Role of IT in Dialysis and How it has evolved

George Rovegno
MIQS Software

Why we need IT/EMRs

Medical Record Architecture Traditional Record Evolved

- Functional
- Time Oriented
- Problem Oriented
- Note intensive
- **An EMR cannot and should not be a digitized paper record**

A new architecture

- Patient-centered NOT user-centered
- All data available at the point of care
- In a single place
- Single entry
- Deliver care + maintain data + drive revenue
- Serve medical, nursing, administrative and financial needs

Rationale for a New Approach

ORIGINS – 1977

"Treatment of patients with chronic renal diseases demands that the physician understand and handle a complicated interplay of many events. Effective treatment by chronic dialysis and transplantation has increased the complexity of tracking clinical events and interrelating clinical, laboratory, and therapeutic data".

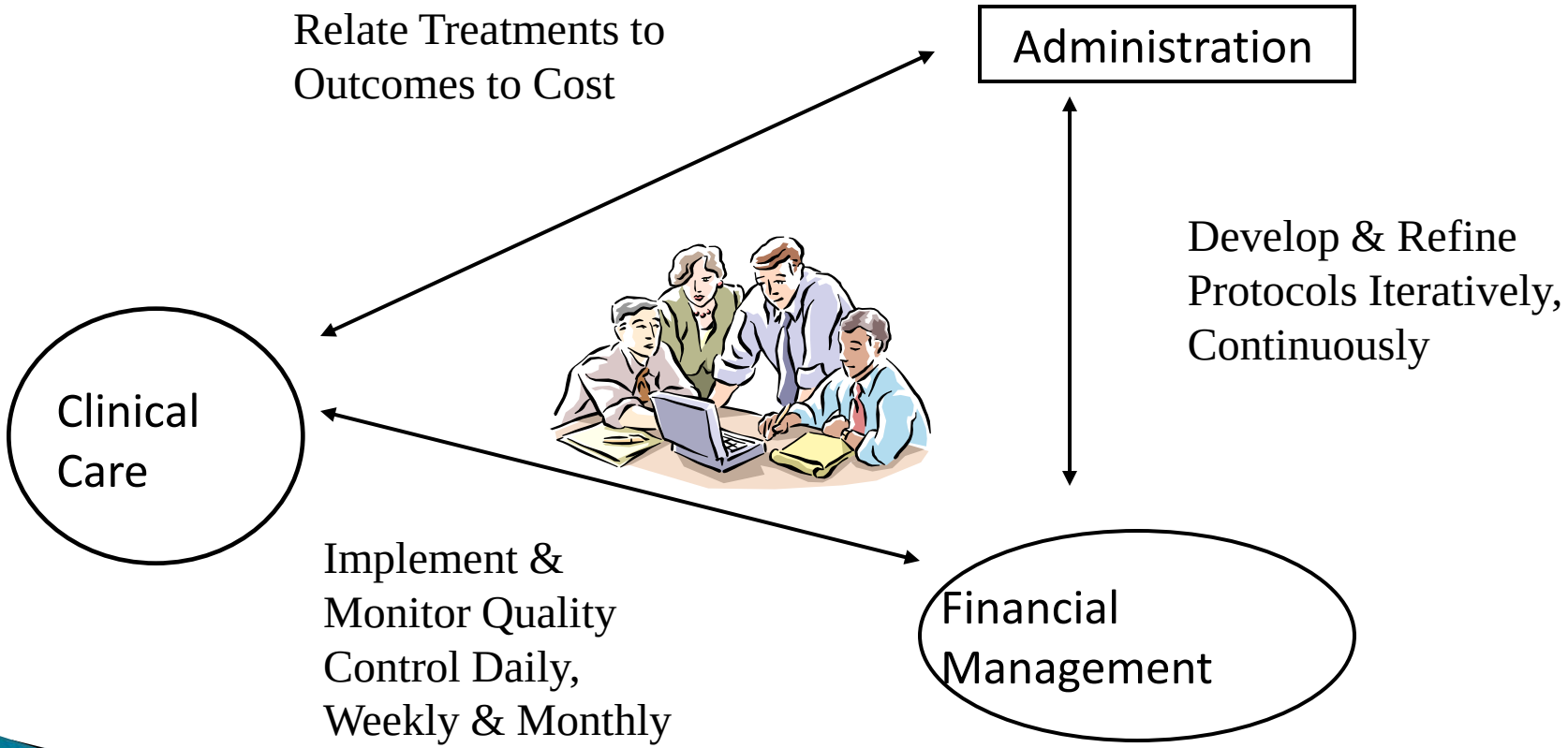
"Better data handling in … renal disease, is clearly needed".

Pollak VE, Buncher CR, Donovan ER. *Arch Int Med* 137:446–456, 1977

We spend 80% of our health care dollars on chronic diseases but EMRs overwhelmingly focus on acute care and office-based practices.

An Integrated Approach

A Process-Oriented Medical Record…



Dialysis IT

- Dialysis was too small to cause specialized technology “inventions”
- Dialysis exploited the evolution, availability and power of tech advances.

Exploit technology advances

- 1972 – relational database “invented” to improve flat field data collection/storage
- “Main Frame” computers too expensive for clinical use
- Minicomputers arrive in the 1970s – Digital Equipment PDP-8 then PDP-11
- Late 1970s Commodore, Sinclair, Radio Shack, APPLE

Exploit technology advances (2)

- 1981: The IBM PC
- Medium sized machines like the CDC VAX and HP “minis”
- “Terminals” to access databases – terminal/server application Menu driven – text
- GUIs – Mac & Windows
- Late 1980s – Client/Server applications
- Each advance was applied to healthcare

Exploit technology advances (3)

- Prices dropped
- Good supply of skilled developers from educational programs
- Scanners, Printers, laptops, hand held devices
- Java, web apps
- Ubiquity of computers in the hands of all
- “You ain’t seen nothing yet

EMR Technology evolution & MIQS

New manual medical record, 1972–1976

New computer medical record 1976–1981

PDP 11/70 with 256,000 bytes of memory

A resource-sharing time-sharing extended (RSTS/E) system available 24 hours a day, seven days a week.

The language is BASIC+.

Pollak, VE. *Arch Int Med* 137:446-456,1977

EMR Technology evolution & MIQS

New computer medical record 1982-90

Digital Equipment VAX 11/780

Memory 4MB increased to 8MB
Disc storage 636MB
VT240 terminals

Custom developed software of Dialysis Clinics, Inc.

The language is BASIC+

Data analysis: Digital Equipment Datatrieve

Robson MR, et al. *Am J Nephrol*. 6:10l-l06, 1986

Prerequisites for a New Record
Exploiting what's available

- Client/server architecture with distributed processing
- Relational database
- Centralized database available to all users, with remote access
- User friendly for physicians, nurses, and other caregivers
- Fast workstations
- Open systems to facilitate data transfer to and from other databases
- High level of security for clinical and financial information
- Integrated electronic mail for secure communication about patients

Benefits of CPR for Dialysis

- Radically reduced paperwork, with integrated, single-entry data management
- Complete elimination of double-entry and hand transfer of data
- Legible orders immediately available anywhere, displayed automatically
- Elimination of need to seek data stored separately on paper; immediate access to stored documents
- Immediate access to entire patient record in dialysis unit, hospital, office, home
- Automated download of laboratory tests eliminates time wasted in calling for, entering and checking lab results
- Automated generation of dialysis schedules
- Automated notification of needed future actions (e.g., chest X-ray in a year)

EMR Technology evolution & MIQS

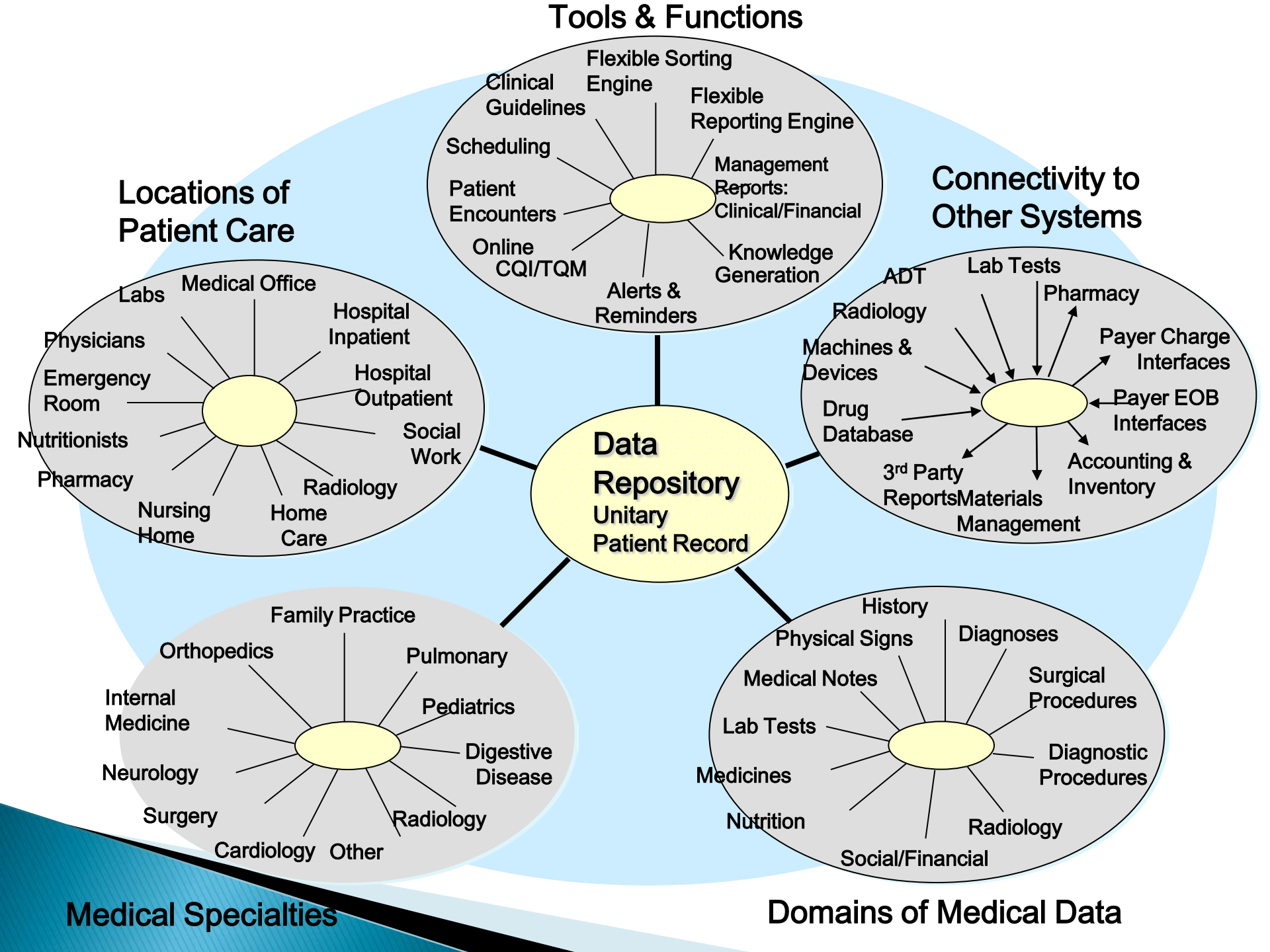
1990-Present

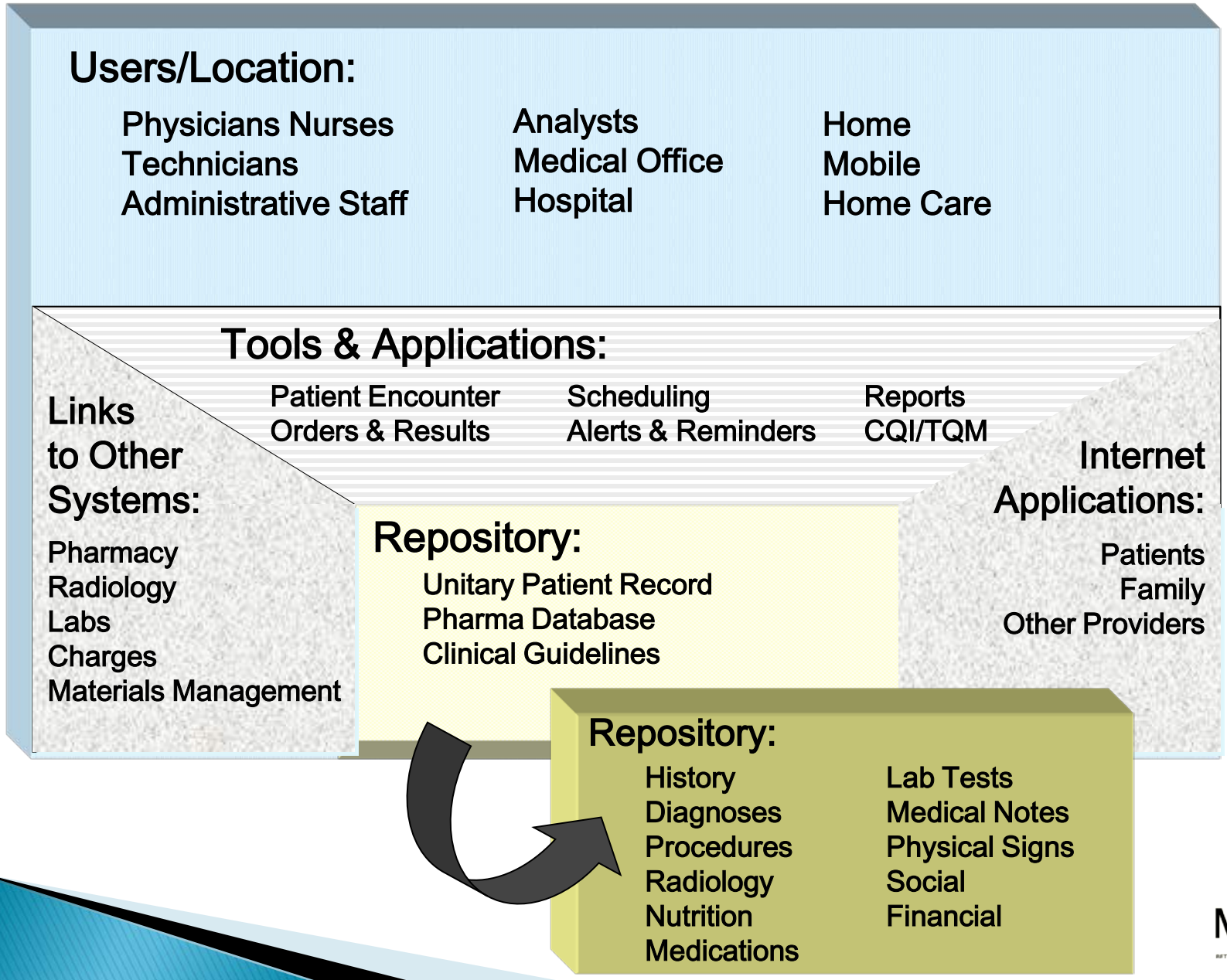
Client-Server using relational database

Sybase® SQL Server/Adaptive Server Enterprise

MAC and Windows Clients

TCP/IP
Power of hardware, functionality of software exploads

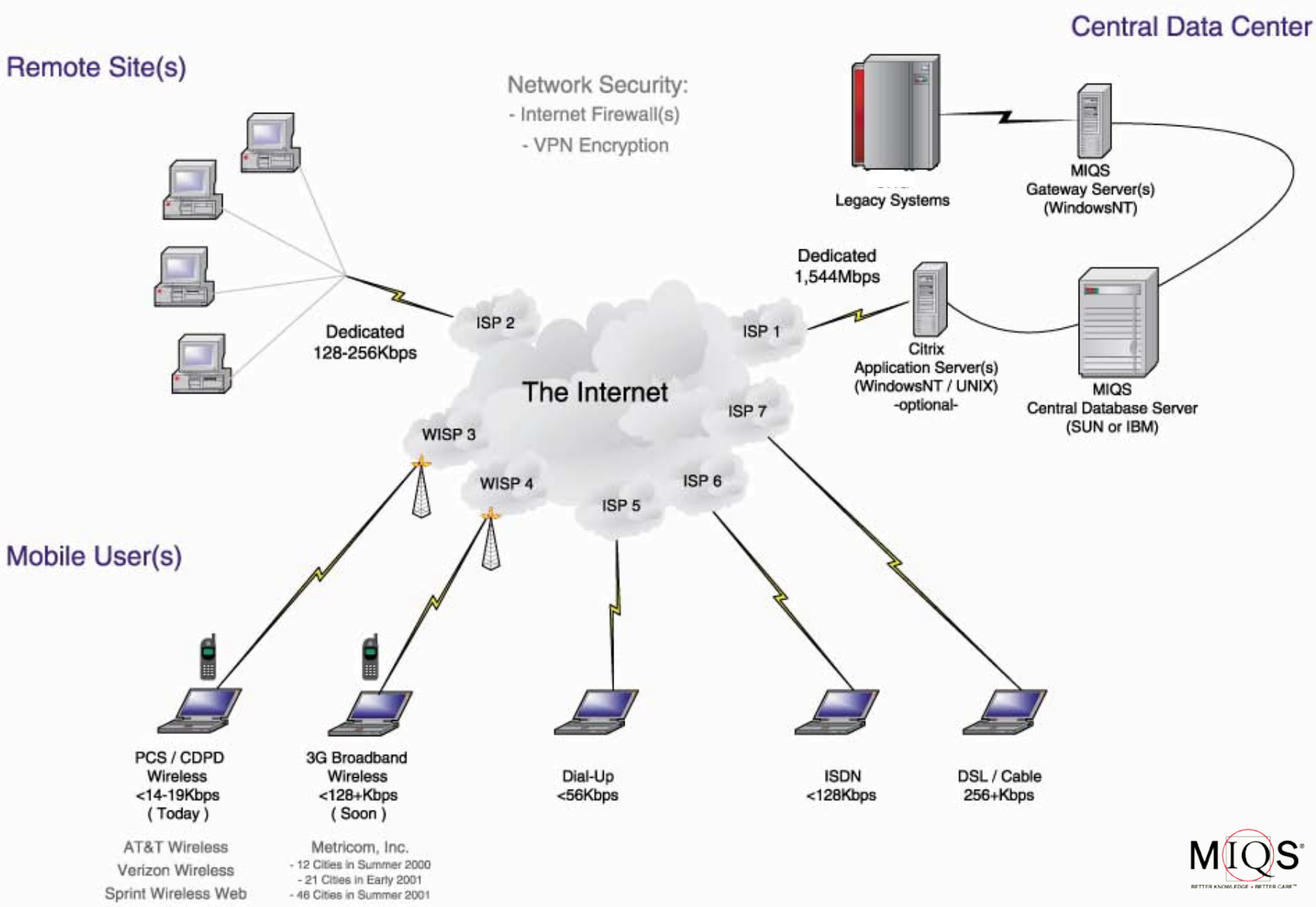

Tools & Functions
Flexible Sorting Engine
Clinical Guidelines
Flexible Reporting Engine
Scheduling
Management Reports: Clinical/Financial
Patient Encounters
Online CQI/TQM
Knowledge Generation
Alerts & Reminders
Locations of Patient Care
Labs
Medical Office
Hospital Inpatient
Physicians
Emergency Room
Hospital Outpatient
Nutritionists
Social Work
Pharmacy
Radiology
Nursing Home
Home Care
Connectivity to Other Systems
ADT
Lab Tests
Pharmacy
Radiology
Payer Charge Interfaces
Machines & Devices
Payer EOB Interfaces
Drug Database
Accounting & Inventory
3rd Party Reports
Materials Management
Data Repository
Unitary Patient Record
Family Practice
Orthopedics
Pulmonary
Internal Medicine
Pediatrics
Digestive Disease
Neurology
Surgery
Radiology
Cardiology
Other
History
Physical Signs
Diagnoses
Medical Notes
Surgical Procedures
Lab Tests
Diagnostic Procedures
Medicines
Nutrition
Radiology
Social/Financial
Medical Specialties
Domains of Medical Data


Users/Location:
Physicians Nurses
Technicians
Administrative Staff
Analysts
Medical Office
Hospital
Home
Mobile
Home Care
Tools & Applications:
Patient Encounter
Orders & Results
Scheduling
Alerts & Reminders
Reports
CQI/TQM
Links to Other Systems:
Pharmacy
Radiology
Labs
Charges
Materials Management
Internet Applications:
Patients
Family
Other Providers
Repository:
Unitary Patient Record
Pharma Database
Clinical Guidelines
Repository:
History
Diagnoses
Procedures
Radiology
Nutrition
Medications
Lab Tests
Medical Notes
Physical Signs
Social
Financial

Dialysis equipment

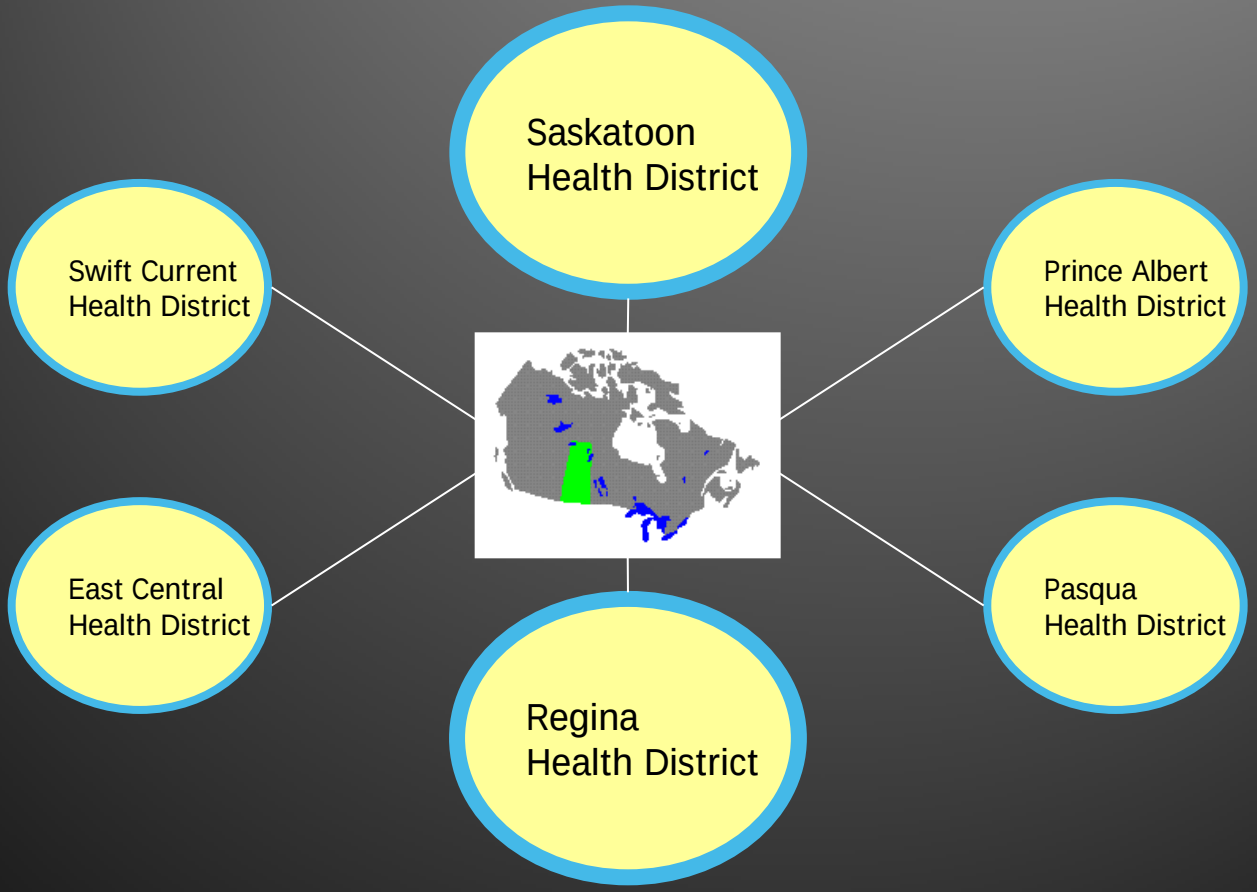
- Inherent use of therapeutic equipment makes connection of machines and EMRs mandatory.
- Saves staff time & effort
- Improves accuracy & care quality
- Other medical equipment interfaced with computers is largely diagnostic & not “real-time”

MIQS Sample Remote Access Architecture



Saskatchewan Health Information Network

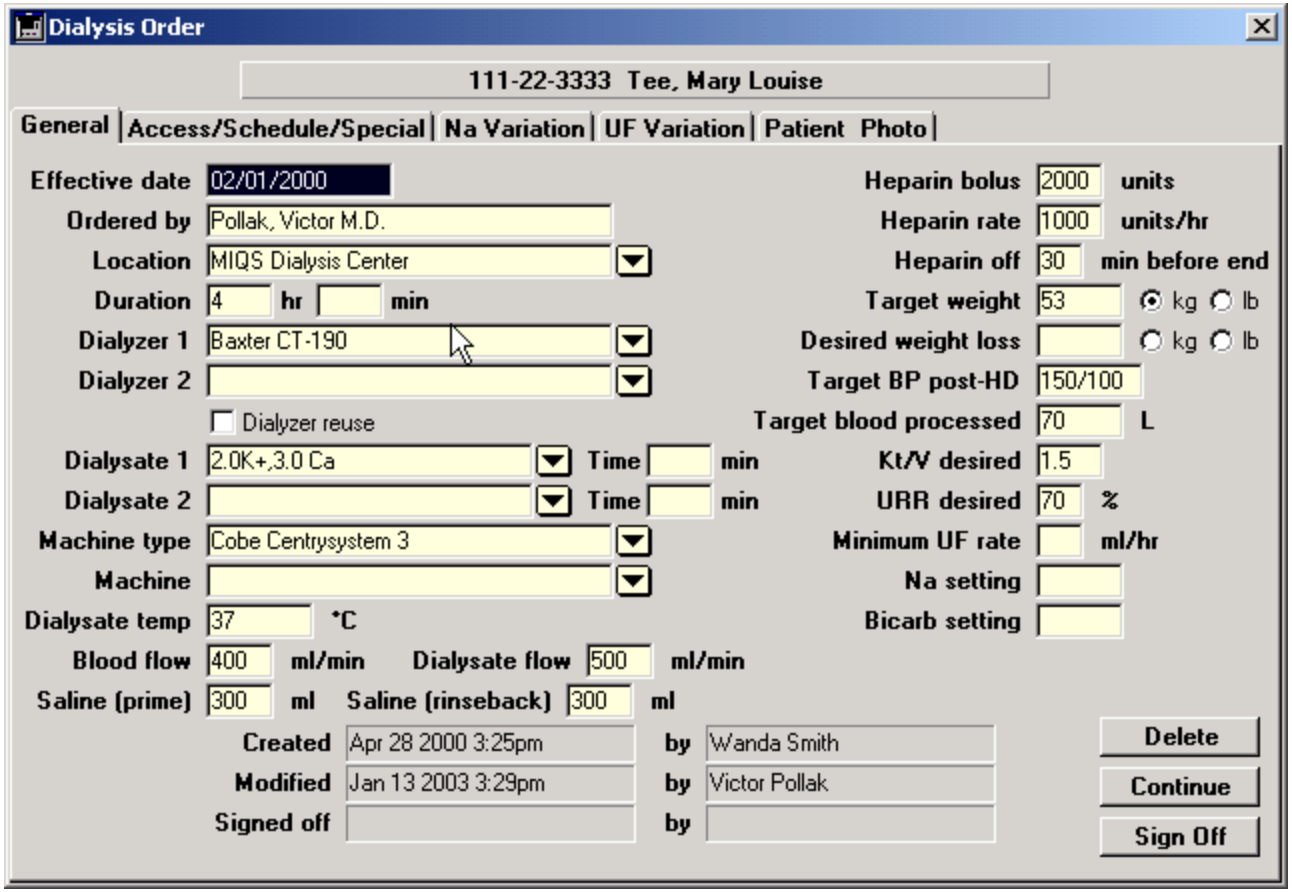
Life-time Data Available everywhere



Workflow management

- Guided by the computer
- Follow the tabs
- Enforces consistent procedures
- Prevents overlooking details

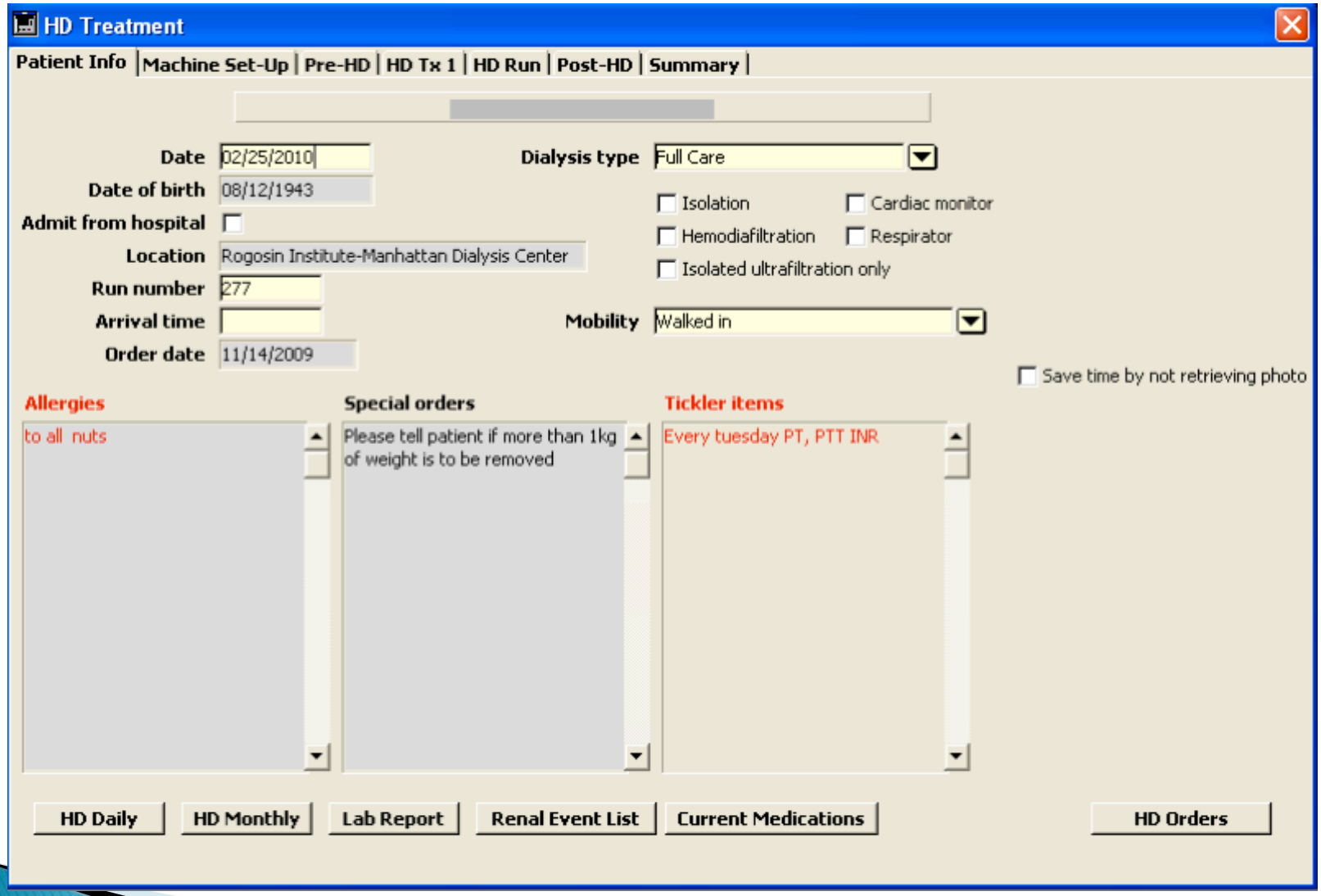
MIQS: HD Orders - 1



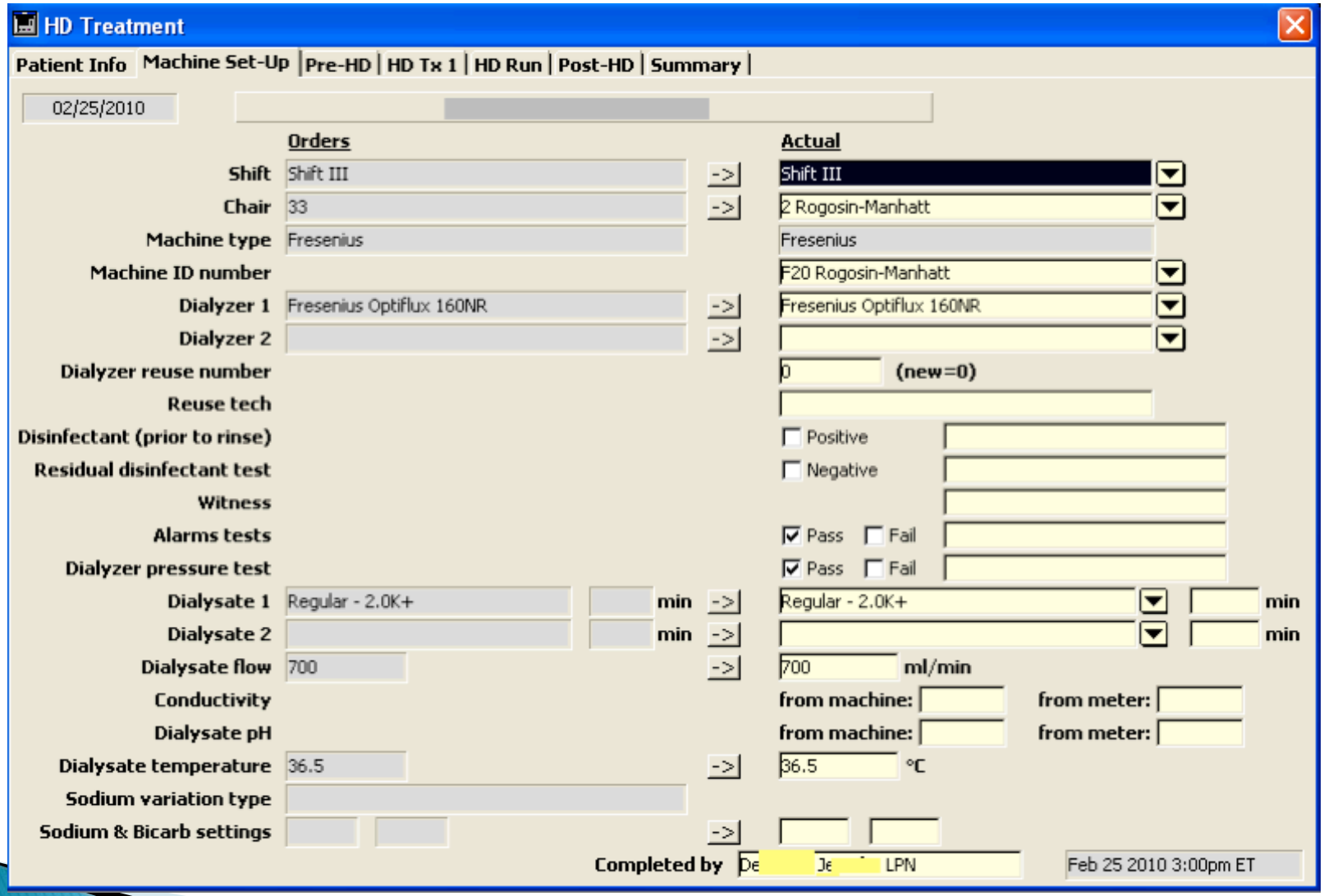
Many entries are made from standard or user defined pop-up lists (▼)

"Target or Desired" orders make it possible to measure performance delivered against performance expected: Weight, BP, Blood Processed, Kt/V & URR

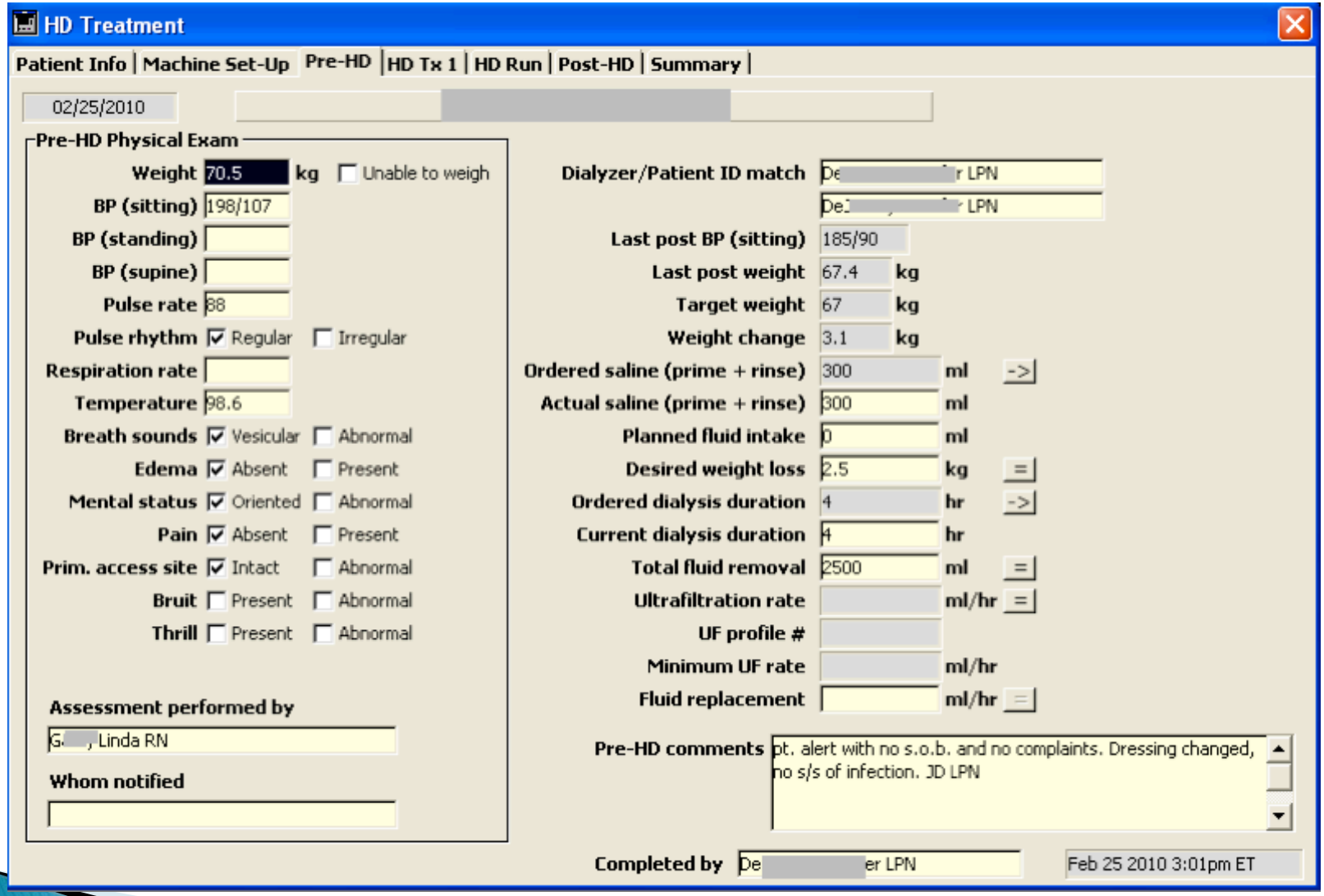
HD Treatment Screens -1



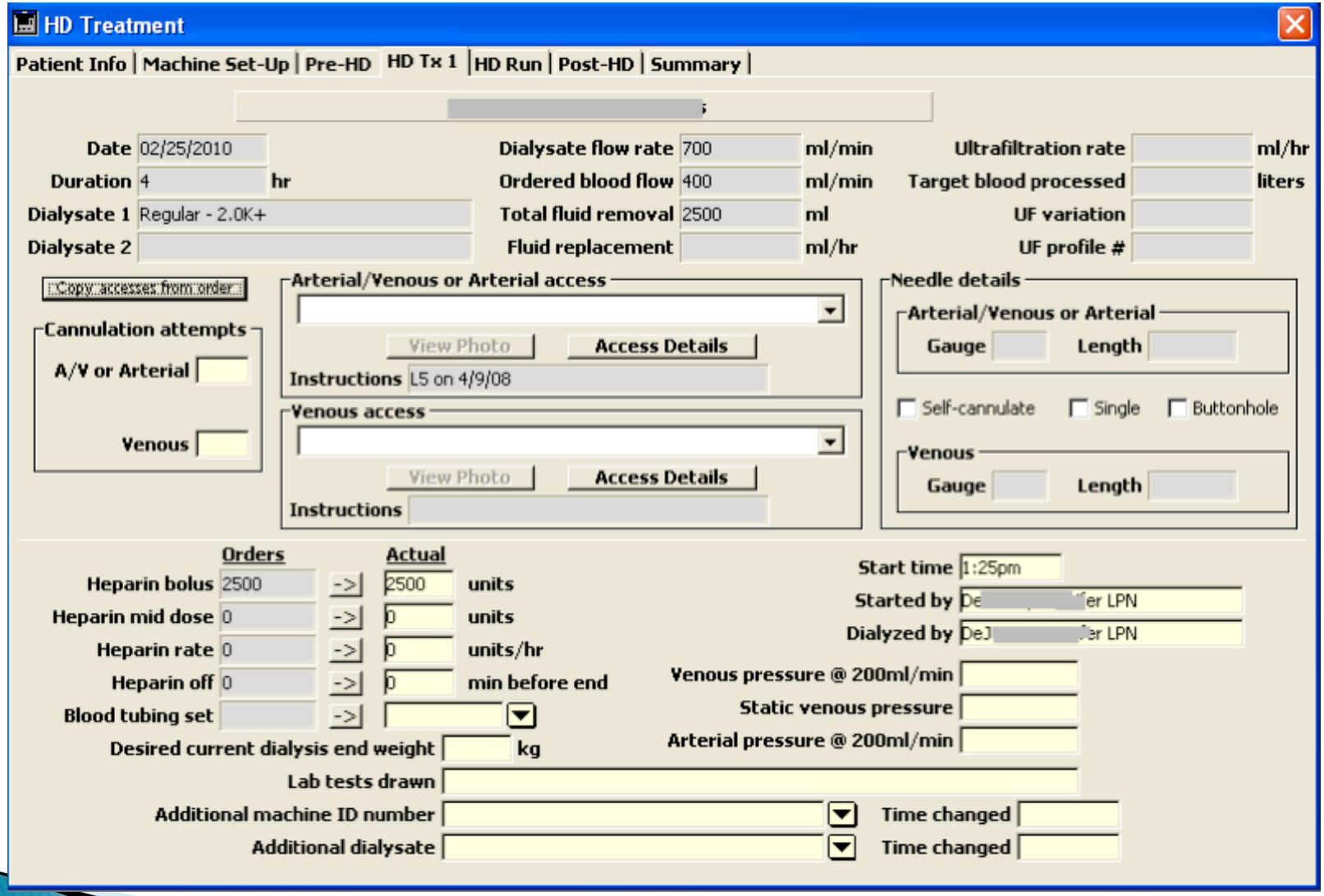
HD Treatment Screens -2



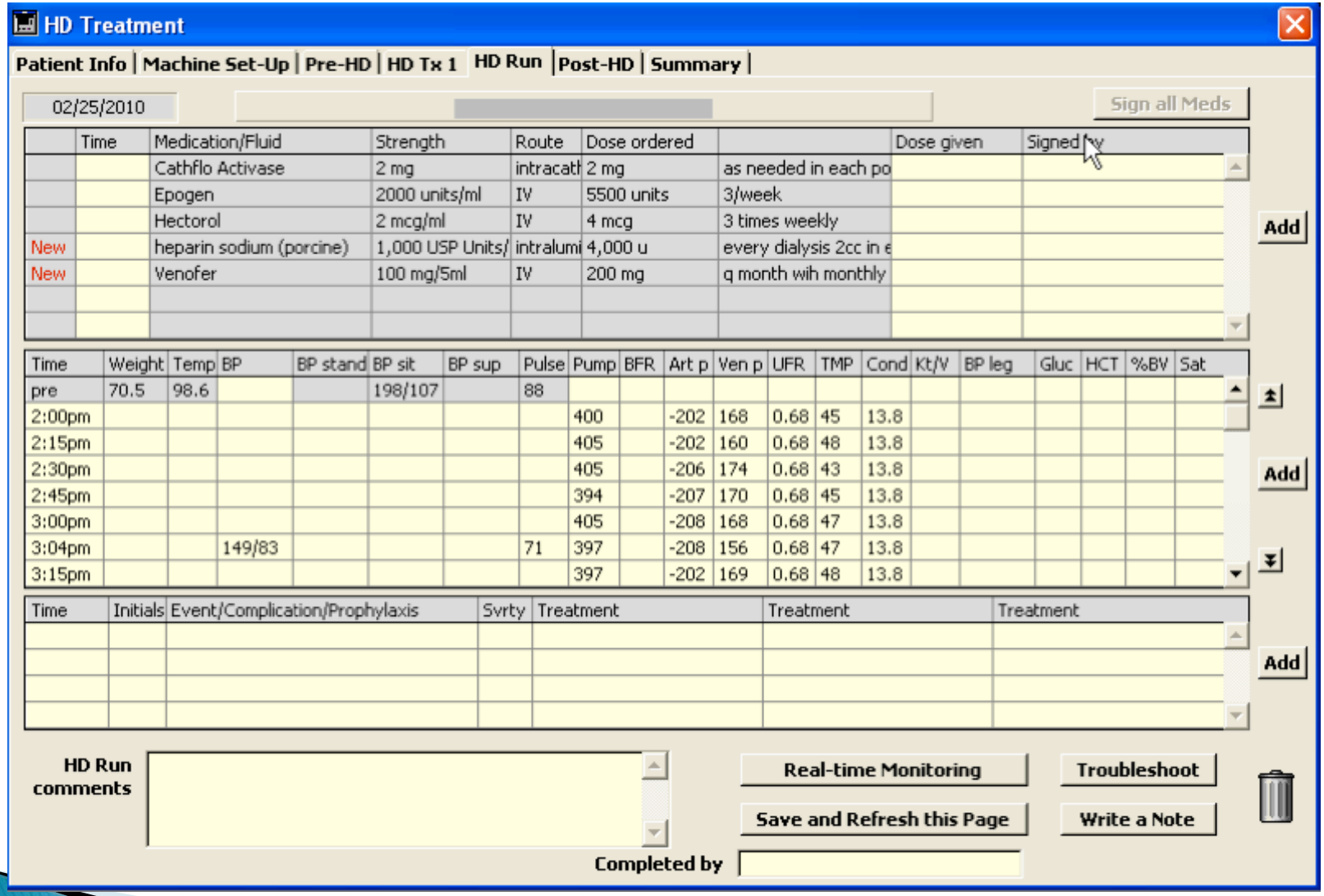
HD Treatment Screens -3



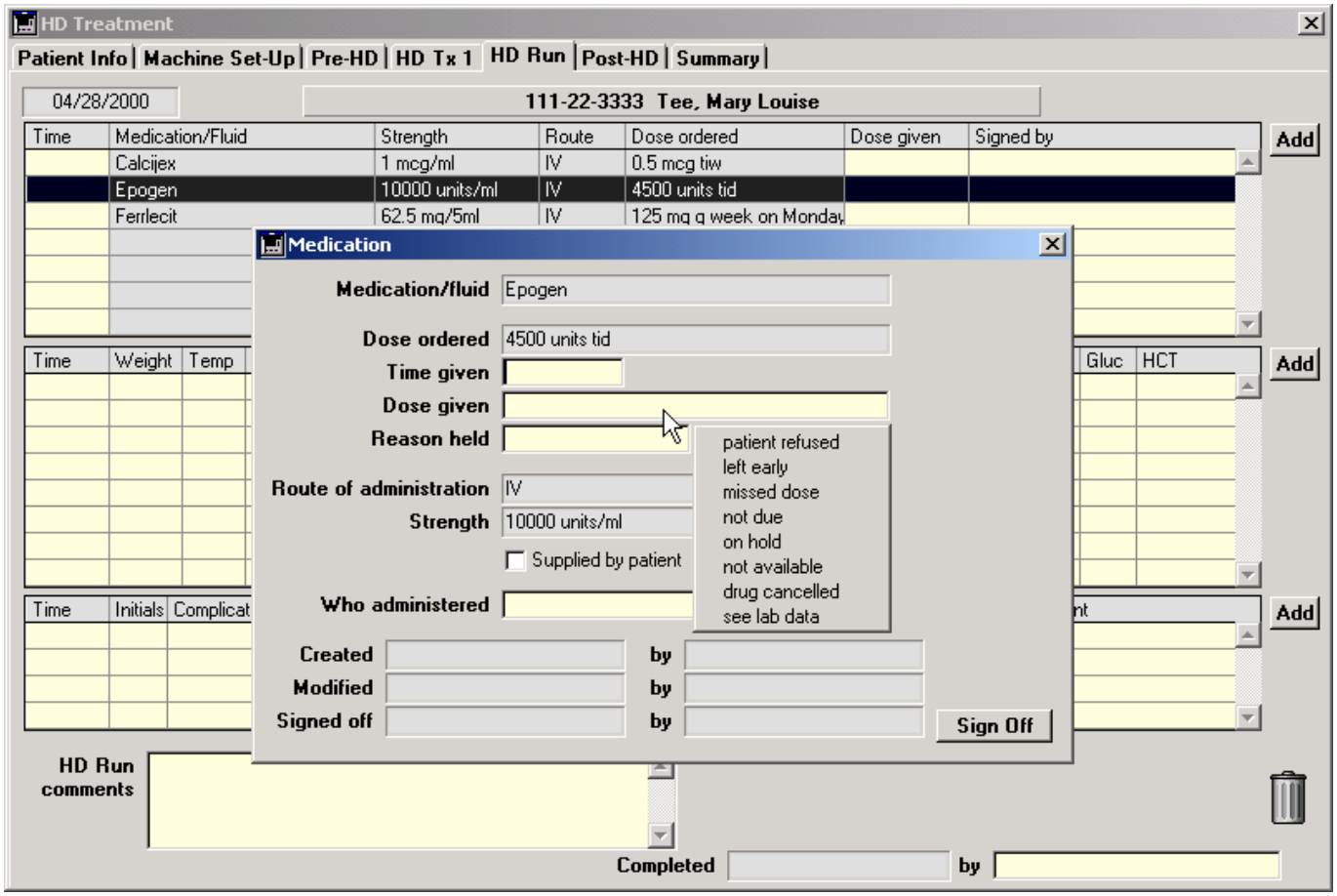
HD Treatment Screens -4



HD Treatment Screens -5



Giving EPO During HD Run

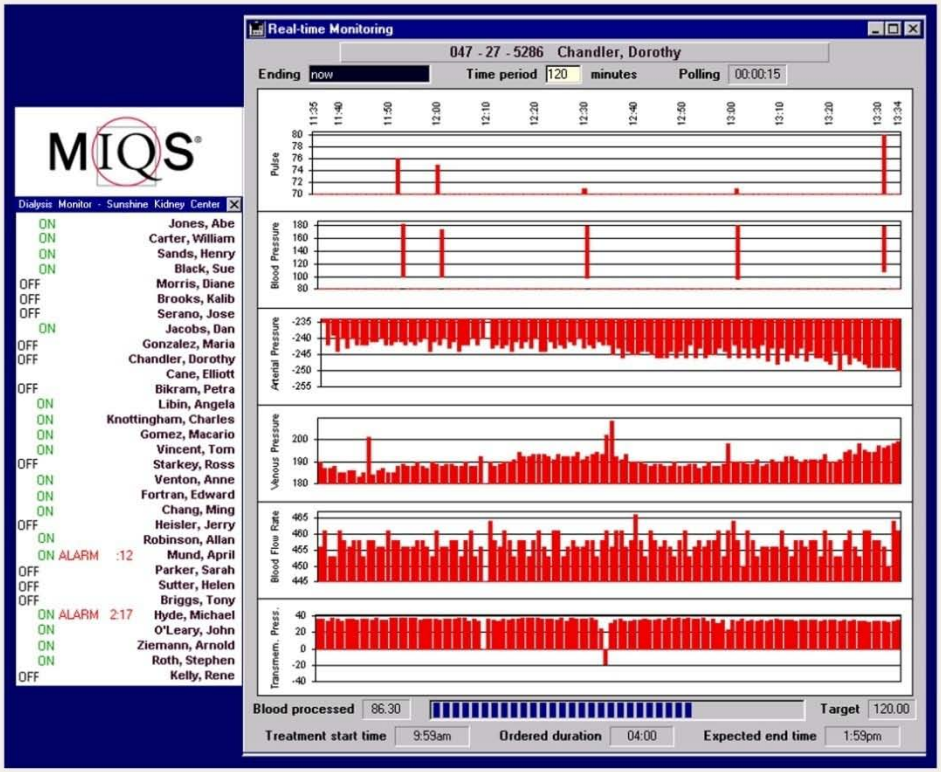


An EPO Order on the HD Run Screen

Nurse records either dose given or reason not given, and signs off

HD Monitoring

Real-Time Monitoring Made Simple
from Any Dialysis Machine



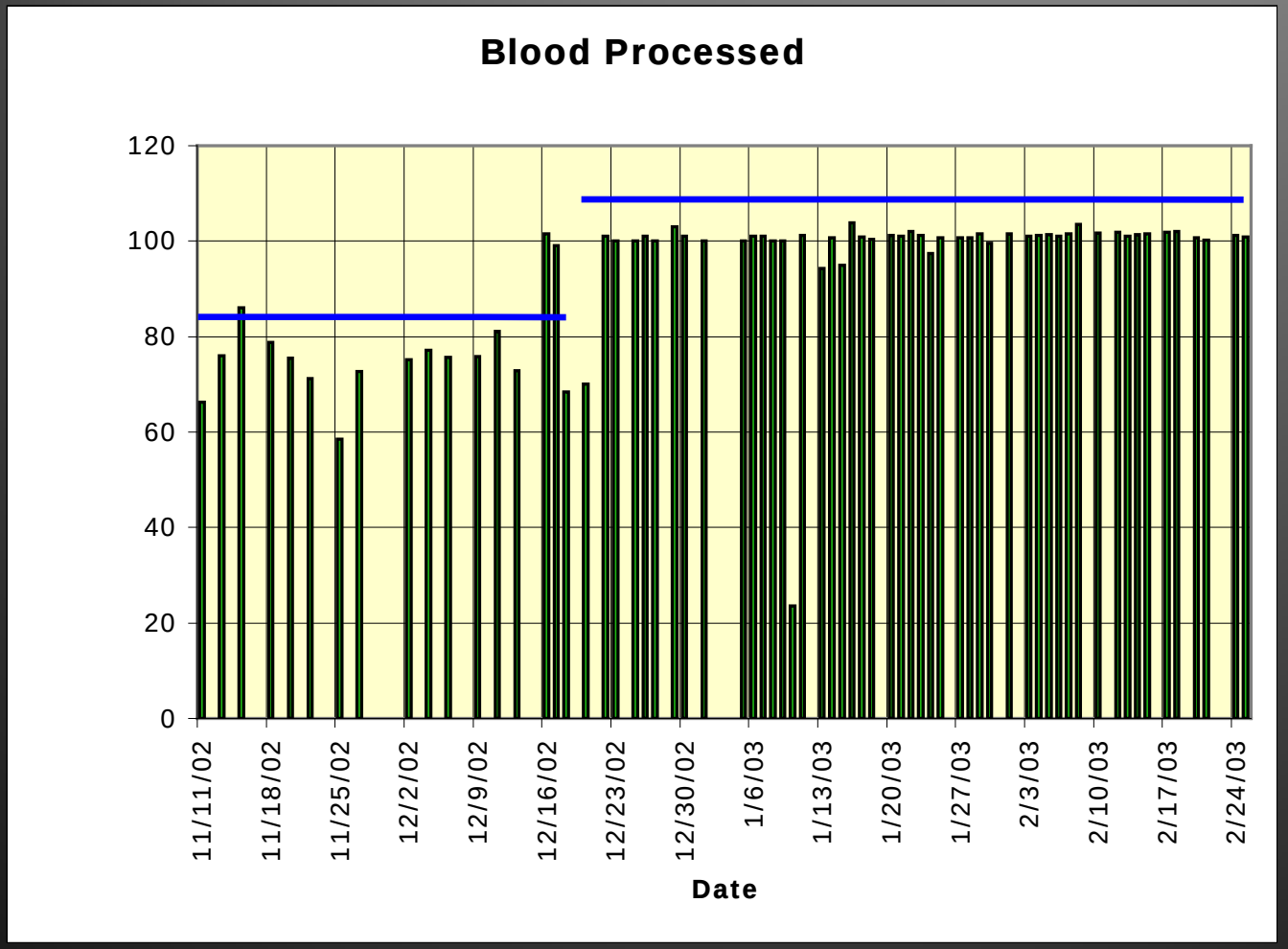
Used to Monitor Patients Dialyzing

- In the dialysis unit
- At home, by nocturnal self dialysis
- In the ICU / CCU, from the main hospital unit
- In distant “satellite” units, from the main dialysis unit

MIQS

Disease Manager Plus

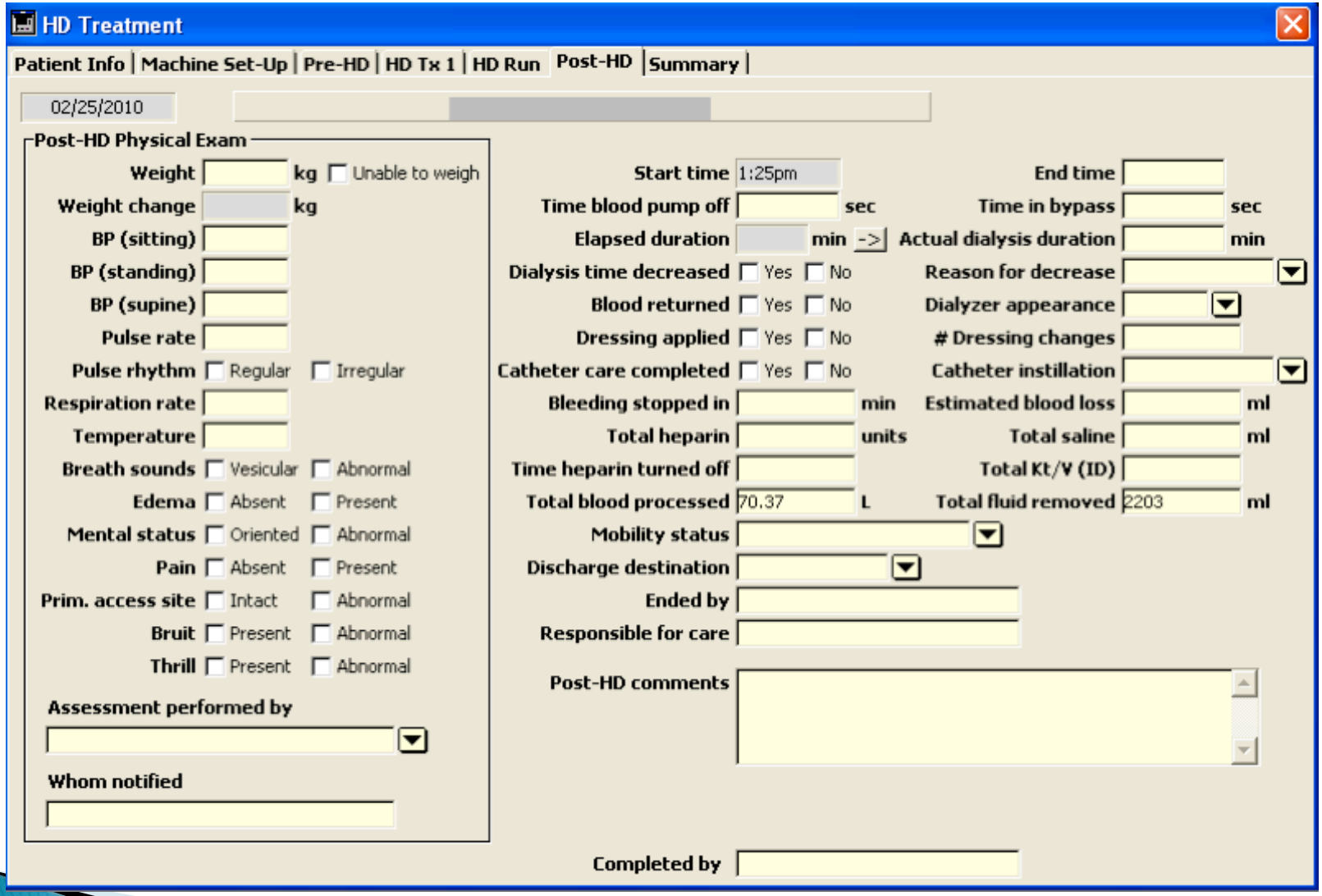
HD Monitoring w/ Data Capture



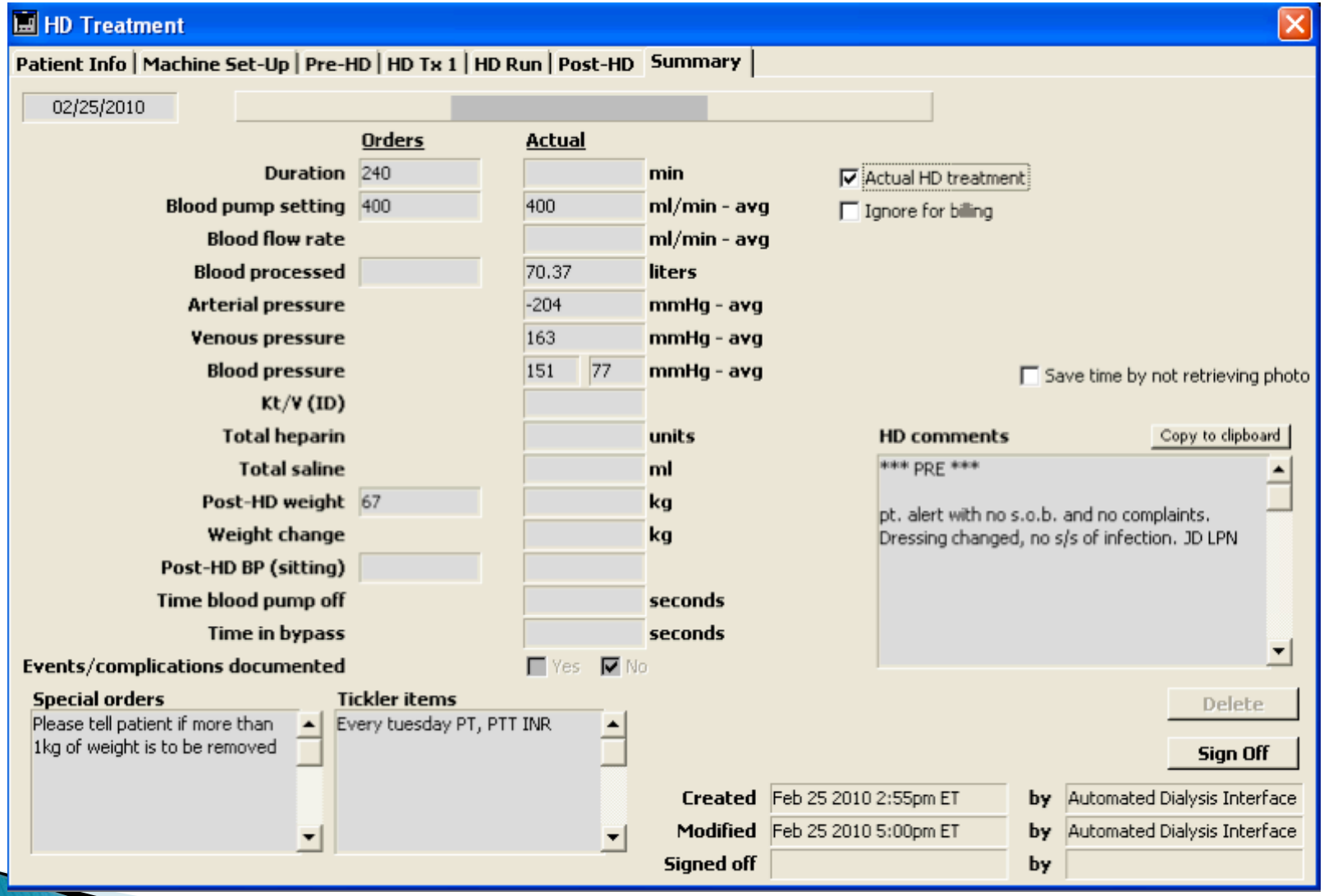
←Target blood processed

In Center HD ↑ Home Nocturnal HD

HD Treatment Screens - 6



HD Treatment Screens - 7



Checking prescription delivery at HD Sign off

Nurse Signs off at End of HD Treatment

A warning appears if something was ordered and not recorded as given.

Some “Recent” Billing issues in Dialysis

- Demands coordination of clinical and administrative staff
- Jan ‘98 - Place URR on the dialysis bill
- Jul ‘03 - Place Hct on bill for patients on EPO
- Jan ‘04 - Document & bill for MCP capitation (MDs)
- Jan ‘05 - Place height & weight on dialysis bill
- Apr ‘05 - Case mix payments for services
- Late ‘05 - Other mandates under CMS conditions for coverage

Billing requires patient-specific time-sensitive clinical data

- and the complexity of data needed is increasing.

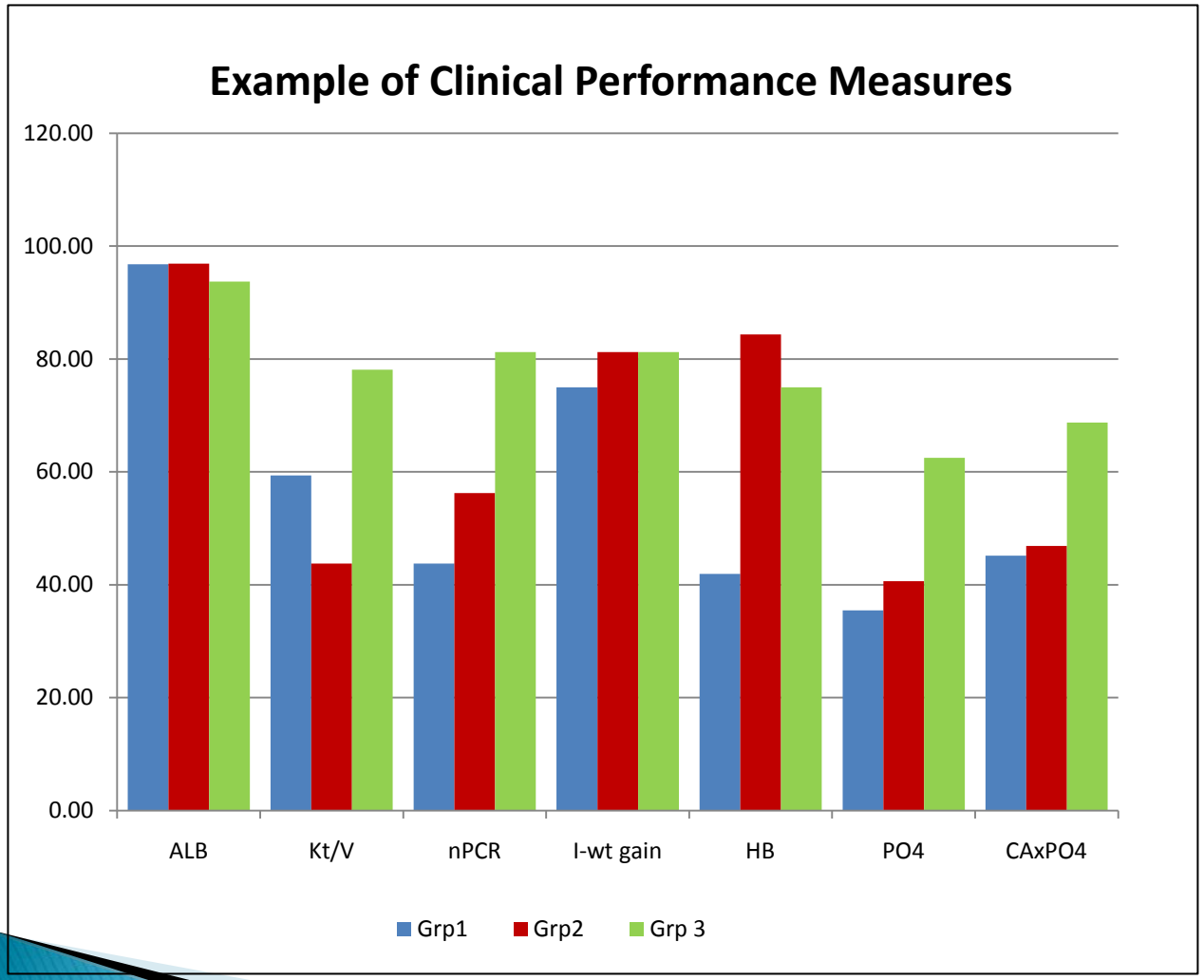
More Reporting

- CMS issued two new regulations on January 29, 2010. These will require providers to report dialysis adequacy, infection, and vascular access results and values on all ESRD claims with dates of service on or after July 1, 2010.

Bundling

- January 1, 2011 ?
- Final regulations?
- Requirements met to be properly paid
- 26 CPMs – CrownWeb
- Accountable through incentives and penalties for e.g. low fistula rates and high central venous catheter rates.

Monitoring Outcomes and Alerts
Clinical Performance Measures



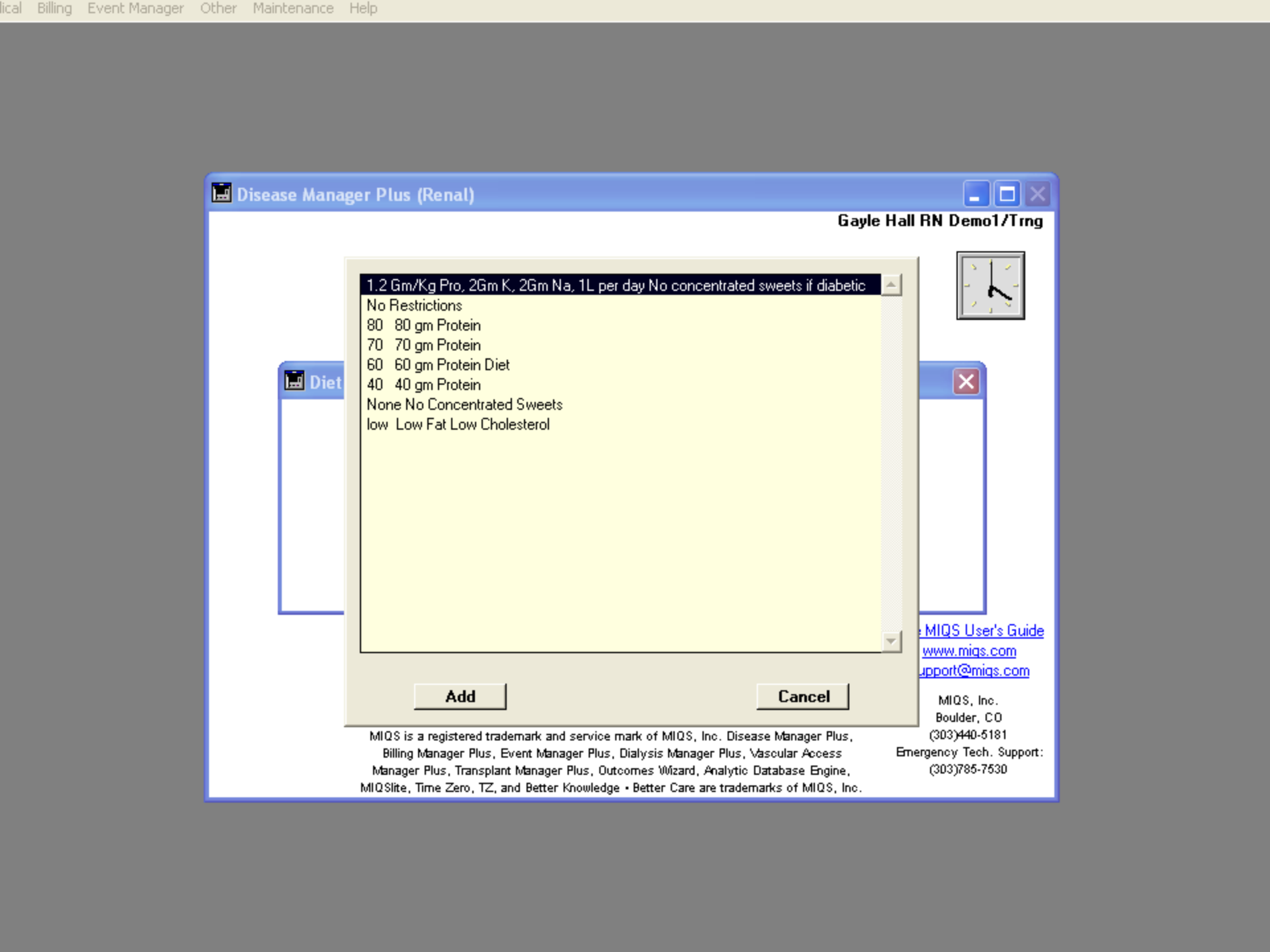
1. Extract data
2. Chart performance measures
3. Monitor & Improve patient care

EMRs have something for everyone

- Dietician
- Social Worker
- Repair/Service Technician
- Reuse Tech
- Patient Care Technician
- Physician & Nursing staff
- Integrated single database – the whole choir sings from the same hymnal

Dietician

- Diet Orders
- Assessments
- Plan of Care
- Care Plan reviews


ical Billing Event Manager Other Maintenance Help
Disease Manager Plus (Renal)
Gayle Hall RN Demo1/Trng
1.2 Gm/Kg Pro, 2Gm K, 2Gm Na, 1L per day No concentrated sweets if diabetic
No Restrictions
80 80 gm Protein
70 70 gm Protein
60 60 gm Protein Diet
40 40 gm Protein
None No Concentrated Sweets
low Low Fat Low Cholesterol
Add
Cancel
Diet
MIQS User's Guide
www.miqs.com
upport@miqs.com
MIQS, Inc.
Boulder, CO
(303)440-5181
Emergency Tech. Support:
(303)785-7530
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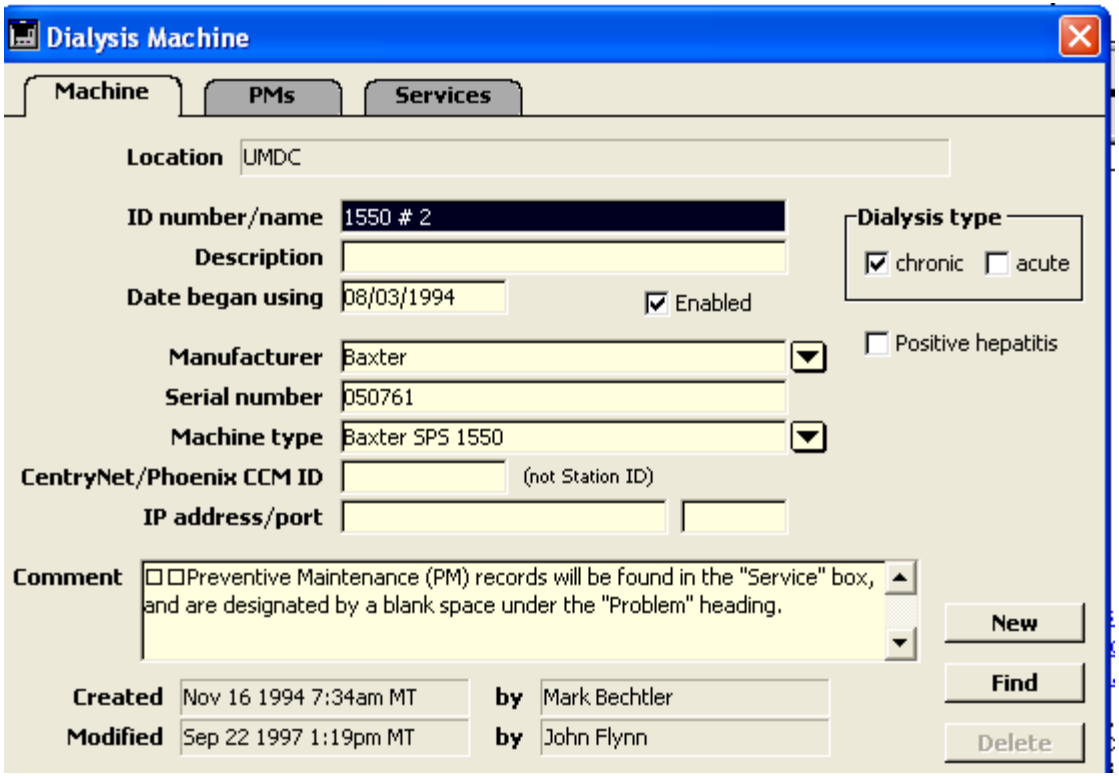
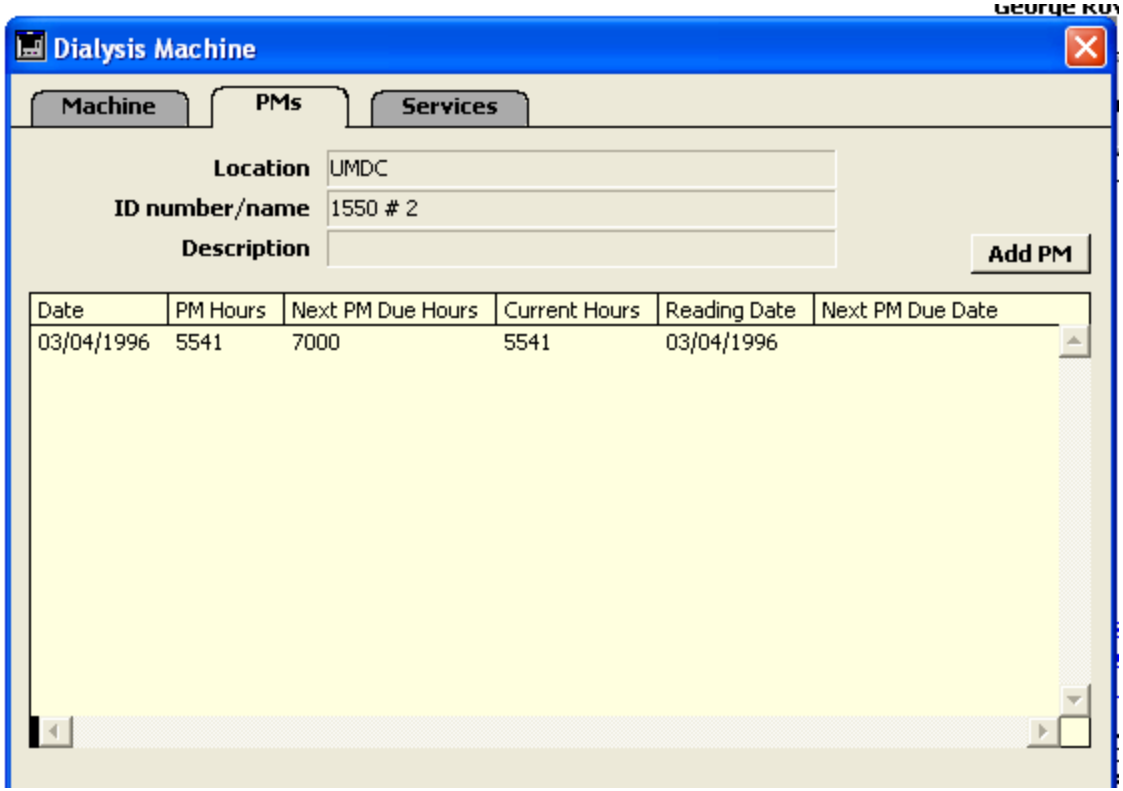
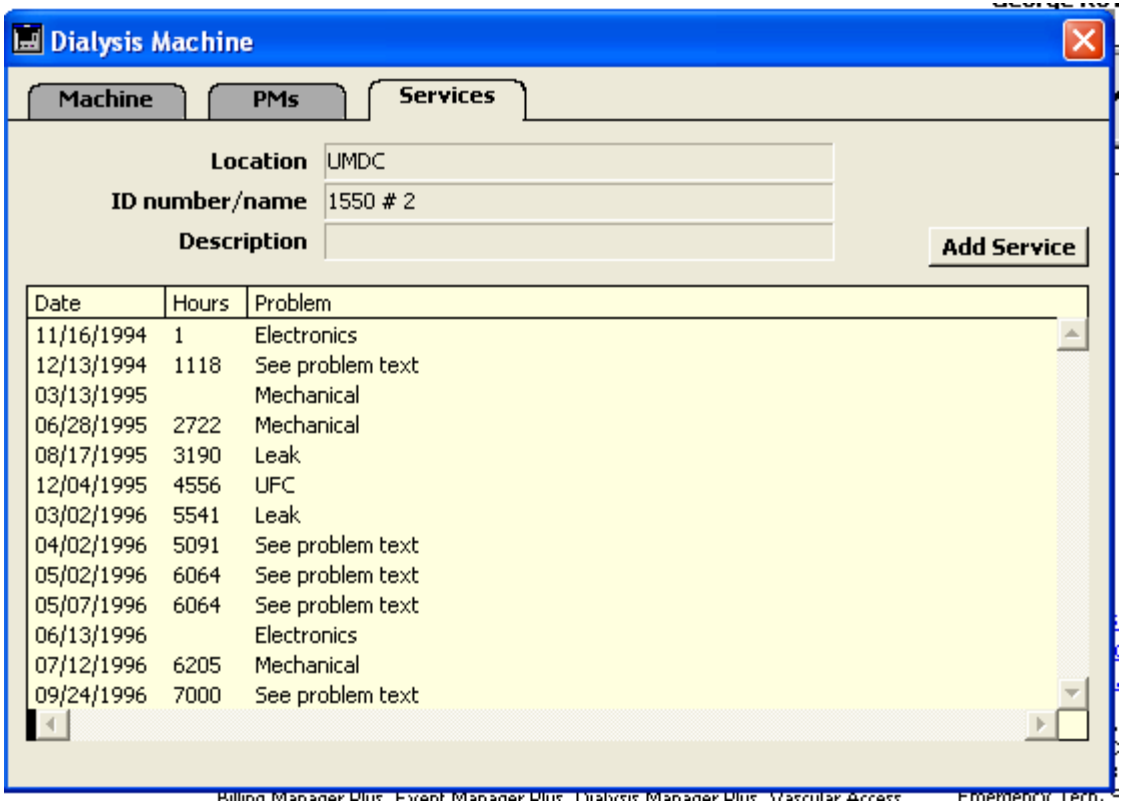
Social Worker

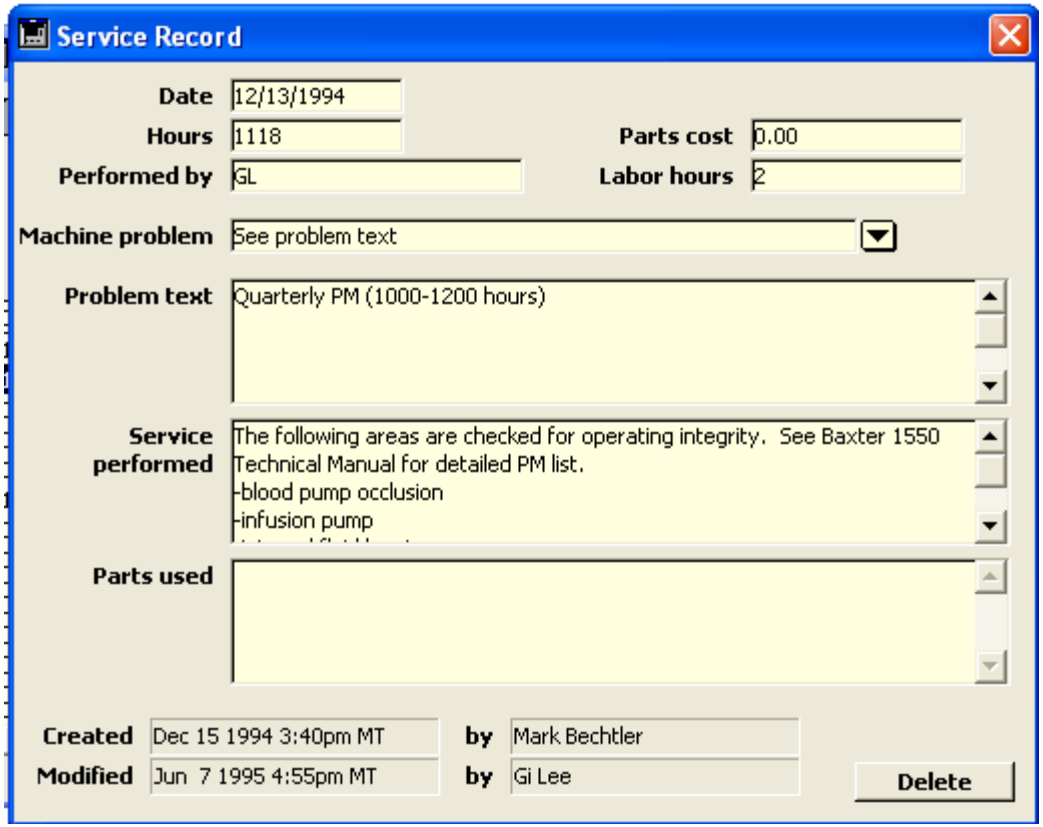
- Assessments
- Plan of Care
- Care Plan reviews

Repair/Service Technician




Dialysis Machine
Machine
PMs
Services
Location
UMDC
ID number/name
1550 # 2
Description
Add PM
Date
PM Hours
Next PM Due Hours
Current Hours
Reading Date
Next PM Due Date
03/04/1996
5541
7000
5541
03/04/1996

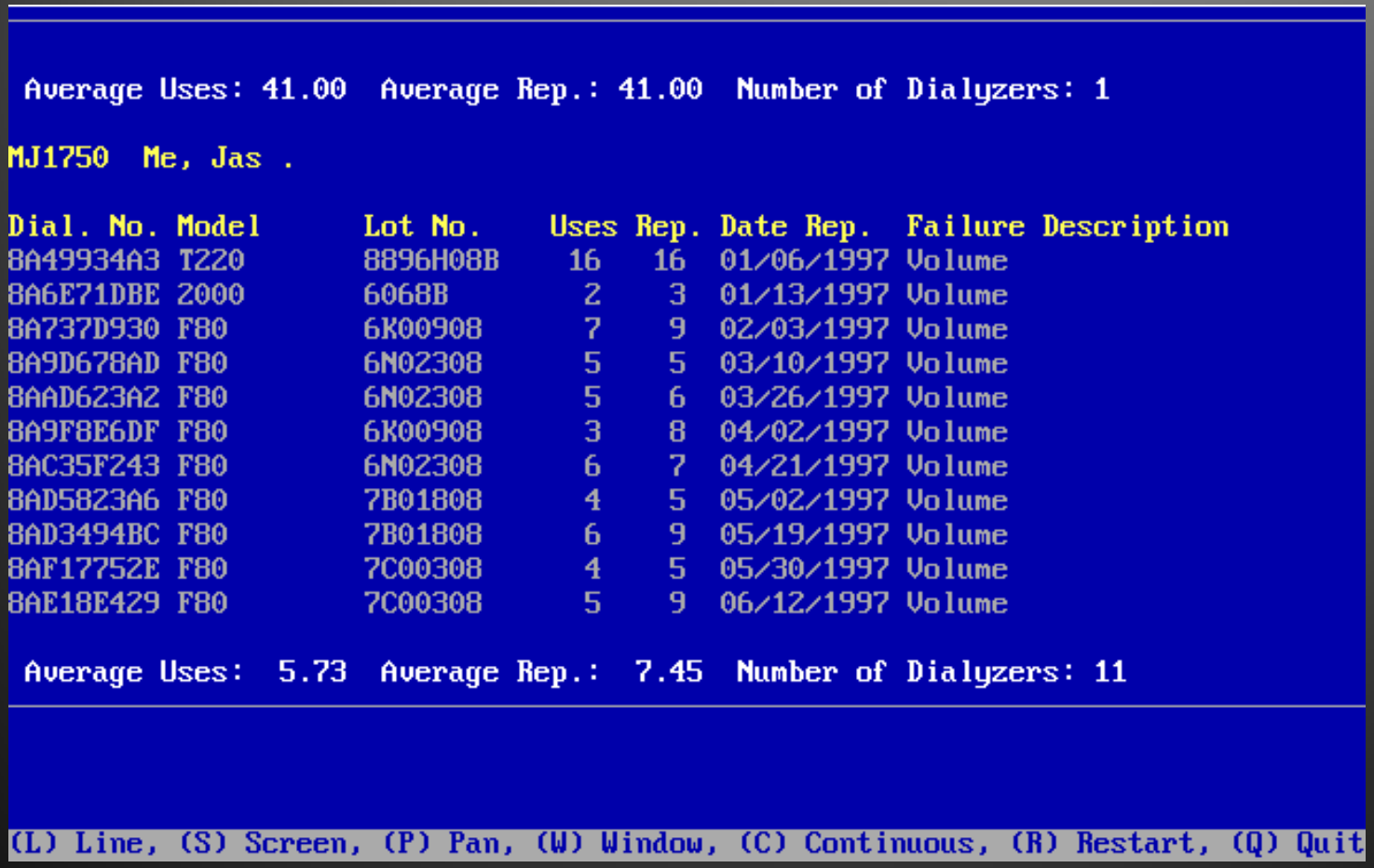

Dialysis Machine
Machine
PMs
Services
Location
UMDC
ID number/name
1550 # 2
Description
Add Service
Date
Hours
Problem
11/16/1994 1 Electronics
12/13/1994 1118 See problem text
03/13/1995 Mechanical
06/28/1995 2722 Mechanical
08/17/1995 3190 Leak
12/04/1995 4556 UFC
03/02/1996 5541 Leak
04/02/1996 5091 See problem text
05/02/1996 6064 See problem text
05/07/1996 6064 See problem text
06/13/1996 Electronics
07/12/1996 6205 Mechanical
09/24/1996 7000 See problem text


Service Record
Date
12/13/1994
Hours
1118
Parts cost
0.00
Performed by
GL
Labor hours
2
Machine problem
See problem text
Problem text
Quarterly PM (1000-1200 hours)
Service performed
The following areas are checked for operating integrity. See Baxter 1550 Technical Manual for detailed PM list.
-blood pump occlusion
-infusion pump
Parts used
Created
Dec 15 1994 3:40pm MT
by
Mark Bechtler
Modified
Jun 7 1995 4:55pm MT
by
Gi Lee
Delete

Reuse & IT/Software

- Greg Bogenschutz of software consulting company Sunbend Corp programmed the first commercial reuse software, Renalog for Renal Systems.
- As a CDC developer he used Control Data's "Micro IPF“ relational database for Renalog I and II
- IPF stood for "Information Processing Family". When the Renatron connection features were added to Renalog II, a Control Data upgrade version called “IM” (Information Manager) was used.
- Following slides compliments of Wayne Carlson Minntech

Active Patient Dialyzer Summary



Average Uses: 41.00 Average Rep.: 41.00 Number of Dialyzers: 1

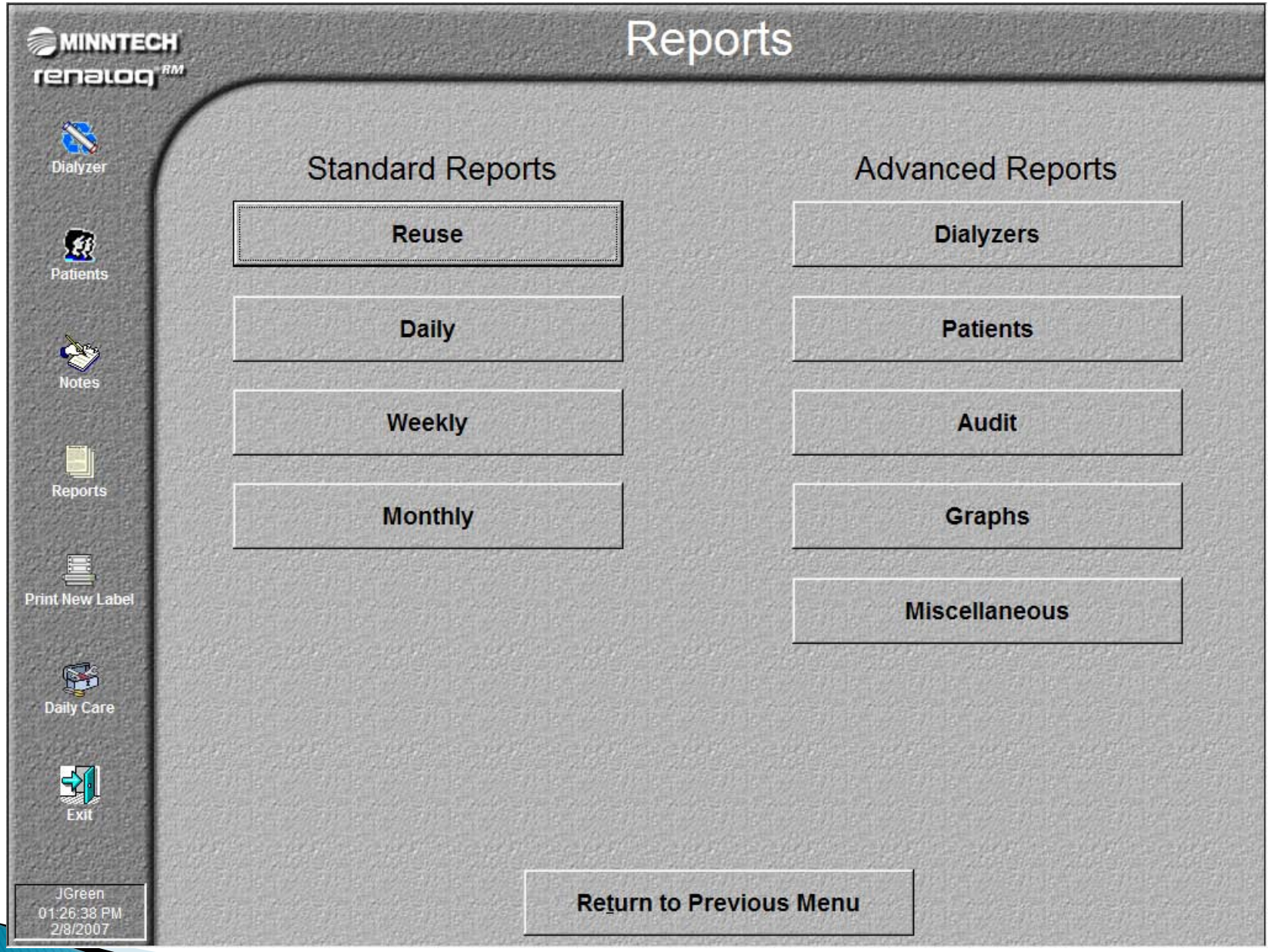
MJ1750 Me, Jas .

Dial. No.	Model	Lot No.	Uses	Rep.	Date Rep.	Failure Description
8A49934A3	T220	8896H08B	16	16	01/06/1997	Volume
8A6E71DBE	2000	6068B	2	3	01/13/1997	Volume
8A737D930	F80	6K00908	7	9	02/03/1997	Volume
8A9D678AD	F80	6N02308	5	5	03/10/1997	Volume
8AAD623A2	F80	6N02308	5	6	03/26/1997	Volume
8A9F8E6DF	F80	6K00908	3	8	04/02/1997	Volume
8AC35F243	F80	6N02308	6	7	04/21/1997	Volume
8AD5823A6	F80	7B01808	4	5	05/02/1997	Volume
8AD3494BC	F80	7B01808	6	9	05/19/1997	Volume
8AF17752E	F80	7C00308	4	5	05/30/1997	Volume
8AE18E429	F80	7C00308	5	9	06/12/1997	Volume

Average Uses: 5.73 Average Rep.: 7.45 Number of Dialyzers: 11

(L) Line, (S) Screen, (P) Pan, (W) Window, (C) Continuous, (R) Restart, (Q) Quit

Volume – Not GUI


MINNTECH
renalog RM
Reports
Dialyzer
Patients
Notes
Reports
Print New Label
Daily Care
Exit
JGreen
01:26:38 PM
2/8/2007
Standard Reports
Reuse
Daily
Weekly
Monthly
Advanced Reports
Dialyzers
Patients
Audit
Graphs
Miscellaneous
Return to Previous Menu

MINNTECH renalog RM

Number of Failures per Fail Code

Dialyzer
Patients
Notes
Reports
Print New Label
Daily Care
Exit

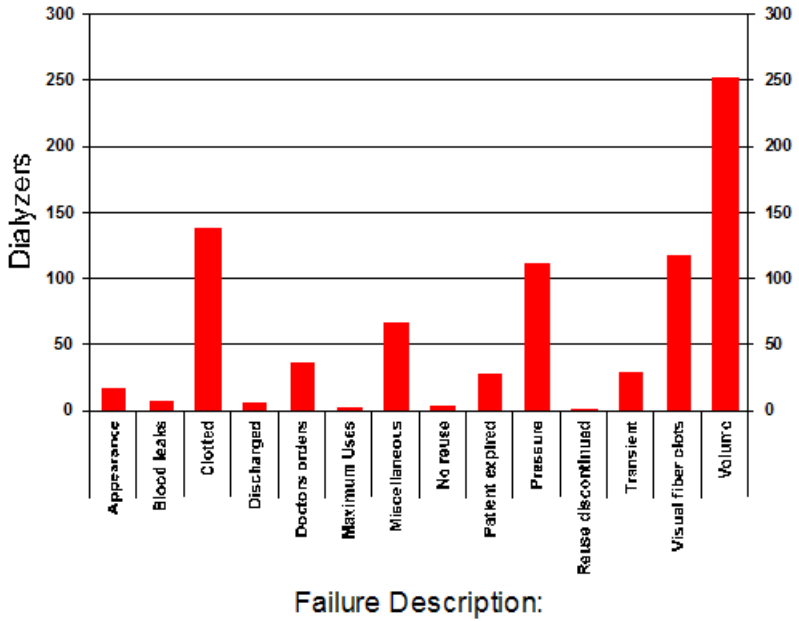
MKuan
01:58:16 PM
2/20/2007

Print... | Page Width | 1/2 | Back | Forward

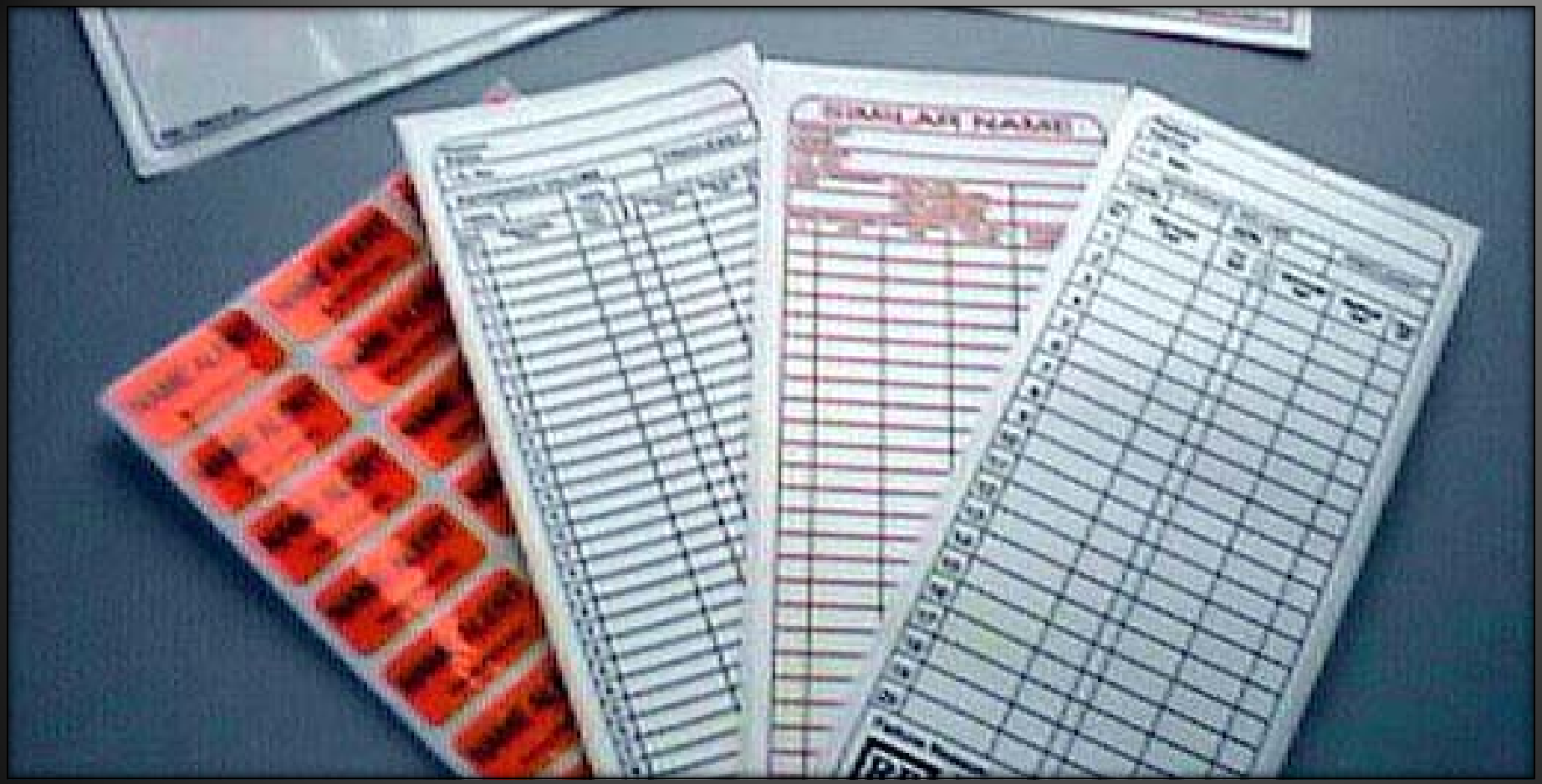
RenalogRM - Minntech

Number of Failures per Fail Code

Fail Date from 1/1/2006 through 12/31/2006



Export Type: Excel | Export | Zoom In | Zoom Out | Print | Close



State of the Art Reuse Labels circa 1985

(Compliments of Vern Taaffe)

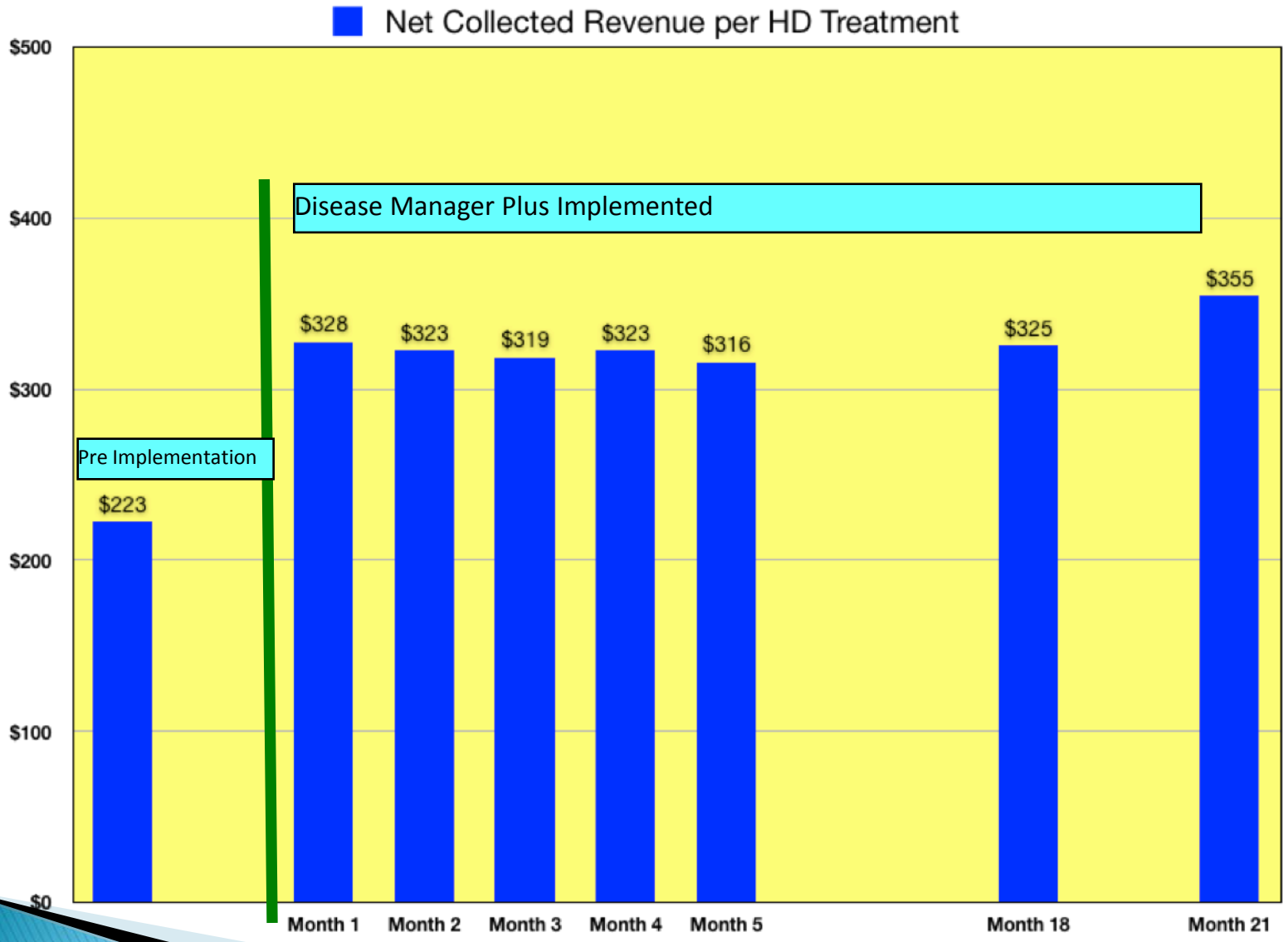
Administrators/Financial Managers Why an EMR?

- Internal controls
- Bill & collect all revenue properly due
- Capture charges
- Bill secondary claims
- Compliance

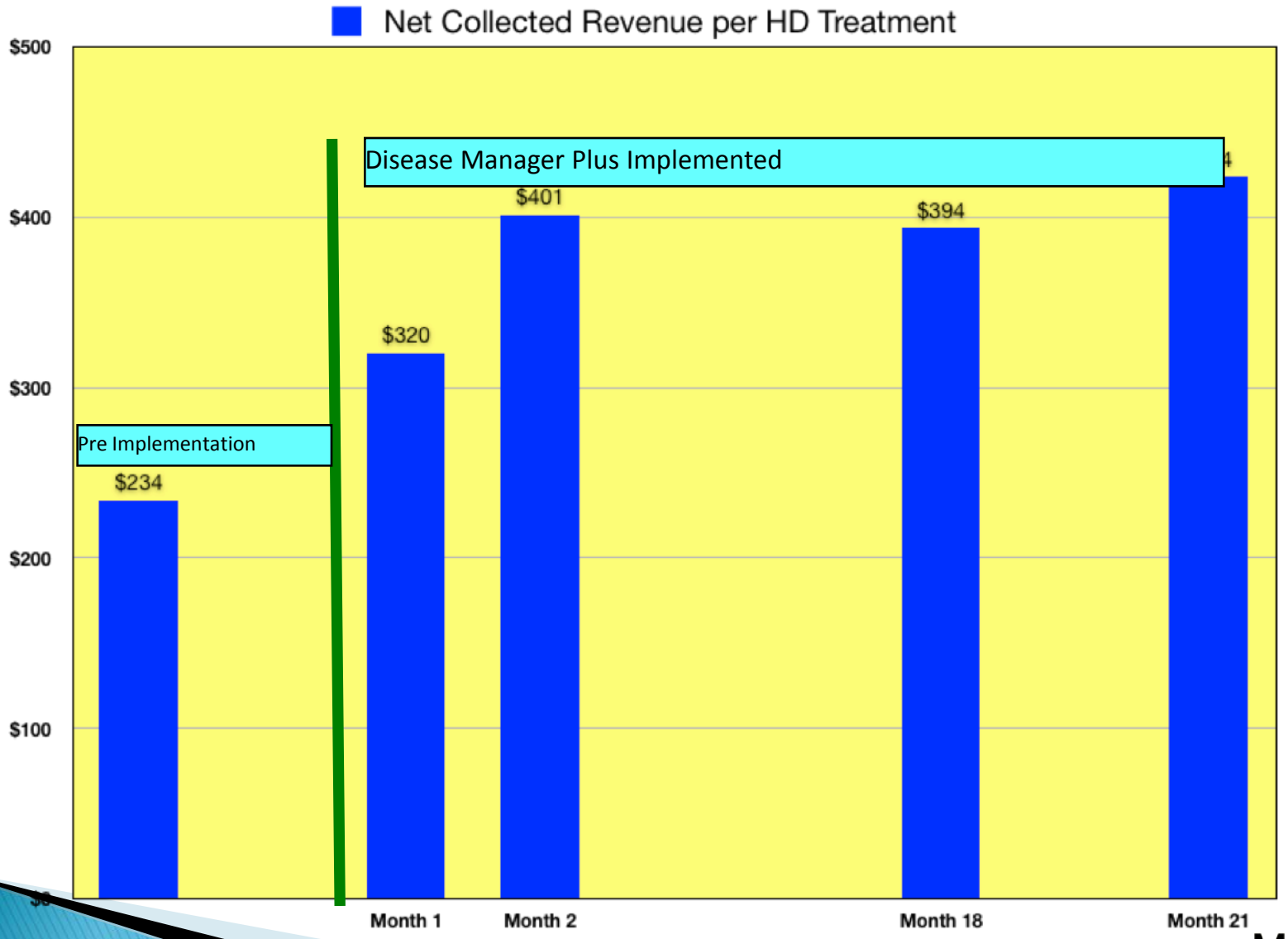
Capture & Enter charges

- Do it right the first time
- Avoid rejections
- 15 billion health claims annually – 30% are rejected by payers
- Of the 30%, 15% are never resubmitted even though there is a payer. (Smith, BT: APA Matrix 16:2 2001)
- 4.6 claims per MD per week are denied due to bad claims (MGMA Center for Research,2003)

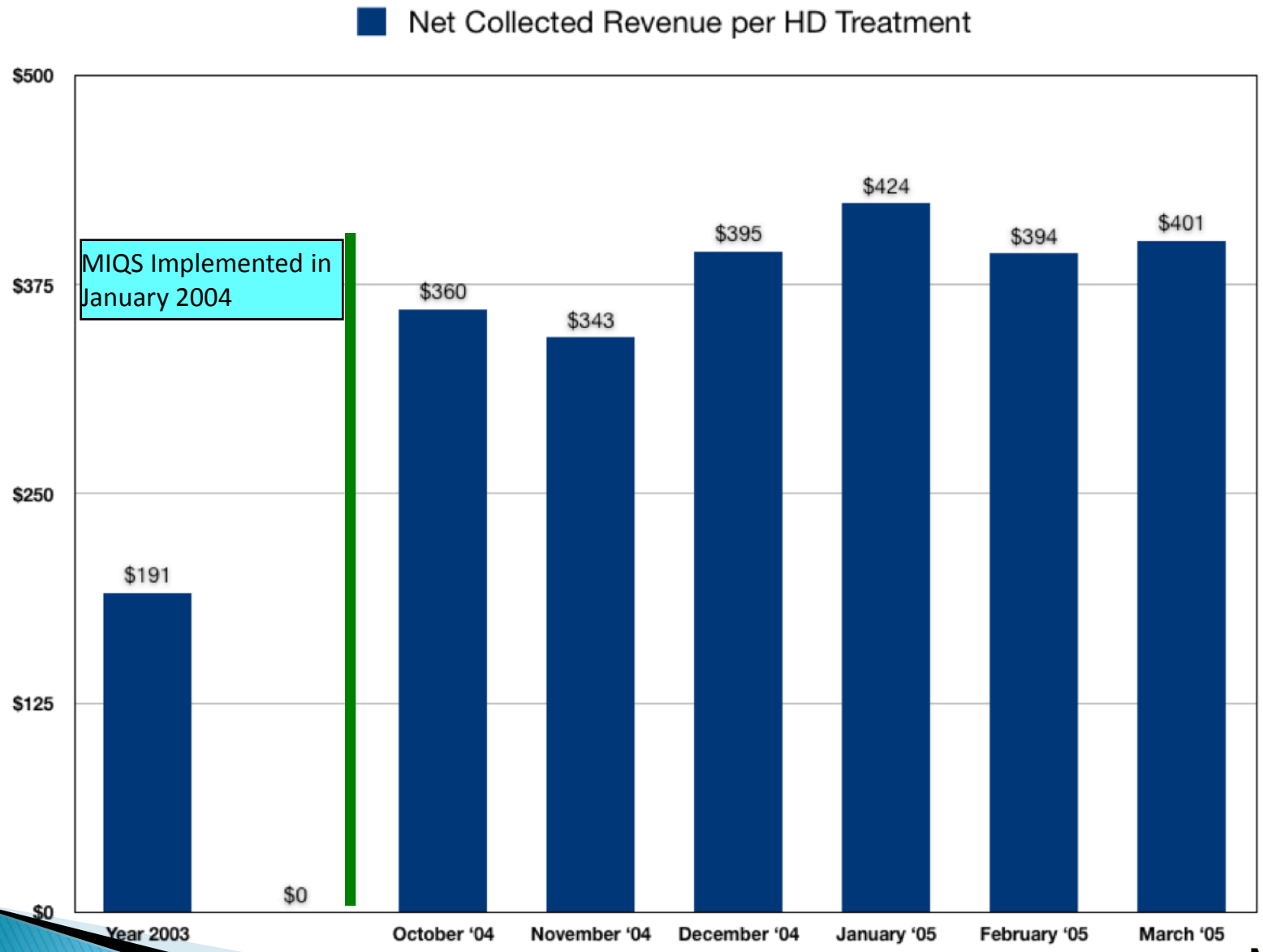
Independent Dialysis Unit #1



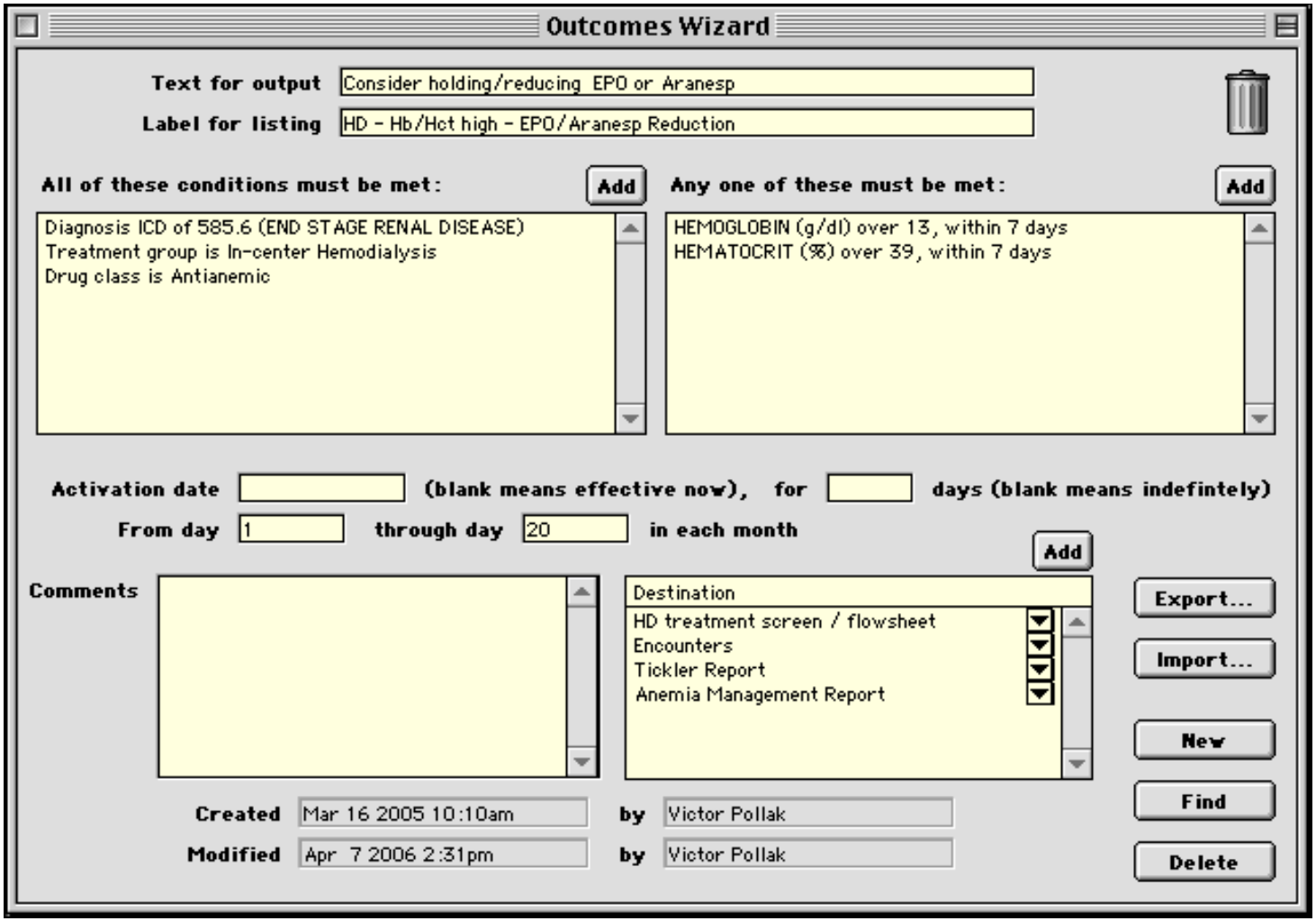
Independent Dialysis Unit #2



Hospital Dialysis Unit

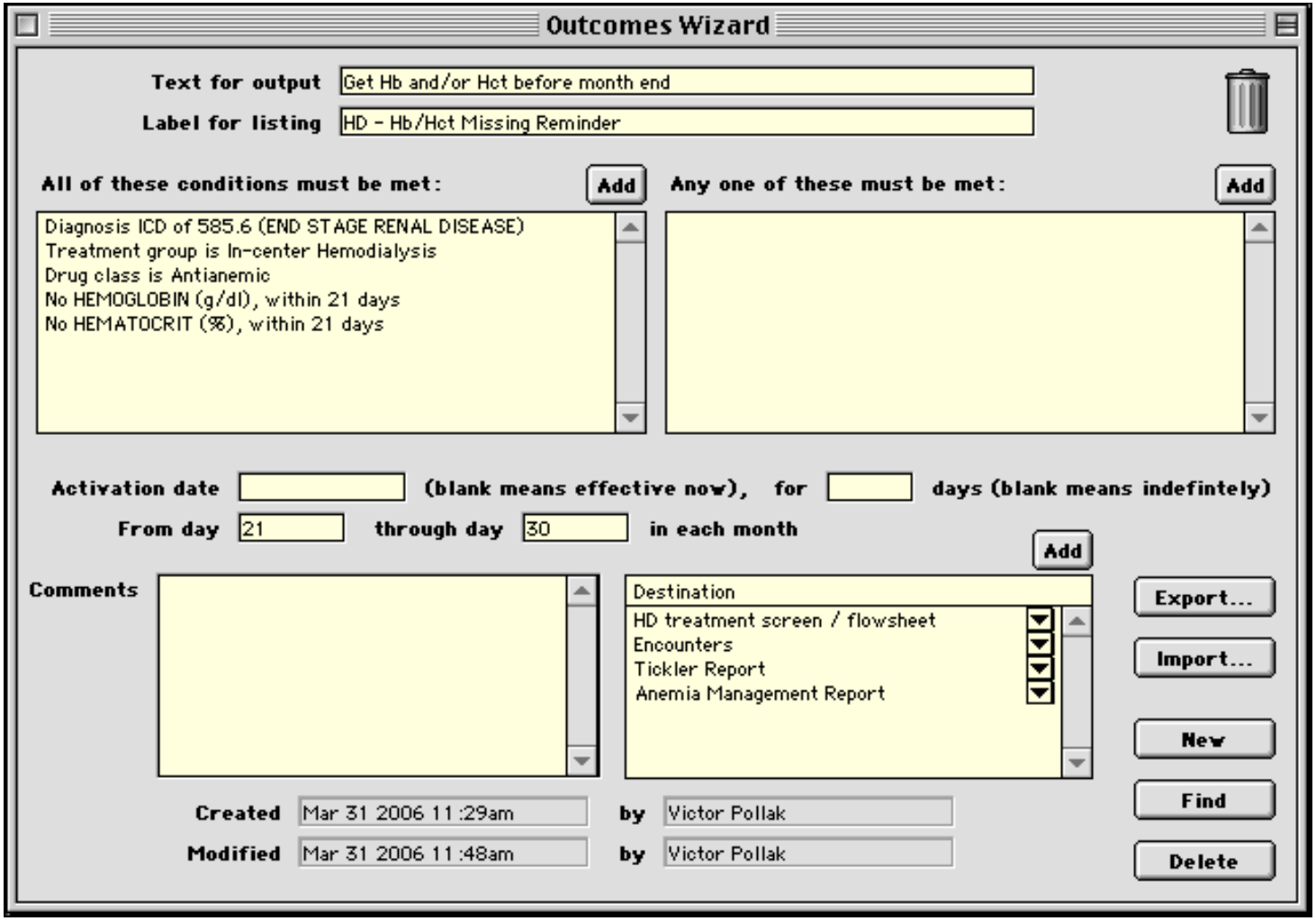


CMS Rule for EPO/Anemia Alert - 1



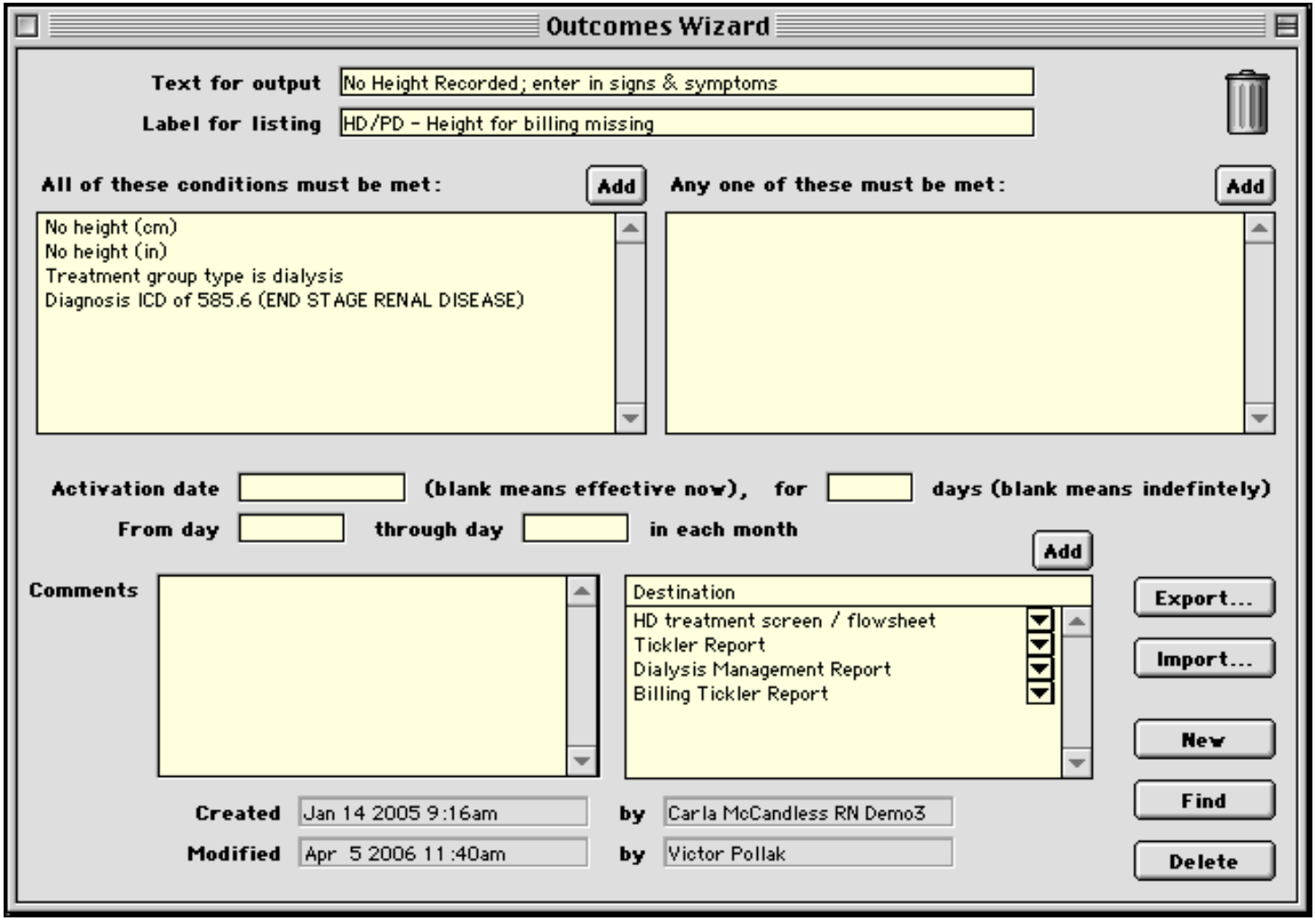
CMS payment rules require a 25% reduction in EPO & Aranesp dosage when Hb and/or Hct exceed the levels indicated

CMS Rule for EPO/Anemia Alert - 2



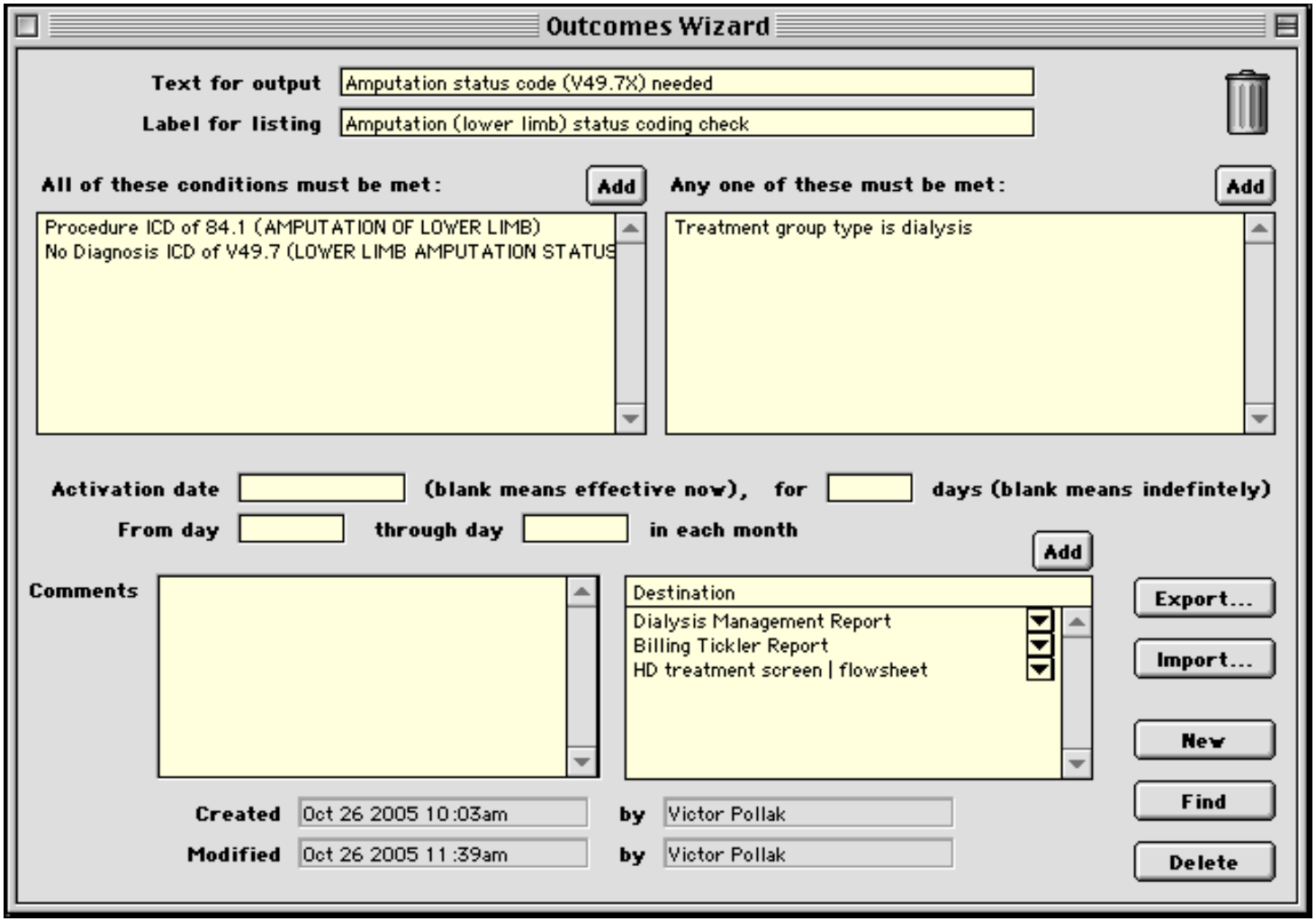
CMS payment rules for EPO & Aranesp require reporting an Hb and/or Hct level measured in each calendar month

CMS Rule on Height for Payment - 1



CMS payment rules for dialysis treatments require that the patient's height be reported on the bill

CMS Rule on Height for Payment - 2



CMS payment rules for dialysis treatments require an "adjusted height" in lower limb amputees (ICD V49.7X)

What do you want to know?

- Who do you want to know it about?
- Who wants to know?
- Cohort selection – by unit, by nephrologist, by diagnosis, by meds, by lab tests
- Very difficult

Users of MIQS Software Include…

Physicians	Financial counselors
Nurses	Schedulers
Nurse practitioners	Administrators
Physician assistants	Transplant coordinators
Patient care technicians	Research coordinators
Dialysis machine technicians	CQI personnel
Dialyzer reuse technicians	Facility billing personnel
Dietitians	Physician billing personnel
Social workers	

Data Analysis: Report Types

- Wordprocessing reports
- Spreadsheet reports
- Graphic reports
  - –Single Patient
  - –Multiple Patient
- Tabular reports
  - –Single Patient
  - –Multiple Patient

What do you want to know?

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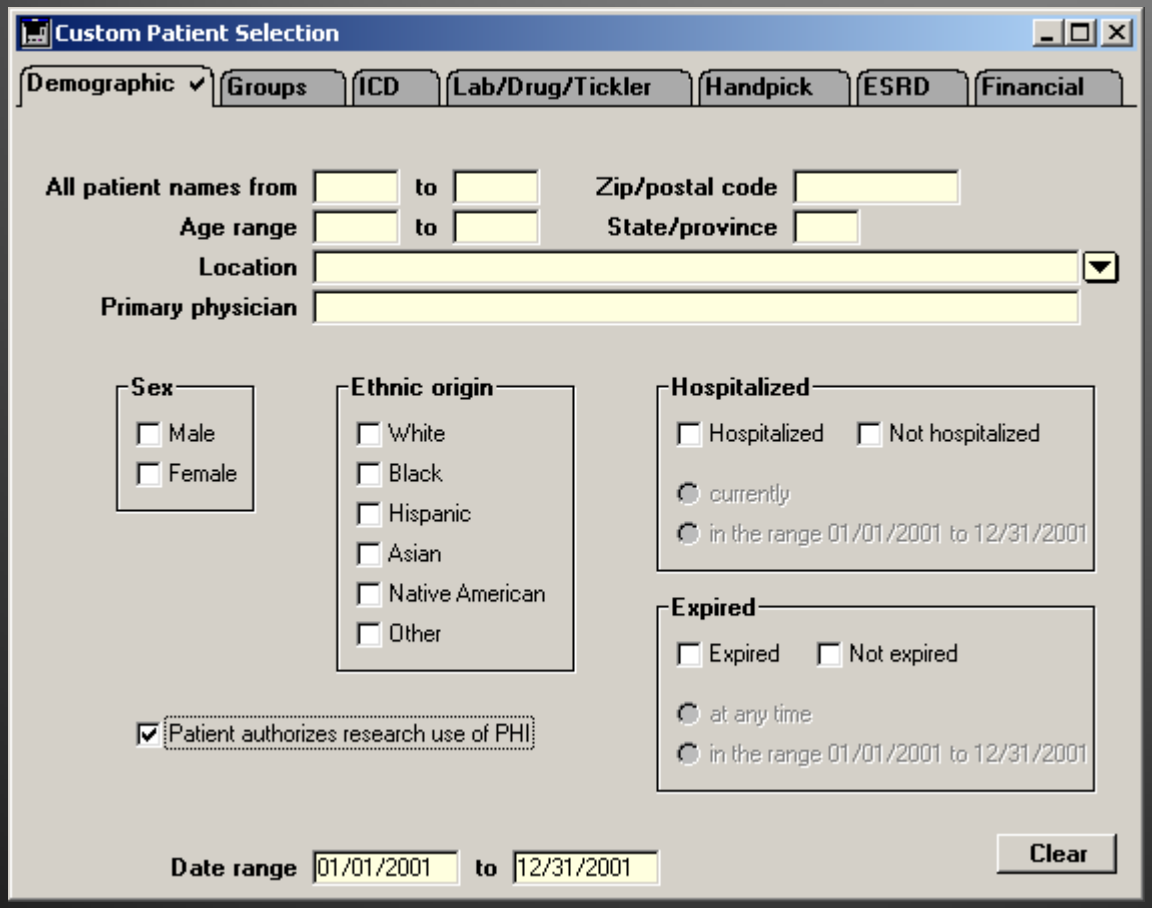
Patient Selection Engine

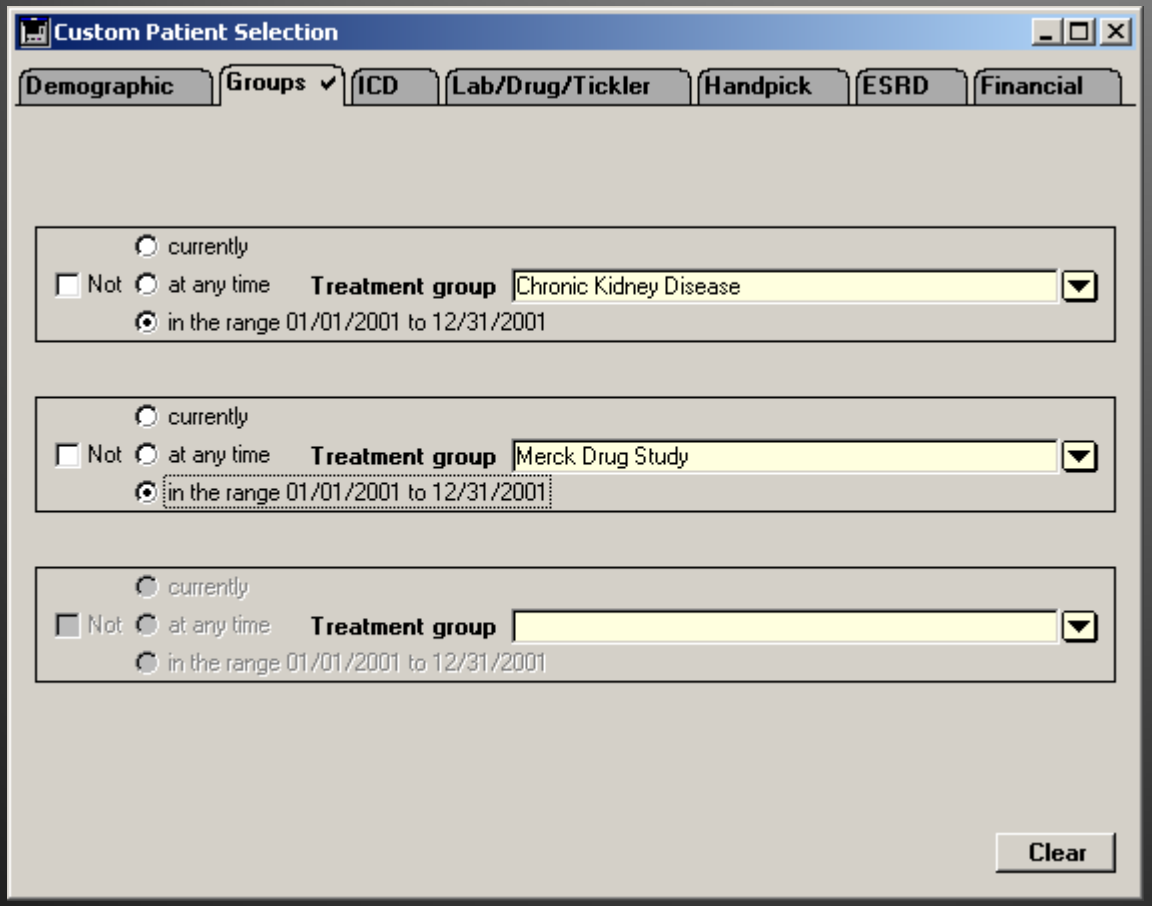
Demographics



Selection can be by age, sex, ethnicity, alive or expired, hospitalized or not. Also, by physician, location, and by authorization of research use of data (HIPAA)

Patient Selection Engine

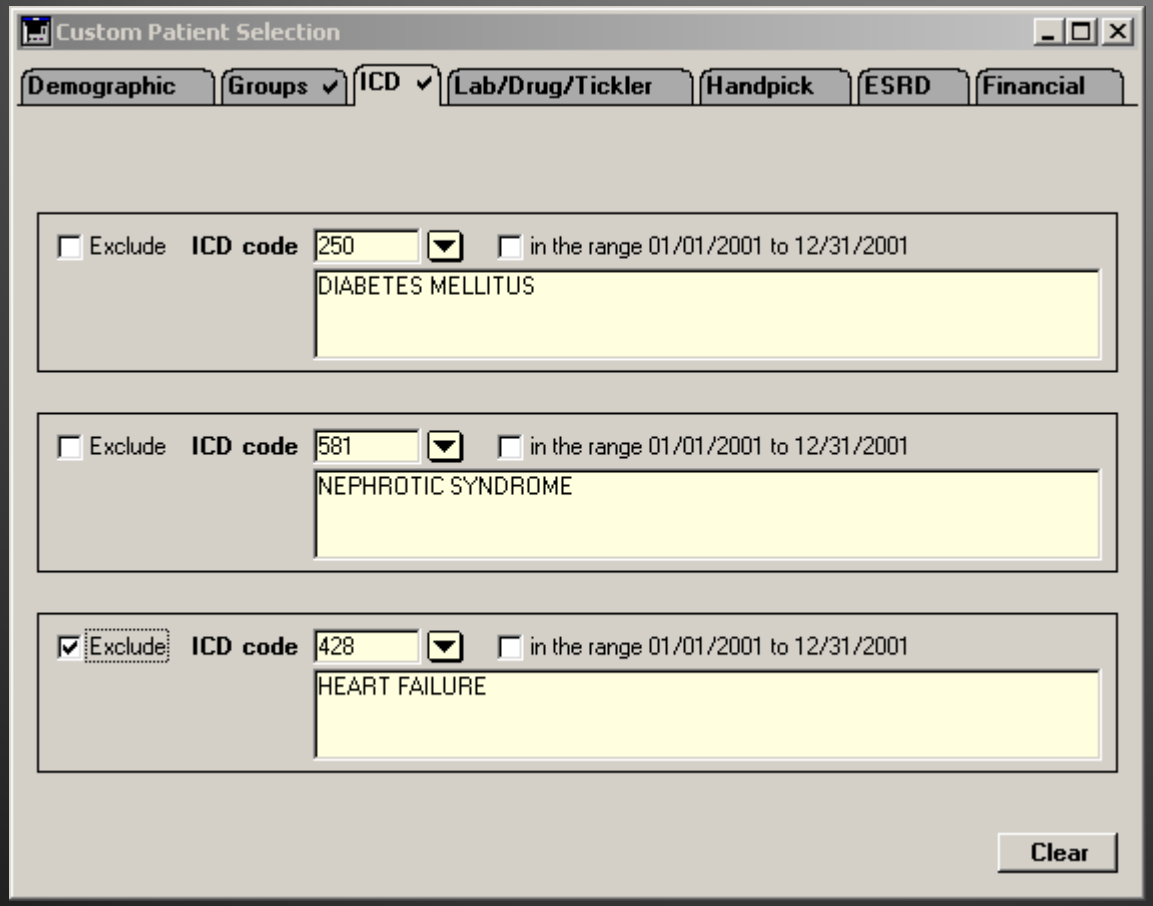
Treatment Groups



Selection can by inclusion or exclusion of 1 to 3 Treatment Groups. Treatment groups can be developed for various purposes by users (see next slide)

Patient Selection Engine

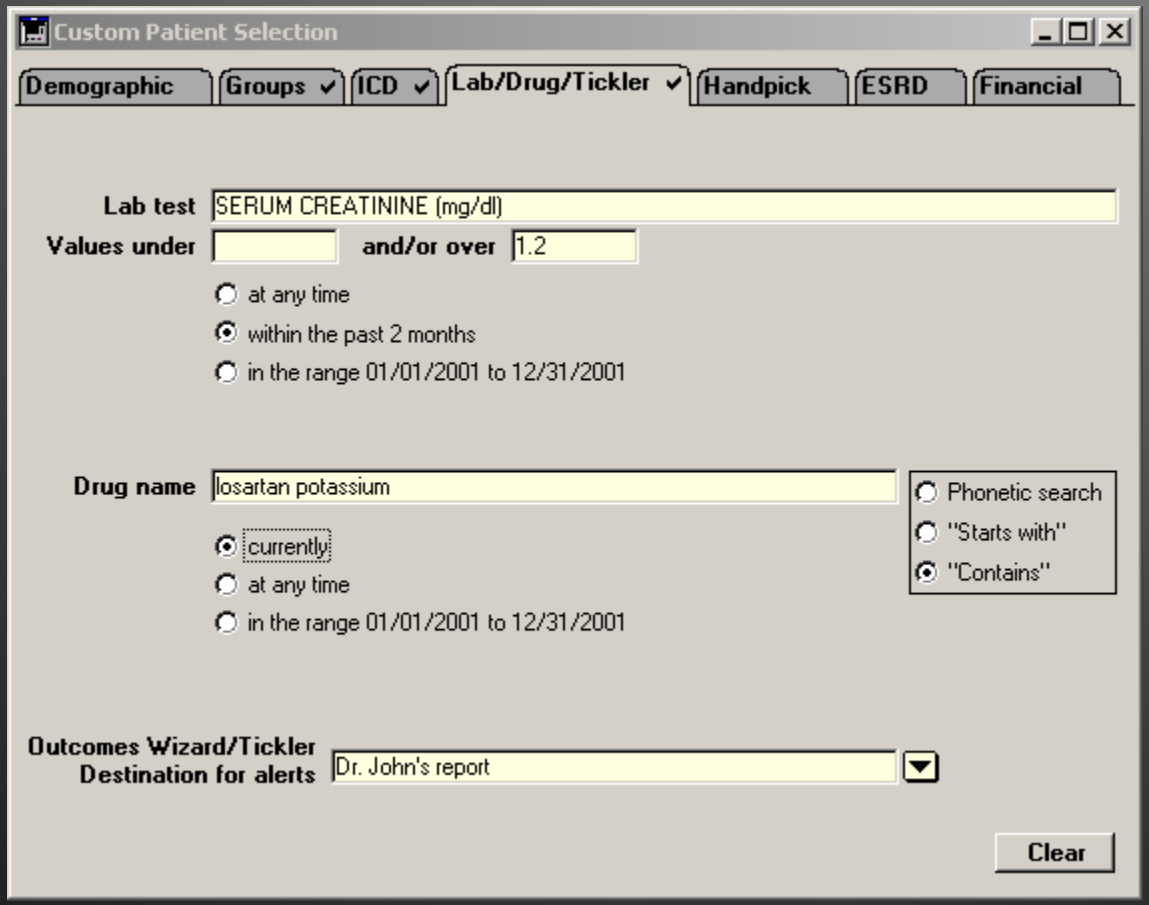
Diseases & Procedures



Selection can be by inclusion or by exclusion of 1 to 3 ICD-coded diseases and/or procedures.

Patient Selection Engine

Lab and Drugs



Selection can also be by Lab test (including exception values) and by medications.

Tech Support of users

- User : Hi, our printer is not working.
- Tech: What is wrong with it?
  User : Mouse is jammed.
  Tech: Mouse? Printers don't have a mouse.
  User: Well you're wrong I will even send a picture to prove it.

The Proof