# Using Predictive Modeling to Target Interventions

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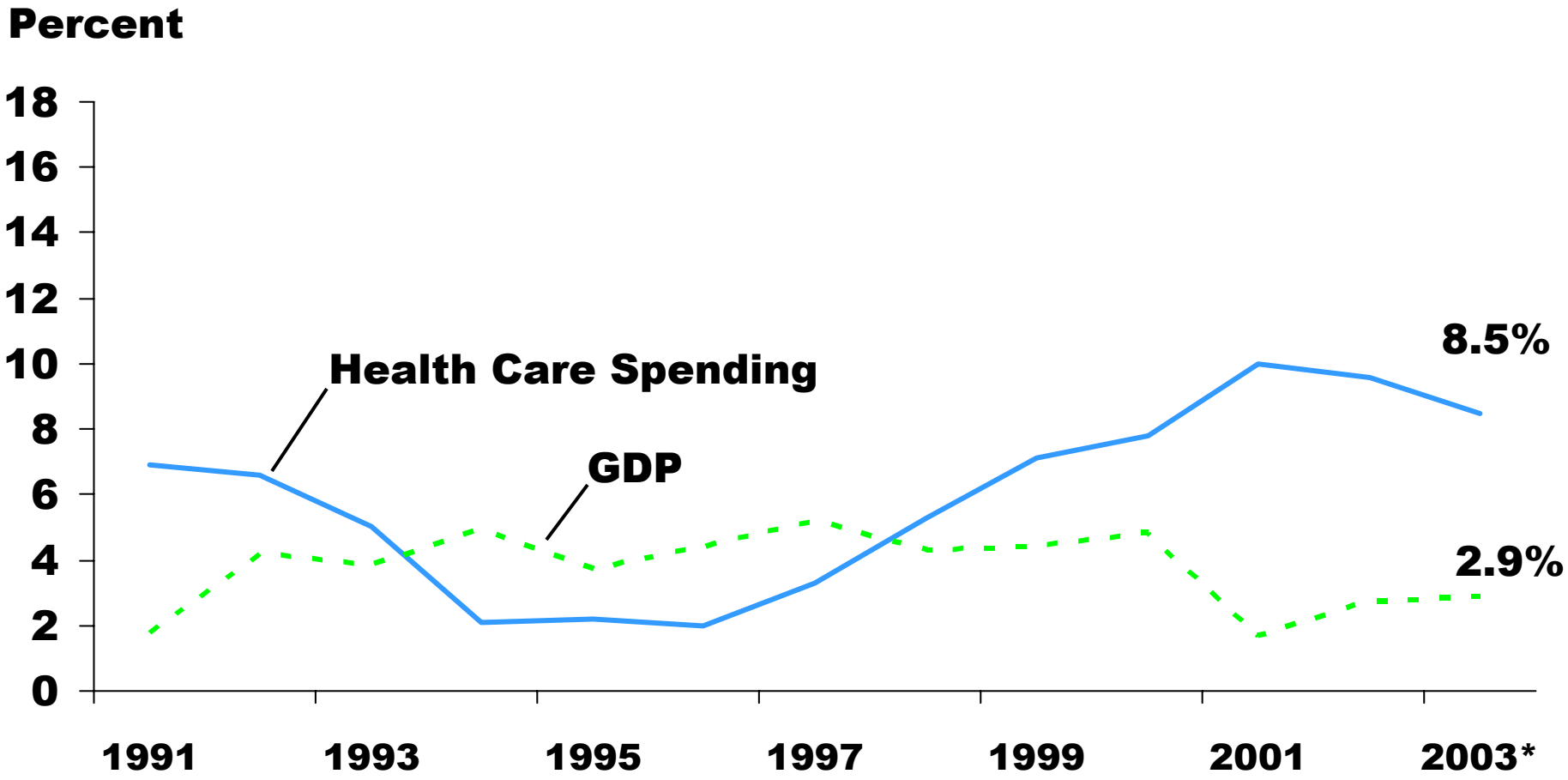
**ABQAURP - PSOS**

# Overview

- Cost and Quality Trends
- Disease Management and Modeling
- Predictive Modeling Fundamentals
- Accuracy of Models - Case Study

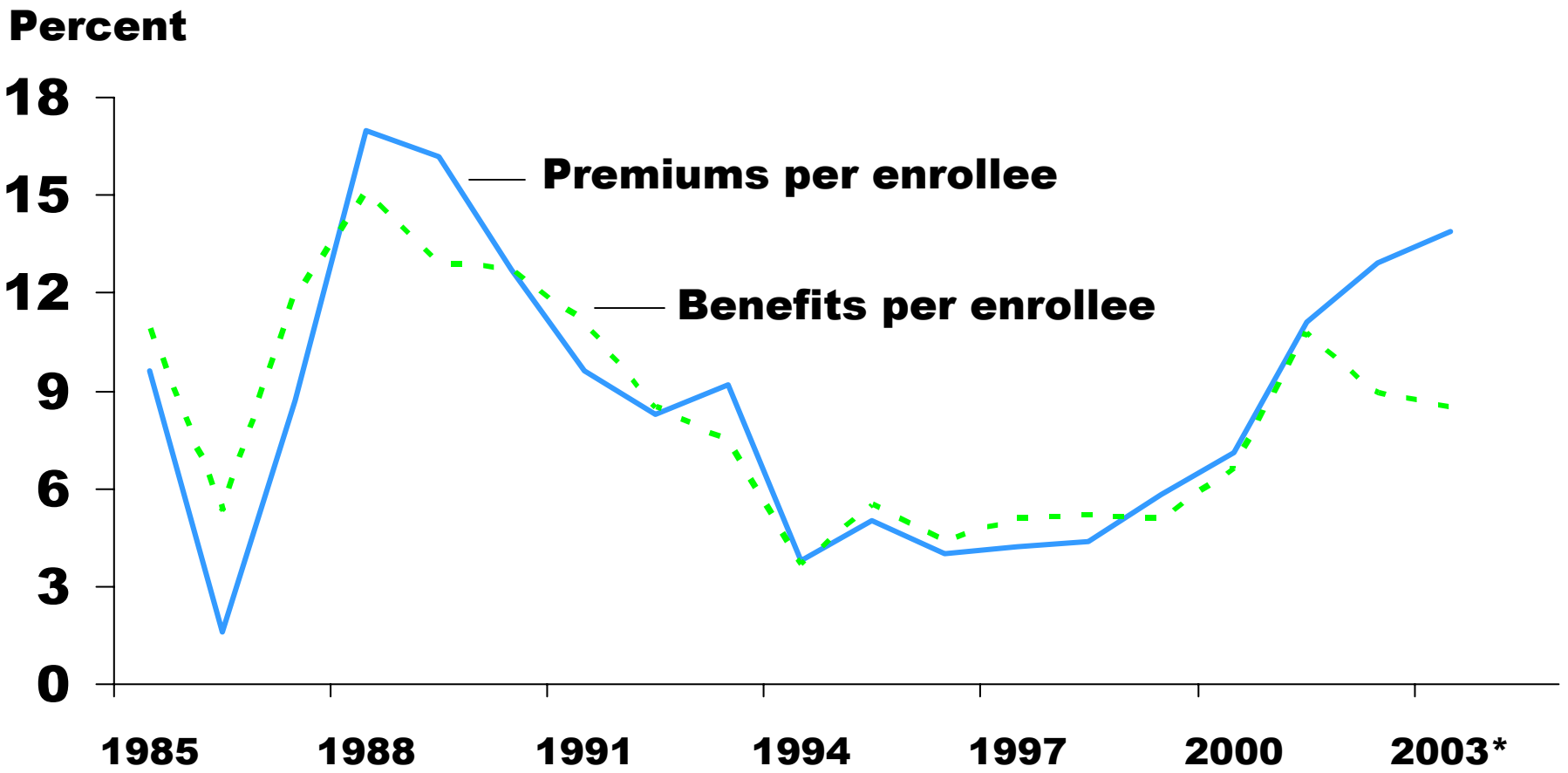
# Change Per Capita In Health Care Spending and GDP




* Data for January through June 2003, compared with corresponding months in 2002

Source: B. Strunk and P. Ginsburg, "Tracking Health Care Costs: Trends Stabilize But Remain High in 2002," *Health Affairs* (Web Exclusive June 11, 2003); B. Strunk and P. Ginsburg, *Tracking Health Care Costs: Trends Slow in First Half of 2003*, Center for Studying Health System Change, December 2003.

# Growth in Per Enrollee Premiums and Benefits



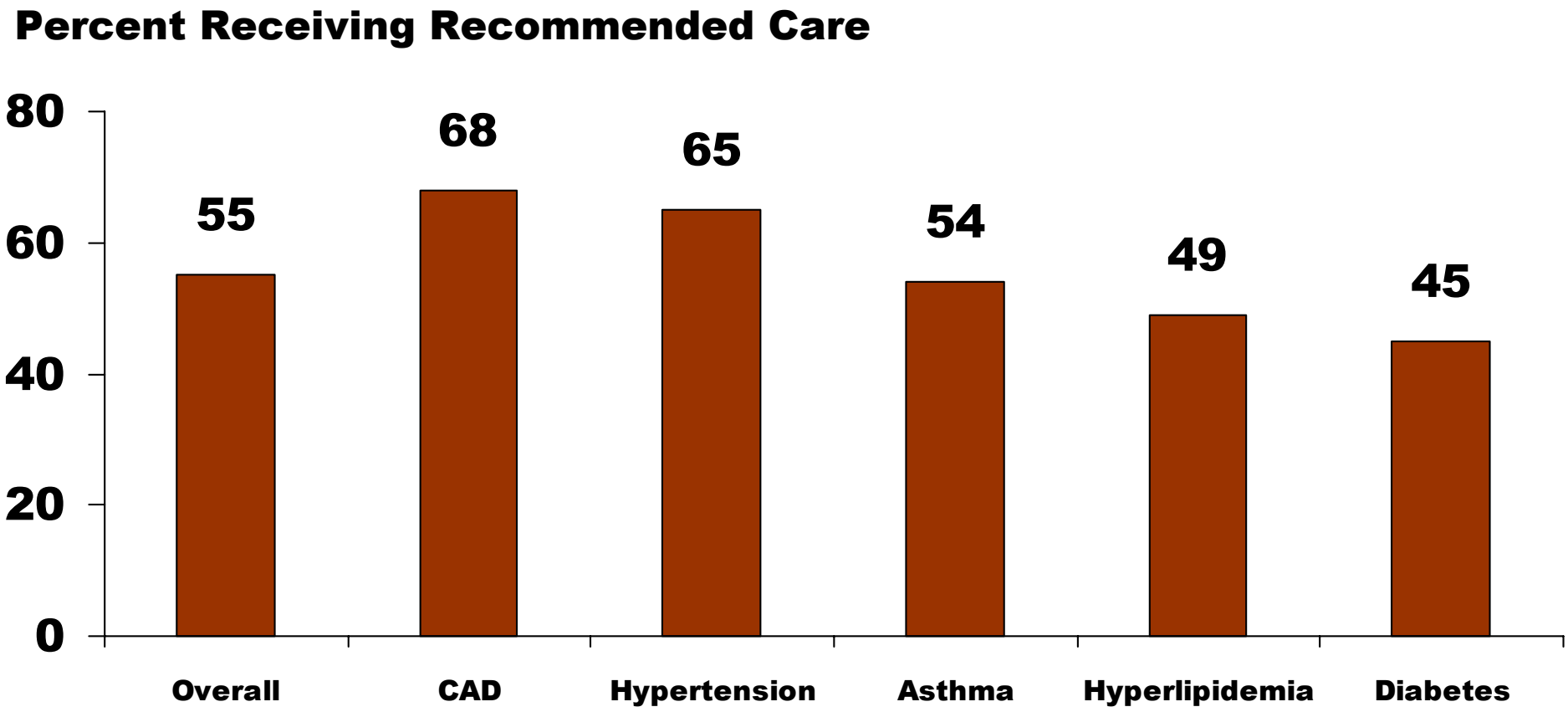

** Data for growth between Spring 2002 and Spring 2003*

*Source: Heffler et al., "Health Spending Projections for 2002-2012," Health Affairs (Web Exclusive February 7, 2003) for 1985–2001; Employer Health Benefits 2003 Annual Survey, The Kaiser Family Foundation and Health Research and Educational Trust, September 2003 for 2002–2003.*

# Drivers of Care Management

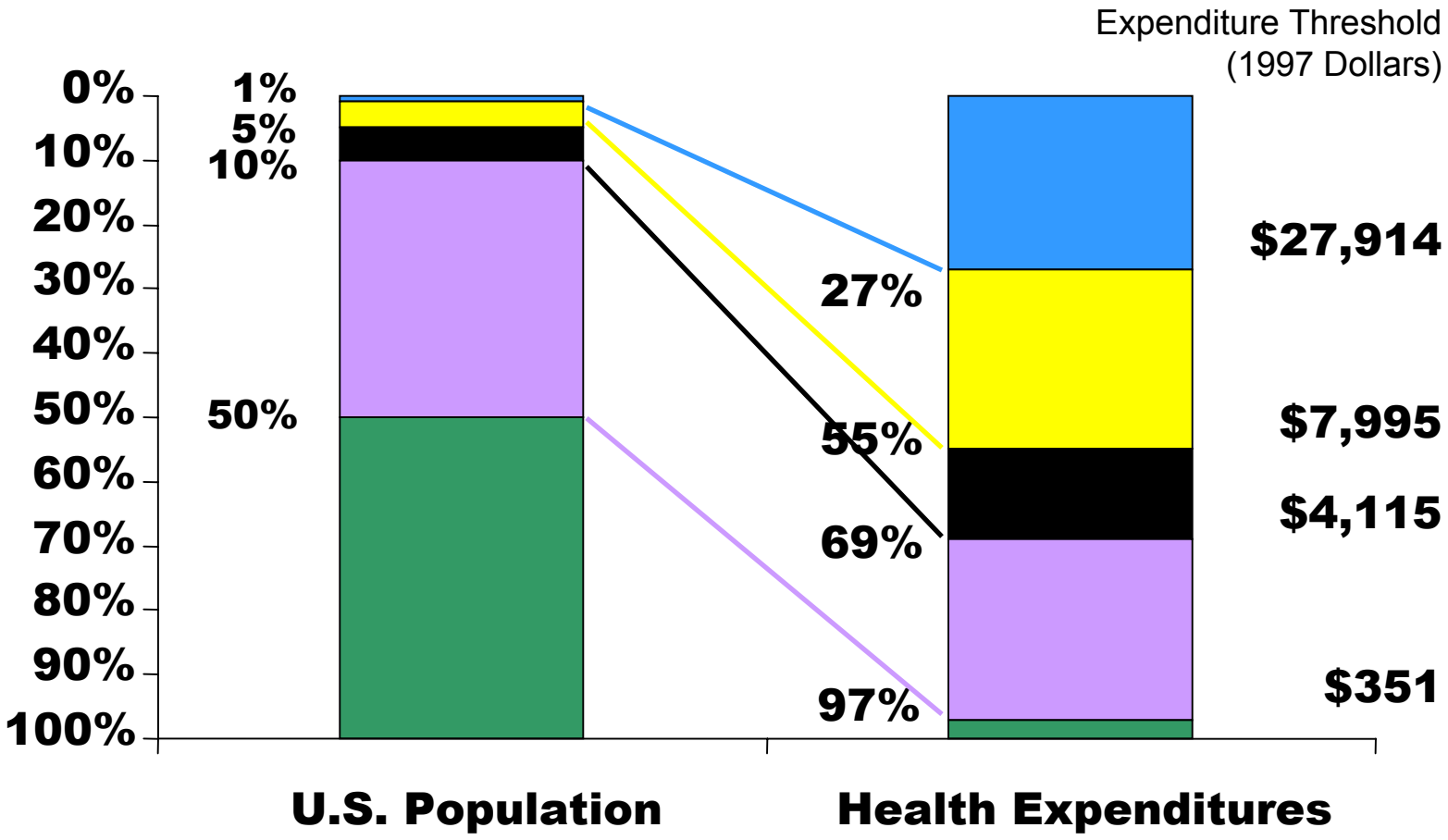
- 50% - preventive care
- 30% - lack recommended acute care
- 40% - lack recommended chronic care
- 30% - receive contraindicated acute care
- 20% - receive contraindicated chronic care

# Recommended Care and Quality Varies




*Source: McGlynn et al., "The Quality of Health Care Delivered to Adults in the United States," The New England Journal of Medicine (June 26, 2003): 2635–2645.*

# Health Care Costs Concentrated in Sick Few




*Source: AC Monheit, "Persistence in Health Expenditures in the Short Run: Prevalence and Consequences," Medical Care 41, supplement 7 (2003): III53–III64.*

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# DM Defined

**"Knowledge-based process intended to improve continuously the value of health care delivery from the perspectives of those who receive, purchase, provide, supply and evaluate it."**

***--James B. Couch, MD***

# DM Criteria Specific

- High dollar and volume
- Preventable complications
- Short time frame for results
- Treatment variability
- Extensive patient non-compliance
- Practical guidelines
- Measurable quality metrics

# DM Processes

- Identify patients
- Develop therapeutic programs
- Improve outcomes
- Achieve acceptable cost levels
- Provide evidence based care

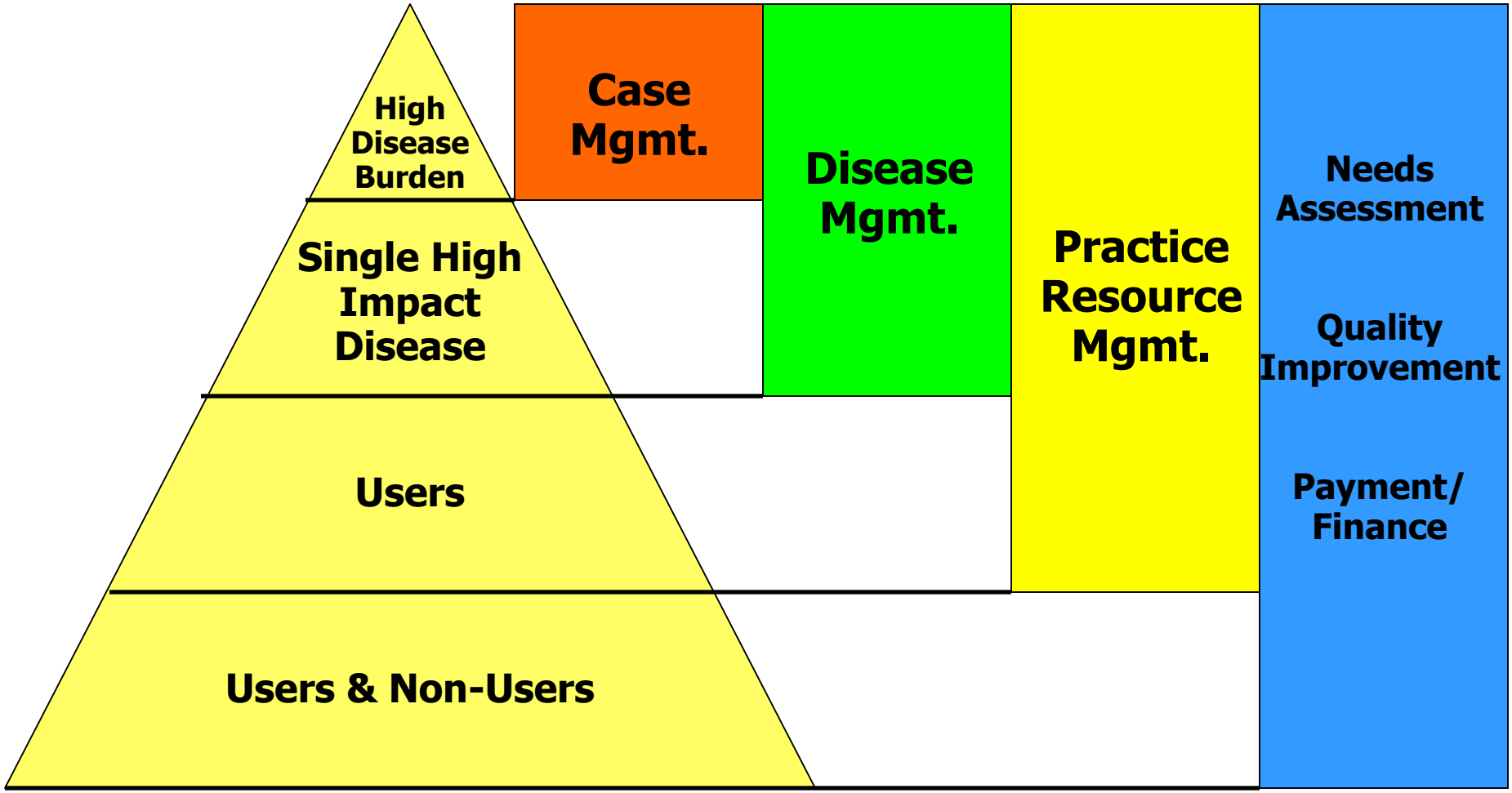
# Spectrum of Care

## *Disease Management*

**Lower Costs** ⟷ **Higher Costs**

| Self-Directed | Primary | Secondary | Tertiary | Long Term Care |
|---|---|---|---|---|
| Patients<br>Provider<br>Home Care | PCP<br>Allied Health Professionals | Specialist<br>Outpatient Clinics | Hospitals<br>Centers of Excellence | Institutions<br>Long Term Care<br>Nursing Homes |

# Risk Measurement Pyramid




*Source: Weiner JP. Presentation at National BCBS Association meeting, Chicago, 1/30/03.*

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# Predictive Modeling Defined

**Use of clinical information available for all members of a population to predict future healthcare needs, overall or for specific types of services.**

*Source: CB Forrest, "Population-based Predictive Modeling Using ACGs: Application to Disease and Case Management", International ACG User's Conference, November 11, 2003*

# Reasons for Predictive Modeling

- Existing high utilization by the few
- Uses available data to identify high-risk
- Allows intervention early in disease cycle
- Enhances case and disease management

# Predictive Modeling Focus

- **Case management targeting**
  - **Identify persons for care programs**
- **Disease management risk stratification**
  - **Intensity tiers**
- **Financial forecasting**
  - **Actuarial risk**

*Source: CB Forrest, "Population-based Predictive Modeling Using ACGs: Application to Disease and Case Management", International ACG User's Conference, November 11, 2003*

# What Predictive Modeling Does

- Stratify members
  - Enhance impact of interventions
- Probabilistic identification of high utilizers
  - Assign risk scores
    - Describe comparative severity of illness
- Identify members not receiving proper care
- Highlight inconsistency of care
- Prospectively identify adverse events
- Allow focused interventions
  - Maximize benefits of disease management
- Discover inefficient care

# Additional Uses of Modeling

- Influence adoption of best practices
- Track effectiveness of interventions
- Establish pay for performance
- Set more accurate premiums
- Develop contracts with providers
  - Actuarial
- Help plan network composition
  - Based on member needs

# Target Populations

- Risk stratify
  - Subpopulation
  - Risk factors
  - Identify most likely to benefit
- Develop specific, targeted interventions
  - Probabilities for certain outcomes
  - Practice guidelines
  - Practice standardization
    - Decrease variation

# Modeling Utilizes Available Data

- Traditional – demographic data
  - Age, sex, occupation, prior costs
- Clinical data from claims
- Pharmacy data
- Diagnostic tests
- Health risk appraisals
- Questionnaires

# Components of Modeling

- Entire population data
  - Baseline assessment used to predict future
- Risk assessment period
  - Static: year 1 predicts year 2
  - Rolling: assign score every period
- Outcomes of interest
  - Changes in health status
  - Costly healthcare events
  - Overall healthcare expenditures

*Source:* CB Forrest, "Population-based Predictive Modeling Using ACGs: Application to Disease and Case Management", International ACG User's Conference, November 11, 2003

# Statistics in Predictive Modeling

| Screening Test | + | − |
|---|---|---|
| + | TP (True Positive) | FP (False Positive) |
| − | FN (False Negative) | TN (True Negative) |

| | |
|---|---|
| Predicative Pos. Value | TP/TP + FP |
| Predicative Neg. Value | TN/FN + TN |
| Sensitivity | TP/TP+FN |
| Specificity | TN/FP + TN |

# Sensitivity Versus Predictive Value

| Score Cut-Point | % True Cases Among Group | % All True Cases Identified |
|---|---|---|
| Top 1% | 69% | 14% |
| Top 5% | 36% | 36% |
| Top 10 % | 25% | 51% |

Predictive Pos. Value

Sensitivity

# First Generation Modeling

- Utilize demographic data
  - Age, sex, diagnoses
- Rely upon historical financial data
- Predict risk

# Second Generation Modeling

- Utilize first generation data sources
- Incorporate second generation sources
  - Pharmacy data
  - Lab data
  - Test data
- Predictions based on risk adjustment
  - DCGs, ACGs, ETGs

# Third Generation Modeling

- Utilize first and second generation sources
- Incorporate other sources and models
  - Health risk appraisals, questionnaires
  - Surveys
  - Regional variability
  - ACGs, DCGs, ETGs
- Model the models
  - Choose the best modeling of models for results
  - Learn from previous data modeling

# Third Generation Process

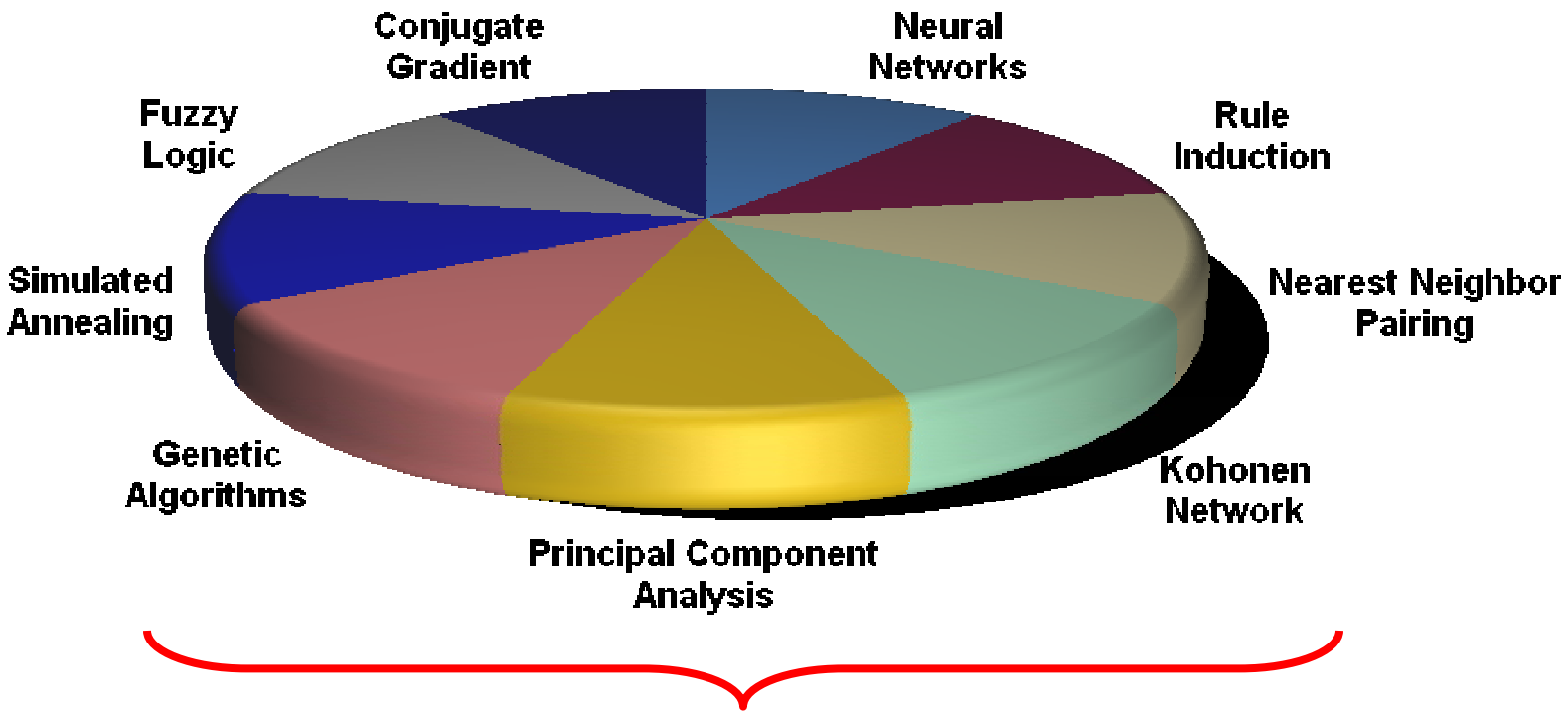
- Perform data cleanup
- Split data into 2 years
- Use Year1 data to predict Year2 cost


- Identify modeling clusters and select best drivers
  - Diseases, enrollment groups, product line

Source: MEDai Inc.

# Modeling of Models

- **Select model for optimum training of each cluster**
  - **Linear & Nonlinear / Regression, Neural Networks….,**




Source: MEDai Inc.

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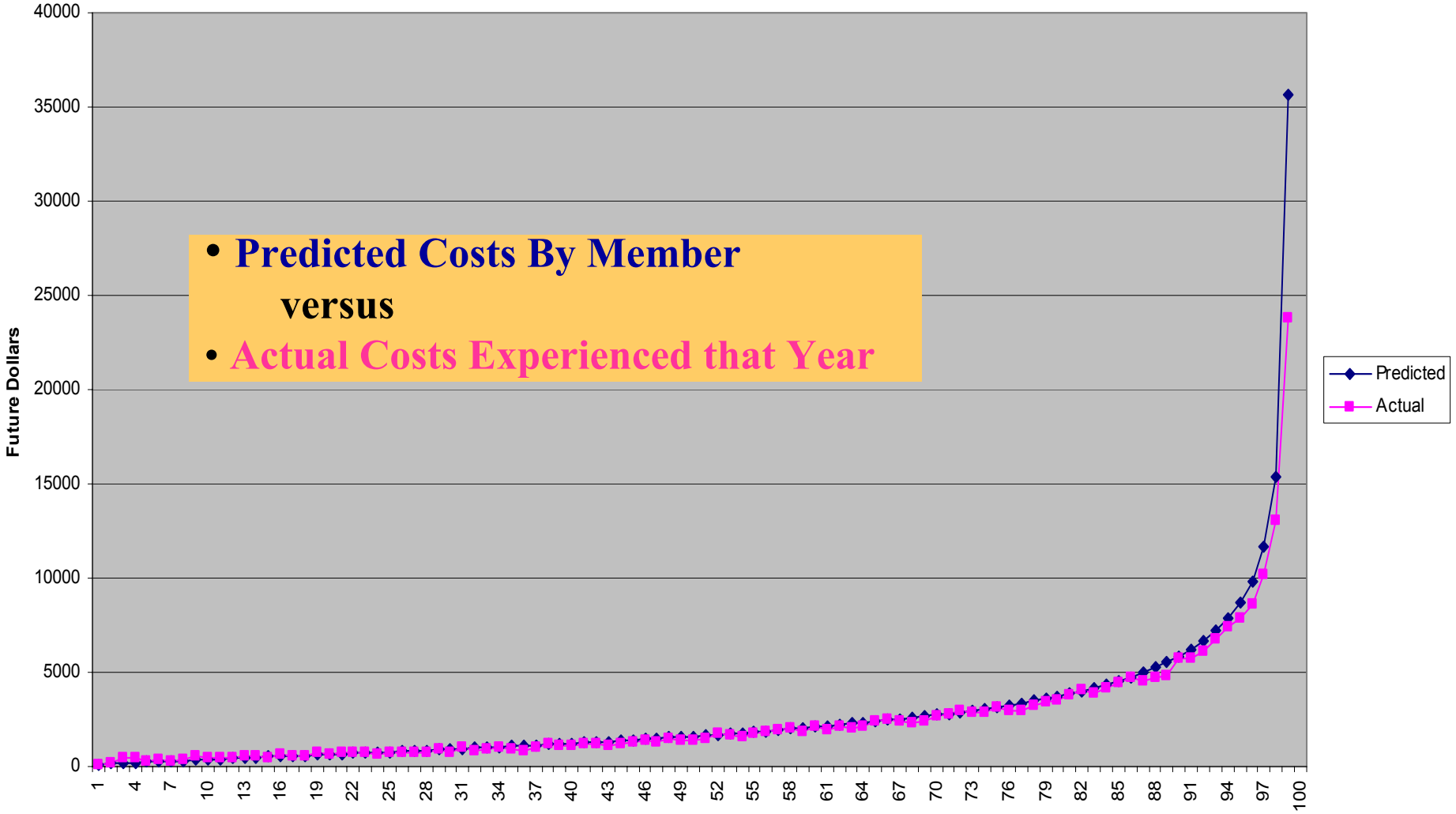
# Accuracy of Third Generation Model

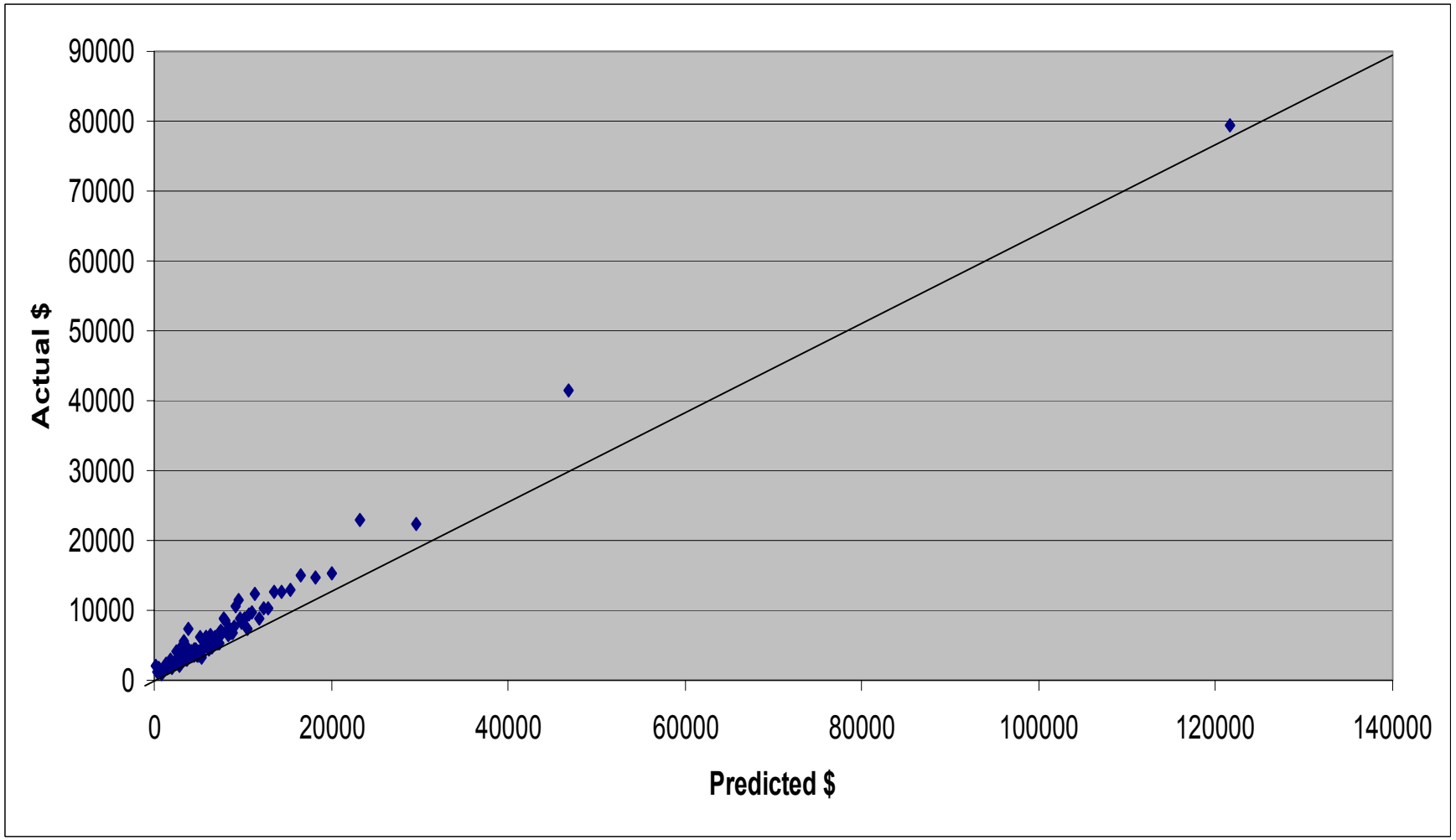



- **Predicted Costs By Member**
  **versus**
- **Actual Costs Experienced that Year**

Each data point represents a single group of members within a range of predicted costs
from the lowest predicted group to the highest predicted group (100 groups each with 1900 members)

*Source: MEDai Inc.*

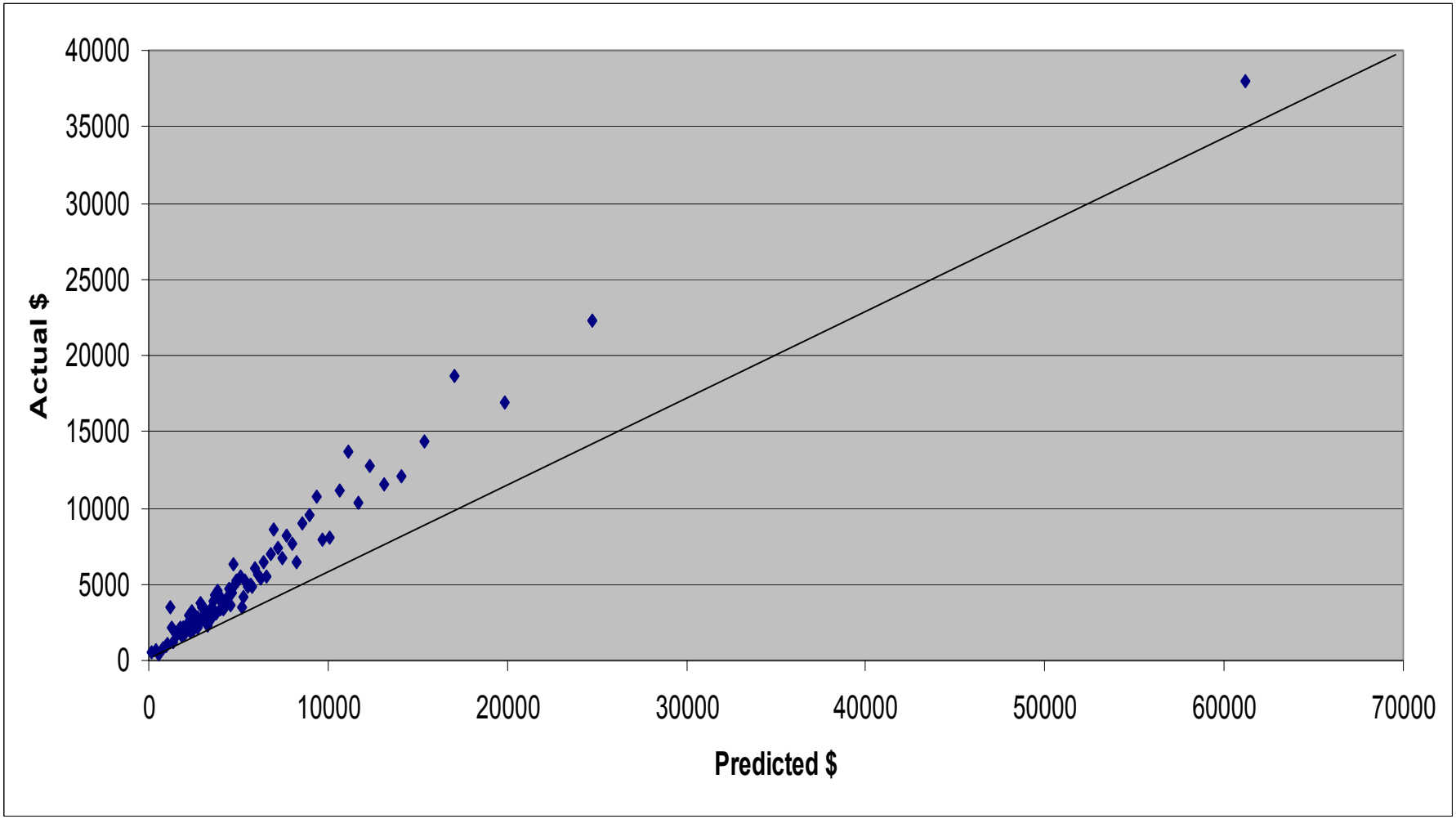
# Diabetes Model Accuracy




95 members per observation

Source: MEDai Inc.

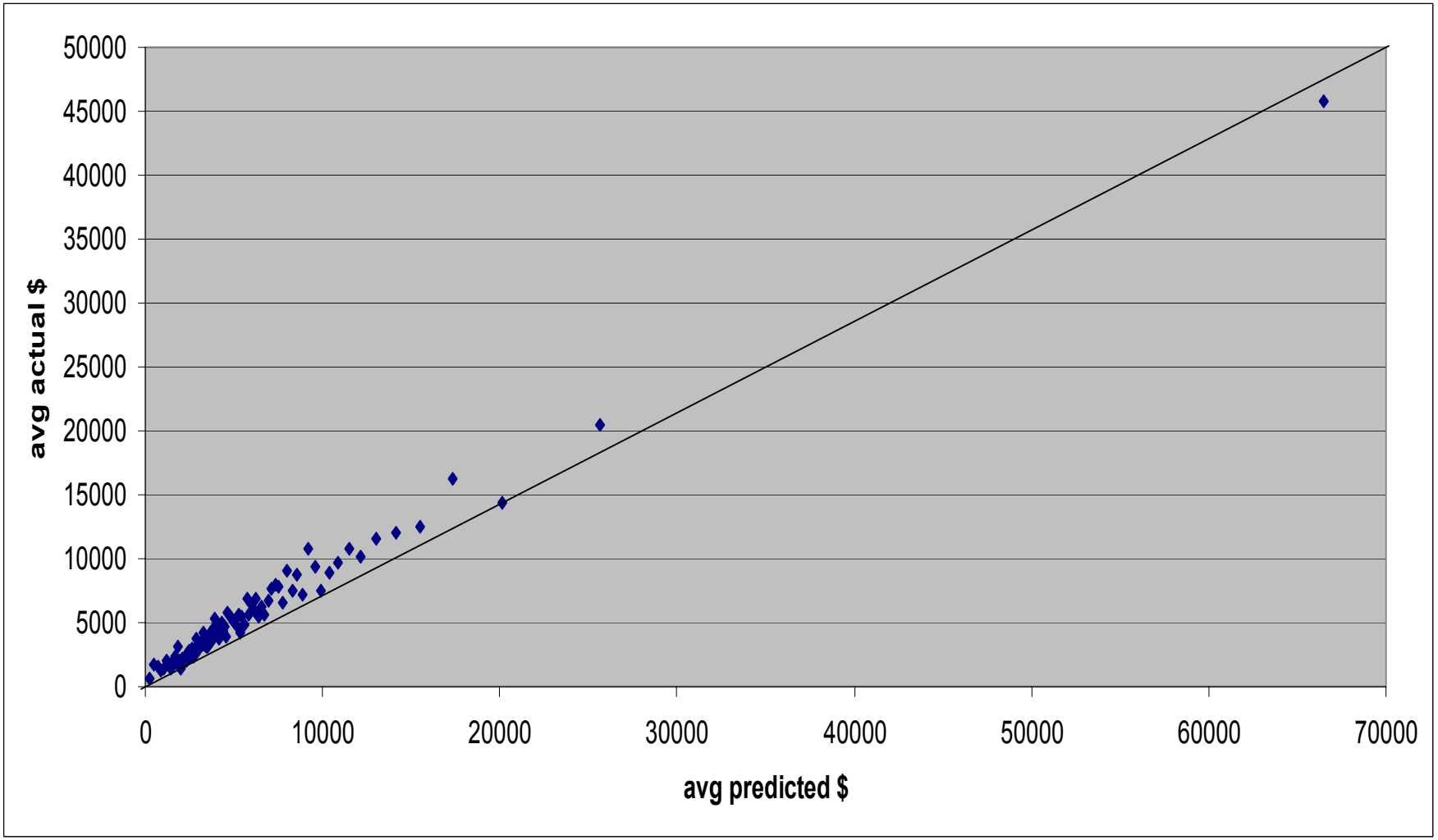
# Depression Model Accuracy




105 members per observation

Source: MEDai Inc.

# Hypertension Model Accuracy




230 members per observation

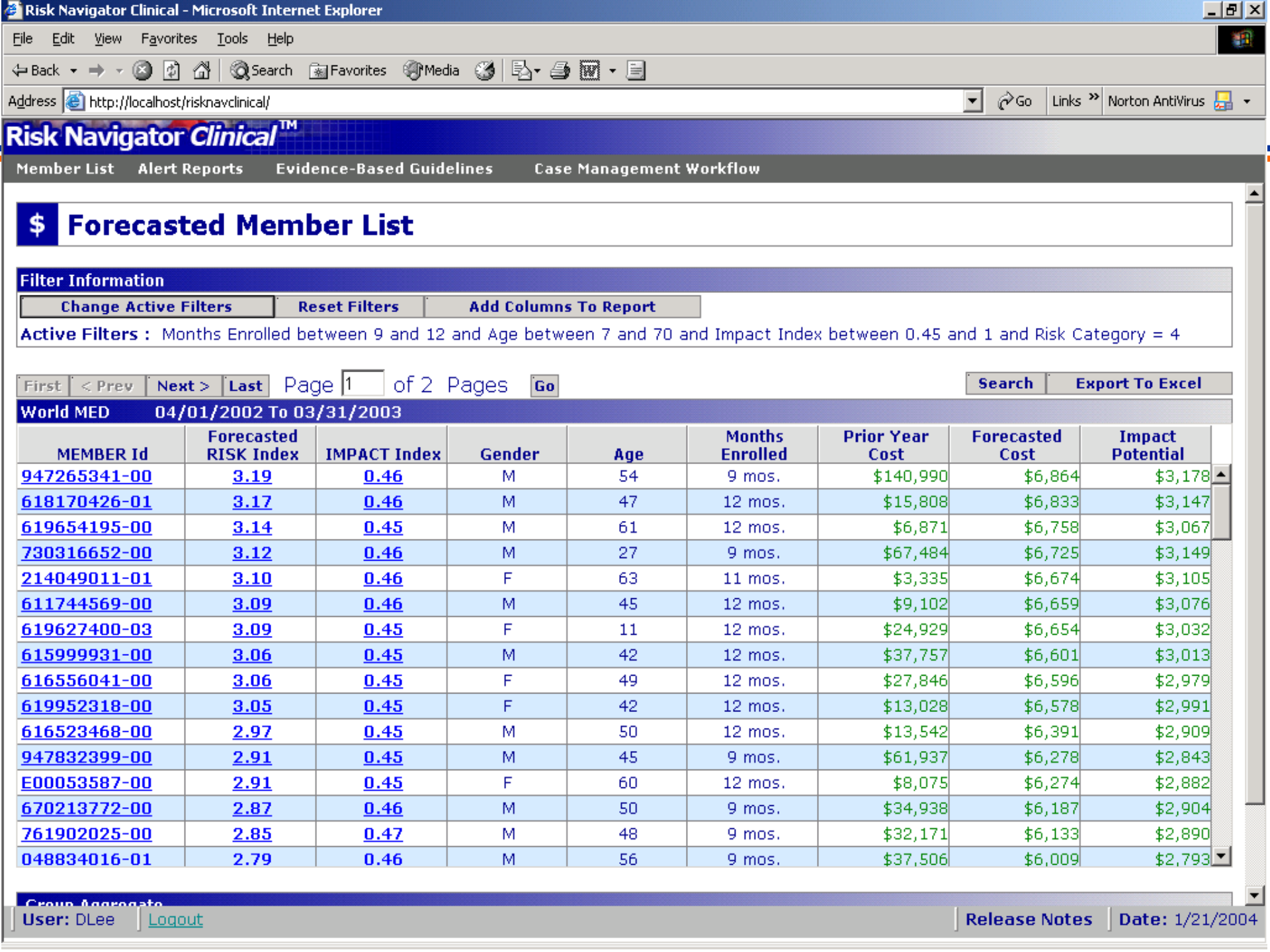
Source: MEDai Inc.

# Underwriting Impact for Employer Groups

| Sample of Employer Group | Members | MEDai forecast $PMPM | Internal Actuary Premium SPMPM | Difference |
|---|---|---|---|---|
| A | 80 | $114 | $119 | $6 |
| B | 78 | $151 | $139 | ($12) |
| C | 78 | $121 | $149 | $28 |
| D | 61 | $167 | $124 | ($43) |
| E | 55 | $114 | $93 | ($21) |
| F | 51 | $145 | $113 | ($32) |
| G | 48 | $170 | $134 | ($36) |
| H | 44 | $111 | $126 | $15 |
| I | 41 | $131 | $135 | $5 |
| J | 39 | $204 | $168 | ($36) |
| K | 36 | $118 | $124 | $6 |

- Health plan XYZ compared their premiums for a sample of employer groups using actuary vs. MEDai's.
- The actuarial model underestimated on the majority of small employer groups in comparison to MEDai.
- This creates substantial losses, since 80% of the employers are small-group. The MEDai forecasting provides a savings opportunity that approximated **$11 million** for 100,000 lives.
- The client states that "in the final quarter of 2001, the actual cost for these groups shows clear underestimation by the internal actuary forecasting."

*Source: MEDai Inc.*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Risk Navigator Clinical™
Member List Alert Reports Evidence-Based Guidelines Case Management Workflow
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Active Filters : Months Enrolled between 9 and 12 and Age between 7 and 70 and Impact Index between 0.45 and 1 and Risk Category = 4
First < Prev Next > Last Page 1 of 2 Pages Go
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World MED 04/01/2002 To 03/31/2003
MEMBER Id | Forecasted RISK Index | IMPACT Index | Gender | Age | Months Enrolled | Prior Year Cost | Forecasted Cost | Impact Potential
947265341-00 | 3.19 | 0.46 | M | 54 | 9 mos. | $140,990 | $6,864 | $3,178
618170426-01 | 3.17 | 0.46 | M | 47 | 12 mos. | $15,808 | $6,833 | $3,147
619654195-00 | 3.14 | 0.45 | M | 61 | 12 mos. | $6,871 | $6,758 | $3,067
730316652-00 | 3.12 | 0.46 | M | 27 | 9 mos. | $67,484 | $6,725 | $3,149
214049011-01 | 3.10 | 0.46 | F | 63 | 11 mos. | $3,335 | $6,674 | $3,105
611744569-00 | 3.09 | 0.46 | M | 45 | 12 mos. | $9,102 | $6,659 | $3,076
619627400-03 | 3.09 | 0.45 | F | 11 | 12 mos. | $24,929 | $6,654 | $3,032
615999931-00 | 3.06 | 0.45 | M | 42 | 12 mos. | $37,757 | $6,601 | $3,013
616556041-00 | 3.06 | 0.45 | F | 49 | 12 mos. | $27,846 | $6,596 | $2,979
619952318-00 | 3.05 | 0.45 | F | 42 | 12 mos. | $13,028 | $6,578 | $2,991
616523468-00 | 2.97 | 0.45 | M | 50 | 12 mos. | $13,542 | $6,391 | $2,909
947832399-00 | 2.91 | 0.45 | M | 45 | 9 mos. | $61,937 | $6,278 | $2,843
E00053587-00 | 2.91 | 0.45 | F | 60 | 12 mos. | $8,075 | $6,274 | $2,882
670213772-00 | 2.87 | 0.46 | M | 50 | 9 mos. | $34,938 | $6,187 | $2,904
761902025-00 | 2.85 | 0.47 | M | 48 | 9 mos. | $32,171 | $6,133 | $2,890
048834016-01 | 2.79 | 0.46 | M | 56 | 9 mos. | $37,506 | $6,009 | $2,793
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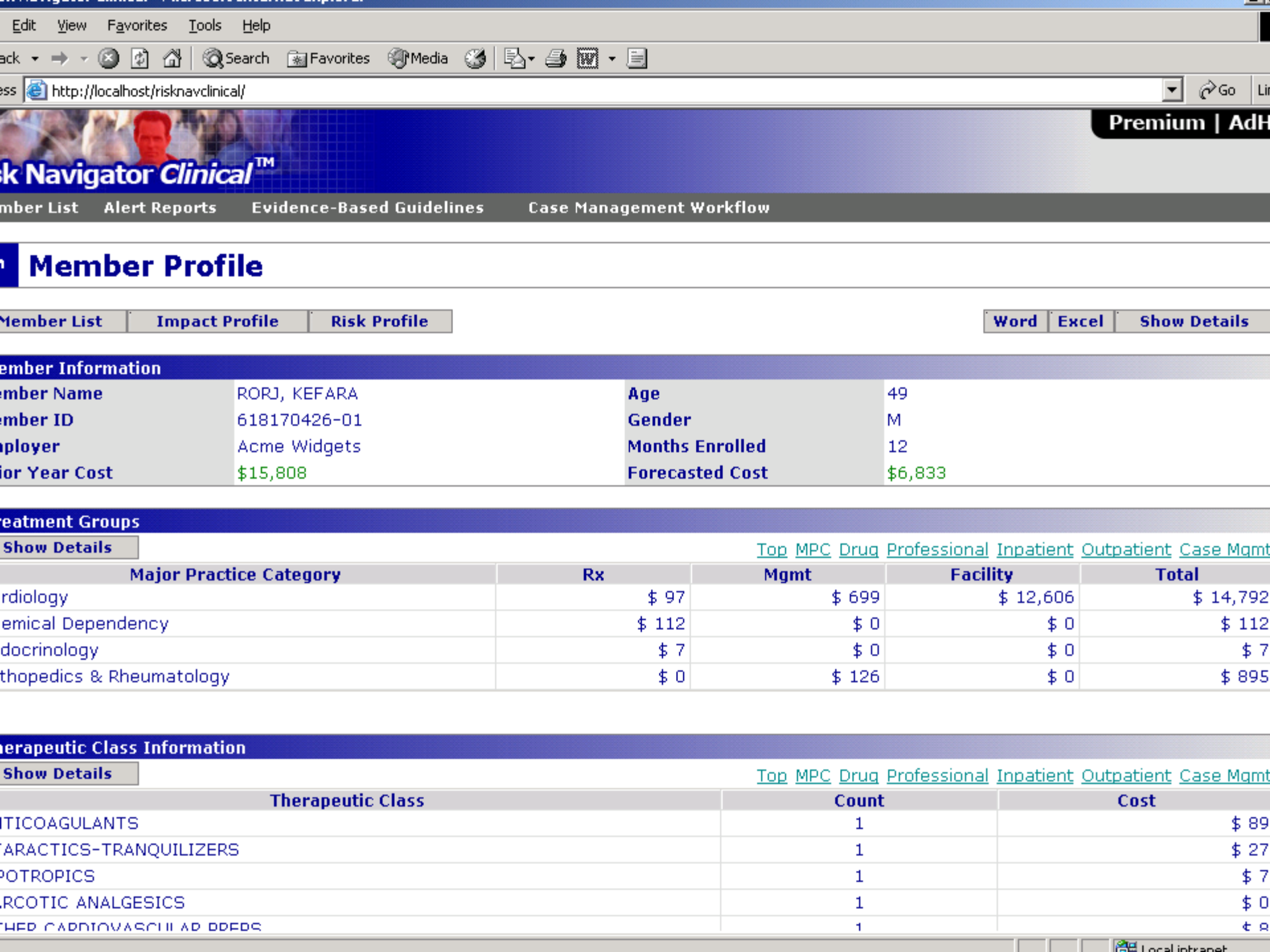
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Age 49
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Months Enrolled 12
Forecasted Cost $6,833
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Top MPC Drug Professional Inpatient Outpatient Case Mgmt
Major Practice Category | Rx | Mgmt | Facility | Total
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docrinology $ 7 $ 0 $ 0 $ 7
thopedics & Rheumatology $ 0 $ 126 $ 0 $ 895
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TARACTICS-TRANQUILIZERS 1 $ 27
POTROPICS 1 $ 7
RCOTIC ANALGESICS 1 $ 0
THER CARDIOVASCULAR PREPS 1 $ 8

# Successful Predictive Modeling

- **Identify clear goals**
  - Models fit some better than others
    - Actuarial versus care management
- **Assess available data inputs**
  - Demographic, claims, pharmacy, lab values
- **Secure a product champion**
  - Key to any successful implementation
- **Apply effective change management**
  - Adjustment of approach to care management

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