MEDICAL/CARE COORDINATION
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April 3 2014, New York City
Agenda

A  Our Approach
B  Our Strategy
C  A Focus on Innovation
Our Approach to Value Based Care Models

Value = \frac{Quality}{Cost}

- Mortality
- Hospitalization
- Quality of Life
- Experience of Care
- Safety
- Service Delivery
Enterprise Segments

Products & Therapy Assets

Chronic Disease Care Provider Network Assets

Care Coordination & Performance Risk Assets

Aligning Resources to Coordinate Care Throughout the Health Value Chain
Business Asset Types Per Enterprise Segment

- Performance Risk Contracting
- Population Health Insurance
- Retail Health Care Management
- Medical Devices
- Pharma & Therapy Technologies
- Product & Therapy Research
- Acute & Chronic Renal Disease
- Adjacent Chronic Illnesses
- Vascular Access
- Pharmacy & Lab Research, Analytics & Data
Accessing the Patient Where They Receive Care

- SPECTRA/SHIEL LABORATORY
- FRESENIUS VASCULAR CARE
- DIALYSIS CLINICS AND TECHNOLOGY
- FRESENIUSRx PHARMACY
- OUTPATIENT SERVICES
- IN-PATIENT SERVICES
- PHYSICIAN PRACTICE
- HOME
- HOME MONITORING & TELEHEALTH
- ACUMEN & eCUBE CLINICAL SUPPORT
- ACUTE DIALYSIS MANAGEMENT
- RENAL INPATIENT CARE MANAGERS
- TREATMENT OPTIONS EDUCATION
- OPTIMAL DIALYSIS START
- RENAL CARE COORDINATORS

FRESENIUS MEDICAL CARE
Chronic Disease Care is Distinctive:
Best Example is Renal Disease Care

Clinical Healthcare Segments

- Acute Illness
- Chronic Disease Care
- Highly Technical Surgery
- General Health & Wellness

Chronic Disease Care Characteristics

- Goal is Crisis Avoidance
- Evidence-Based Care Exists
- Standardized Protocols
- Intensive Measurement
- Trends to Predict Problems
- Frequent Patient Contact & Education
- Efficient Care Yields Better Outcomes
Evolution of Our Ability to Influence Outcomes

- Vascular Access Coordination
- Fluid Management
- Care Transitions
- Depression
- Social & Environmental Issues
- Palliative Care
- Vascular Disease
- Nutritional Competence

Common Dialysis Related Measures

% Incremental Contribution
Renal Patient Outcomes: Impact of Adjacent Illnesses

Only 30% of hard outcomes in renal disease patients controlled by dialysis treatment parameters

Outcomes driven by associated illnesses and the management of multiple conditions

2004
Organized Care for Renal Disease

- Prepare for dialysis to reduce 50% crash into dialysis
- Smoother transition into dialysis to reduce >30% annualized mortality rate

$15,000
$12,000
$9,000
$6,000
$3,000
$0

Late-stage CKD
Incident ESRD
Prevalent ESRD

-6  -5  -4  -3  -2  -1  0  1  2  3  4  5  6

Months pre-initiation
Months post-initiation

Slow CKD progression
Manage Acute & Post Acute Care

55% of hospitalizations are potentially avoidable
HOW IT WORKS?

Anemia Management
Sequencing the Anemia Management Medication Portfolio in the Coming Years

2013

Short Acting ESA Agents

2018

Long Acting ESA Agents

HIF Inhibitors - Novel Agents
Modeling Erythropoiesis in ESRD Patients

Erythropoiesis cell lineage
Mathematical Modeling of the ESRD Patient Physiology

Algorithms

- **V5**
  - Current CMAB computerized algorithm
  - 65000 patients
- **B**
  - Pilot with Basal EPO on hold, 25% reduction
  - 4630 patients
- **C**
  - Pilot with basal EPO on hold, 50% reduction
  - 3213 patients
- **A**
  - Alternate CMAB A – like Arizona
  - 5700 patients
- **Other**
  - Hawaii, Kaiser, other individual algorithms, residual V4 (<15,000)
  - 52000 patients

Dustin Kapraun, Peter Kotanko, Franz Kappel and Doris Furtinger
HOW IT WORKS?

Fluid Management Strategies
1. Targeting the Correct Dry Weight
2. Avoiding Sodium Loading During Dialysis
3. Avoiding Missed & Shortened Treatments
Assessing fluid balance
Window into your patient’s bloodstream
Vascular space dynamics are key in fluid management

The Crit-Line monitor permits a noninvasive focus on these dynamics
Crit-Line Initial Results: Four Months of Follow Up

-6% Fluid-Related Admissions

-10% All-Cause Hospital Admissions

-12% % of Patients with Post SBP>=180

N=226 clinics
HOW IT WORKS?
Maintaining Nutritional Competence
Why is Nutrition So Important?

Improving mortality risk and risk for hospitalization (hazard ratios)

Mortality  Hospitalization
*p<0.001

three-month average albumin (g/dL)

<=3.0  3.01-3.2  3.21-3.4  3.41-3.6  3.61-3.8  3.81-4.0  4.01-4.2  4.21-4.4  >4.4
The Z Score is a percentile based on five elements that relate to nutritional health of the ESRD Patient:

1. Albumin
2. Creatinine
3. Phosphorus
4. enPCR
5. Interdialytic Weight Gain
The Trajectory of the Z Score Change Helps Predict Outcomes

Nutritional Score in Incident HD Patients by time of death (loose criteria)
Components of the Nutritional Z Score During Hospitalization

Time course of nutritional parameters around time of hospitalization

- **Albumin [g/dL]**
  - Graph showing a decrease from approximately 3.90 to 3.65, then an increase back to 3.90.

- **Creatinine [mg/dL]**
  - Graph showing a decrease from approximately 8.8 to 4.9, then an increase back to 8.8.

- **Phosphorus [mg/dL]**
  - Graph showing a decrease from approximately 5.3 to 4.9, then an increase back to 5.3.

- **enPCR [g/kg/d]**
  - Graph showing a decrease from approximately .900 to .775, then an increase back to .900.

- **IDWG [L]**
  - Graph showing a decrease from approximately 2.90 to 2.65, then an increase back to 2.90.

(months before/after hospitalization)
The Impact of Readmission on Nutritional Competence

Nutritional score around hospital by number of rehospitalizations
(percentile of nutritional score, loose criteria utilized)

Number of rehospitalizations: 0 1 2 3 >=4

(months before/after hospitalization)
PREDICTIVE ANALYTICS
Patient Cohorts

- CKD 4-5
- ESRD INCIDENT PATIENTS
- ESRD PREVELANT
Data Sources

- Demographics
- Laboratory in-center
- Payor claims
- Clinical assessments
- Clinical data outside of dialysis
- Outpatient procedures and visits
- Hospitalizations
- Treatment related
- Patient lifestyle
Example Predictive Models

- **CKD PROGRESSION LIGHT MODEL**
  - **INPUT**: CLAIMS DATA
  - **OUTPUT**: GFR IN 6 MONTHS

- **CKD PROGRESSION MODEL**
  - **INPUT**: CLINICAL DATA
  - **OUTPUT**: GFR IN 6 MONTHS

- **HIGH-RISK LIGHT HOSPITALIZATION MODEL**
  - **INPUT**: CLINICAL DATA
  - **OUTPUT**: PROBABILITY OF >5 ADMITS

- **HIGH-RISK HOSPITALIZATION MODEL**
  - **INPUT**: CLINICAL DATA
  - **OUTPUT**: PROBABILITY OF >5 ADMITS

- **HIGH-RISK INCIDENT MODEL**
  - **INPUT**: CLINICAL DATA
  - **OUTPUT**: OUTCOMES IN 120 DAYS

- **READMISSION MODEL**
  - **INPUT**: CLINICAL DATA
  - **OUTPUT**: PROBABILITY OF READMISSION

- **EOL MODEL**
  - **INPUT**: CLINICAL DATA
  - **OUTPUT**: DEATH IN NEXT 6 MONTHS
Complex Mathematical Models

HIGH-RISK HOSPITALIZATION MODEL
OUTPUT = PROBABILITY OF >5 ADMITS IN 12 MNS

Decision Trees
Random Forest
Artificial Neural Networks (ANN)
Supported Vector Machines (SVM)
Least Absolute Shrinkage and Selection Operator
Multivariate Adaptive Regression Spline (MARS)
Predictors based on historical hospitalization rate
Multiple regression models
Generalized Additive Model (GAM)
General Linear Model (GLM)
Measuring Successful Models

AUC = 0.90
41 PREDICTORS
NON-LINEAR RELATIONSHIPS

HIGH-RISK HOSPITALIZATION MODEL
OUTPUT = PROBABILITY OF
>5 ADMITS IN 12 MNS
Applying Interventions Selectively

MODEL FULLY AUTOMATED AND IMPLEMENTED

INITIAL RESULTS

HIGH-RISK HOSPITALIZATION MODEL
OUTPUT = PROBABILITY OF >5 ADMITS IN 12 MNS

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<td>Reduction</td>
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