTRIN</td>
</tr>
<tr>
<td>CREAM/OINT/ENEMA</td>
<td>HYZARA</td>
</tr>
<tr>
<td>HYDROCORTISONE</td>
<td></td>
</tr>
<tr>
<td>HYDRODIURIL</td>
<td></td>
</tr>
<tr>
<td>HYDROMORPHONE</td>
<td></td>
</tr>
<tr>
<td>HYDROXYPROPYL-METHYL-CELLULOSE</td>
<td></td>
</tr>
</tbody>
</table>

- After selecting the desired medication, its indication for use is displayed to further alert clinicians of the intended use.
The prescriber selects a patient from the inpatient screen.

After selecting the patient, additional specific information appears. “Is This The Correct Patient?” must be answered.
As the number of pharmacist’s clinical interventions increases, the number of adverse drug reactions decreases (optimizing medication use reduces the number of adverse drug reaction reports).
CPR Return on Investment

Efficiency / Patient Focused Care

*Medication Turnaround Time*

- Time from when order is initiated until Pharmacy acknowledges order
- Time for Pharmacist to process order
- Time for prescription to be filled and delivered to patient area.
- TOTAL TIME REQUIRED
CPR Return on Investment

**Fiscal Viability**

CPOE Cost Avoidance Initiatives

- Medication Ordering Pathways
- Dosage Modifications
- IV to PO
- IV Push
- Therapeutic Interchange

MMC actual dollar expenditures

- $10,516,953
- $11,158,487
- $11,562,929*
- $12,296,652**
- $14,202,633*

Adjusted expenditures that reflect annual budget increase on drug purchases experienced by Non-Federal Hospital

- Projected expenditures for 2002
- Projected expenditures based on data from first 6 months of 2001
CPR Return on Investment

- Efficiency / Patient Focused Care

*Laboratory Tests 1996 - 2001*
CPR Return on Investment

- Patient Focused Care

Radiology Turnaround Time to Final Report
CPR Return on Investment

Fiscal Viability

Radiology Department Monthly Comparison of Procedures
1999; 2000; 2001; 2002
CPR Return on Investment

- Patient Satisfaction

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
</tr>
</thead>
<tbody>
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<td>CPR Return on Investment</td>
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</tr>
<tr>
<td>70%</td>
<td>85%</td>
<td>84%</td>
<td>63%</td>
<td>67%</td>
<td>73%</td>
<td>84%</td>
</tr>
</tbody>
</table>

- Information/Communication/Education
- Transition and Continuity
- Satisfaction with Admissions/Registration
- Overall Medical/Surgical Patient Satisfaction
- Likelihood to Recommend

CPR Return on Investment

- Patient Safety / Regulatory Compliance

  The Ambulatory CPR:
  - Improved compliance with problem lists from 67% to 97%
  - Improved allergy documentation from 88% to 100%
  - Improved pain assessment documentation to 95%
  - Improved medication list documentation from 67% to 100%
## CPR Return on Investment

### Patient Access

<table>
<thead>
<tr>
<th>Year</th>
<th>Length of Stay Reduction</th>
<th>Discharges</th>
<th>Incremental Discharges vs. Base Year</th>
<th>Discharges Attributed to MACS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td></td>
<td>28,356</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1996</td>
<td>.56</td>
<td>30,200</td>
<td>1844</td>
<td>461</td>
</tr>
<tr>
<td>1997</td>
<td>.91</td>
<td>32,150</td>
<td>3794</td>
<td>949</td>
</tr>
<tr>
<td>1998</td>
<td>.05</td>
<td>33,148</td>
<td>4792</td>
<td>1198</td>
</tr>
<tr>
<td>1999</td>
<td>.26</td>
<td>35,493</td>
<td>7137</td>
<td>1784</td>
</tr>
<tr>
<td>2000</td>
<td>.23</td>
<td>35,687</td>
<td>7331</td>
<td>1833</td>
</tr>
<tr>
<td>2001</td>
<td>.17</td>
<td>35,626</td>
<td>7270</td>
<td>1818</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2.21</strong></td>
<td><strong>230,660</strong></td>
<td><strong>32,168</strong></td>
<td><strong>8043</strong></td>
</tr>
</tbody>
</table>
CPR Return on Investment

- Fiscal Viability

Cash 1996 – 2001 (in millions)

- POE
- PACS & RAD
- TSI, Reinstallation of Patient Accounting
- Med Admin
- Ambulatory EMR
- Emergency EMR
- Obstetrical EMR

Dec-96, Dec-97, Dec-98, Dec-99, Dec-00, Dec-01
Vision For Future

- Expand patient safety initiatives
- Expand decision support and knowledge documentation CPRs
- Break Ground New Hospital – planning to become a Digital Hospital
  - OR/Anesthesia Records
  - Virtual Imaging Radiology
  - Clinical Equipment Integration CPR, physiological, images, audio
  - Physical plant computers