Big Data driving change in Healthcare:

Saving Lives
Saving Money

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Atrius Health

March 25th, 2014
Health Analytics and BIG DATA, Toronto
Larry Garber, MD – Reliant Medical Group

Outline

- The problem with healthcare in USA
- Accountable Care Organizations (ACOs) to the rescue
- Using EHRs, HIEs, analytics, and clinical decision support to make ACOs successful

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Larry Garber, MD

- Internist at Atrius/Reliant (AKA Fallon Clinic) x 27 yrs

- Medical Director for Informatics x 15 years
- Principal Investigator for $3.5M AHRQ and ONC grants for SAFE Health and IMPACT HIEs in Massachusetts
- Chair, MAeHC
- Member ONC HIT Policy Committee's HIE Workgroup and Privacy & Security Tiger Team, and MA HIT Council

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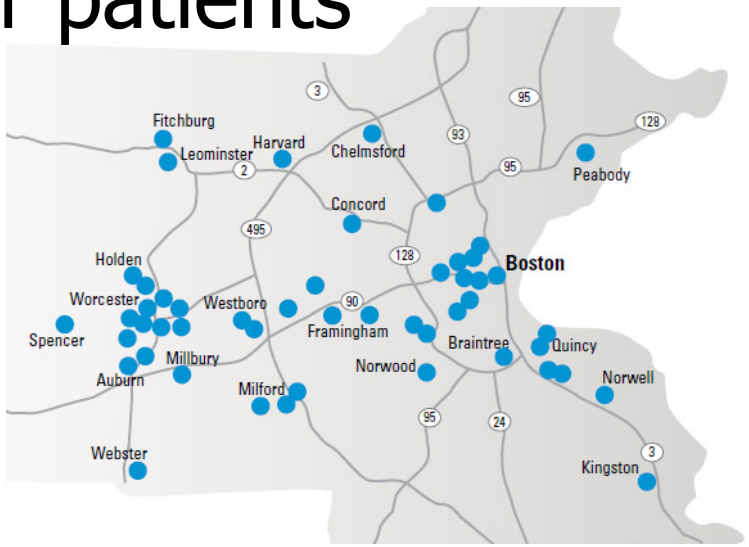
- Alliance of 6 multi-specialty group practices
- 1000+ Physicians, 35 specialties
- 50 sites near Boston, Massachusetts
- 1 Million patients with ~4 Million visits/year
- Not affiliated with any hospitals
- Financial risk for 70% of our patients
- Not-for-profit
- A Pioneer ACO
- HIMSS Ambulatory Stage 7



PROBLEM WITH HEALTHCARE IN THE UNITED STATES

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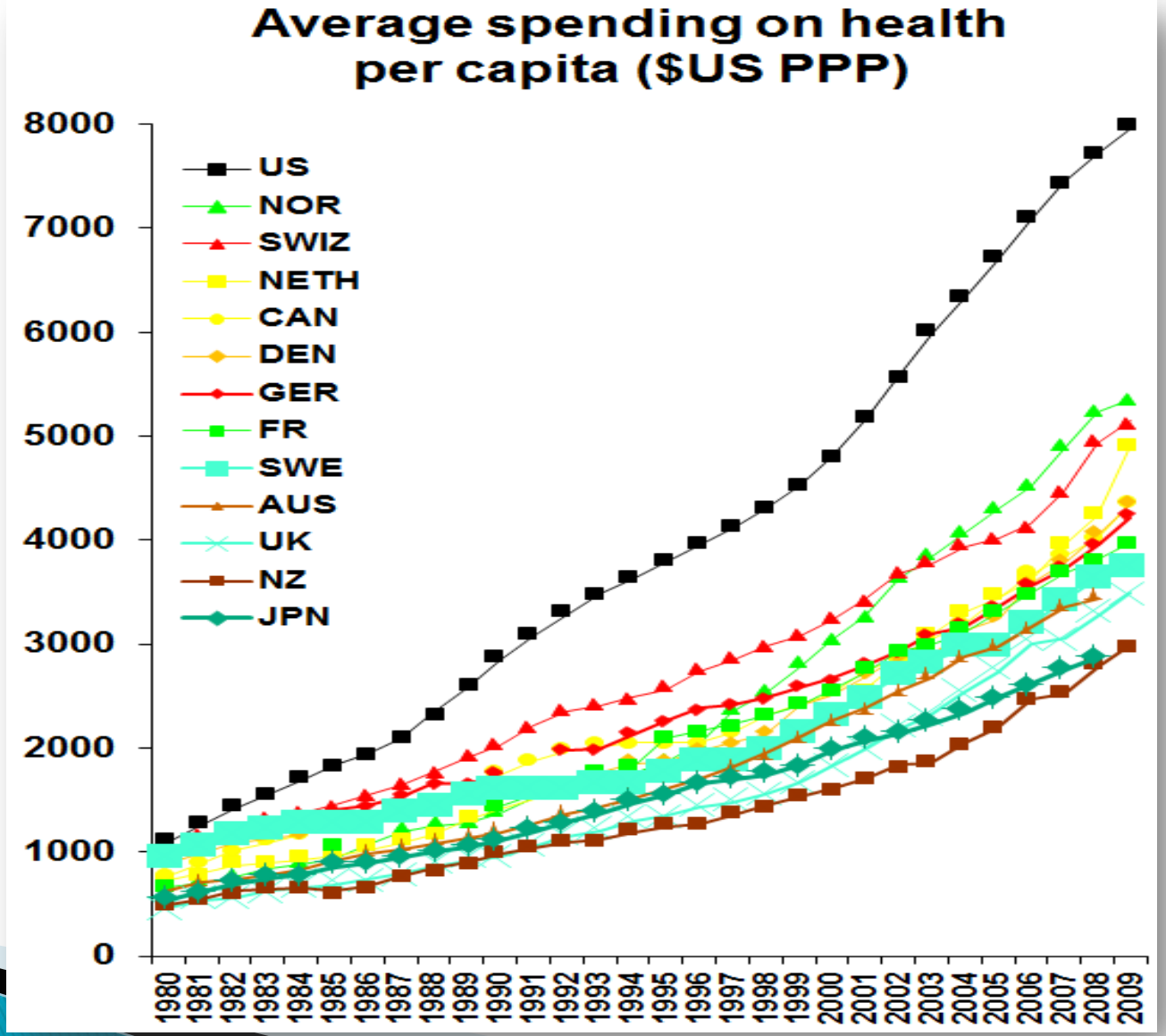
US Healthcare Costs are Excessive…



Note: PPP = Purchasing power parity—an estimate of the exchange rate required to equalize the purchasing power of different currencies, given the prices of goods and services in the countries concerned.
Source: OECD Health Data 2011 (Nov. 2011).

…Doesn't Achieve Highest Quality

Country Rankings	
	1.00–2.33
	2.34–4.66
	4.67–7.00

	AUS	CAN	GER	NETH	NZ	UK	US
OVERALL RANKING (2010)	3	6	4	1	5	2	7
Quality Care	4	7	5	2	1	3	6
Effective Care	2	7	6	3	5	1	4
Safe Care	6	5	3	1	4	2	7
Coordinated Care	4	5	7	2	1	3	6
Patient-Centered Care	2	5	3	6	1	7	4
Access	6.5	5	3	1	4	2	6.5
Cost-Related Problem	6	3.5	3.5	2	5	1	7
Timeliness of Care	6	7	2	1	3	4	5
Efficiency	2	6	5	3	4	1	7
Equity	4	5	3	1	6	2	7
Long, Healthy, Productive Lives	1	2	3	4	5	6	7
Health Expenditures/Capita, 2007	$3,357	$3,895	$3,588	$3,837*	$2,454	$2,992	$7,290

Note: * Estimate. Expenditures shown in $US PPP (purchasing power parity).
Source: Calculated by The Commonwealth Fund based on 2007 International Health Policy Survey; 2008 International Health Policy Survey of Sicker Adults; 2009 International Health Policy Survey of Primary Care Physicians; Commonwealth Fund Commission on a High Performance Health System National Scorecard; and Organization for Economic Cooperation and Development, *OECD Health Data, 2009* (Paris: OECD, Nov. 2009).

US Government's Theory

- US Physicians and Hospitals are not financially incentivized to provide high quality, cost-effective care
- Changing payment model from Fee-For-Service to Pay-for-Performance (P4P) should properly align incentives
- In 2011, created the Accountable Care Organization (ACO) program

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The ACO Model – Balancing Act

Cost vs. Quality/Safety/Outcomes vs. Satisfaction

BUILDING THE BUSINESS AND CLINICAL INTELLIGENCE INFRASTRUCTURE TO SUPPORT ACO'S AND EXCEPTIONAL OUTCOMES

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Infrastructure Components

- Electronic Health Record
- Patient Engagement Tools (Personal Health Record, Home monitoring, etc…)
- Health Information Exchange
- Clinical Decision Support
- Healthcare Analytics and Reporting Tools

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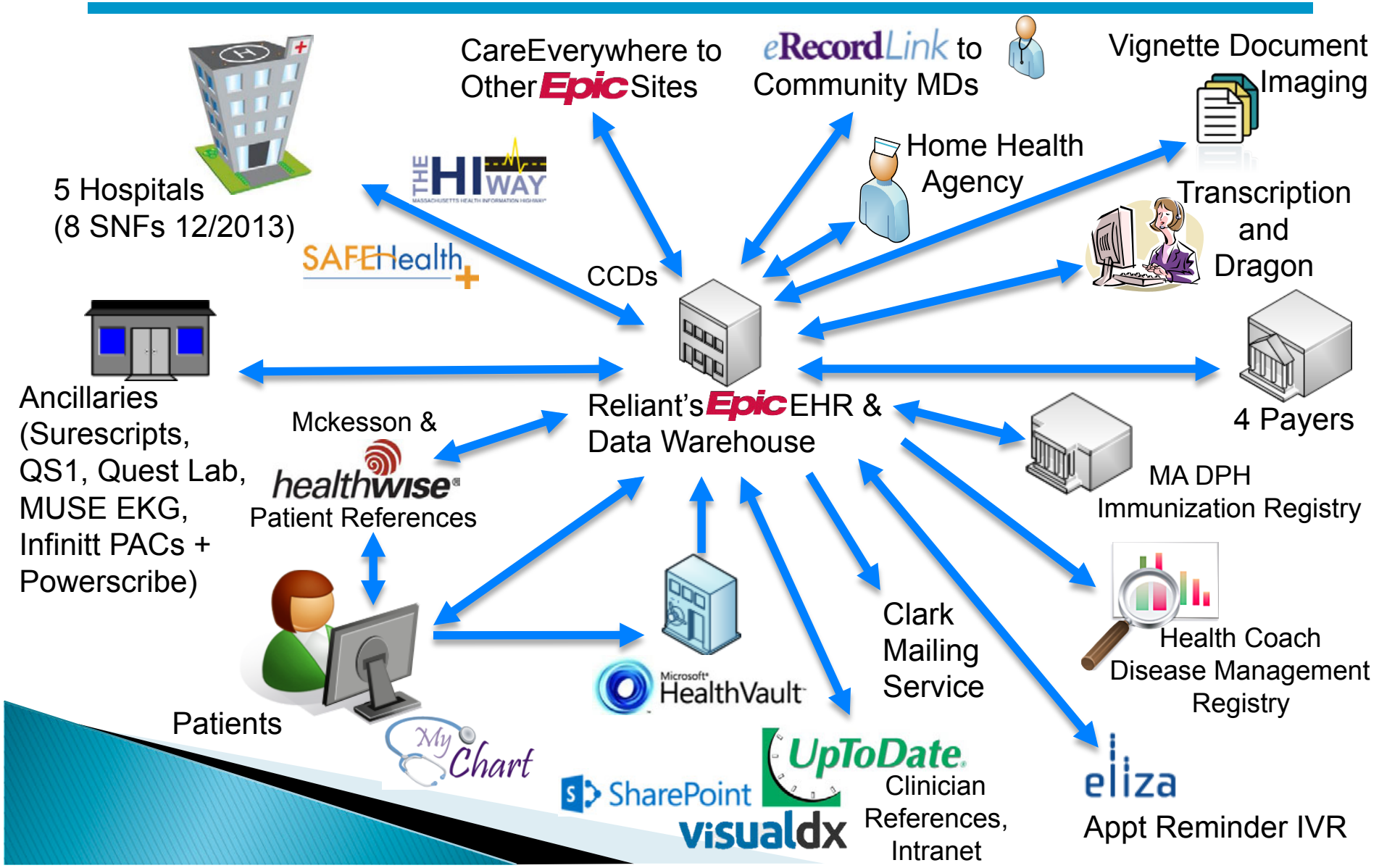
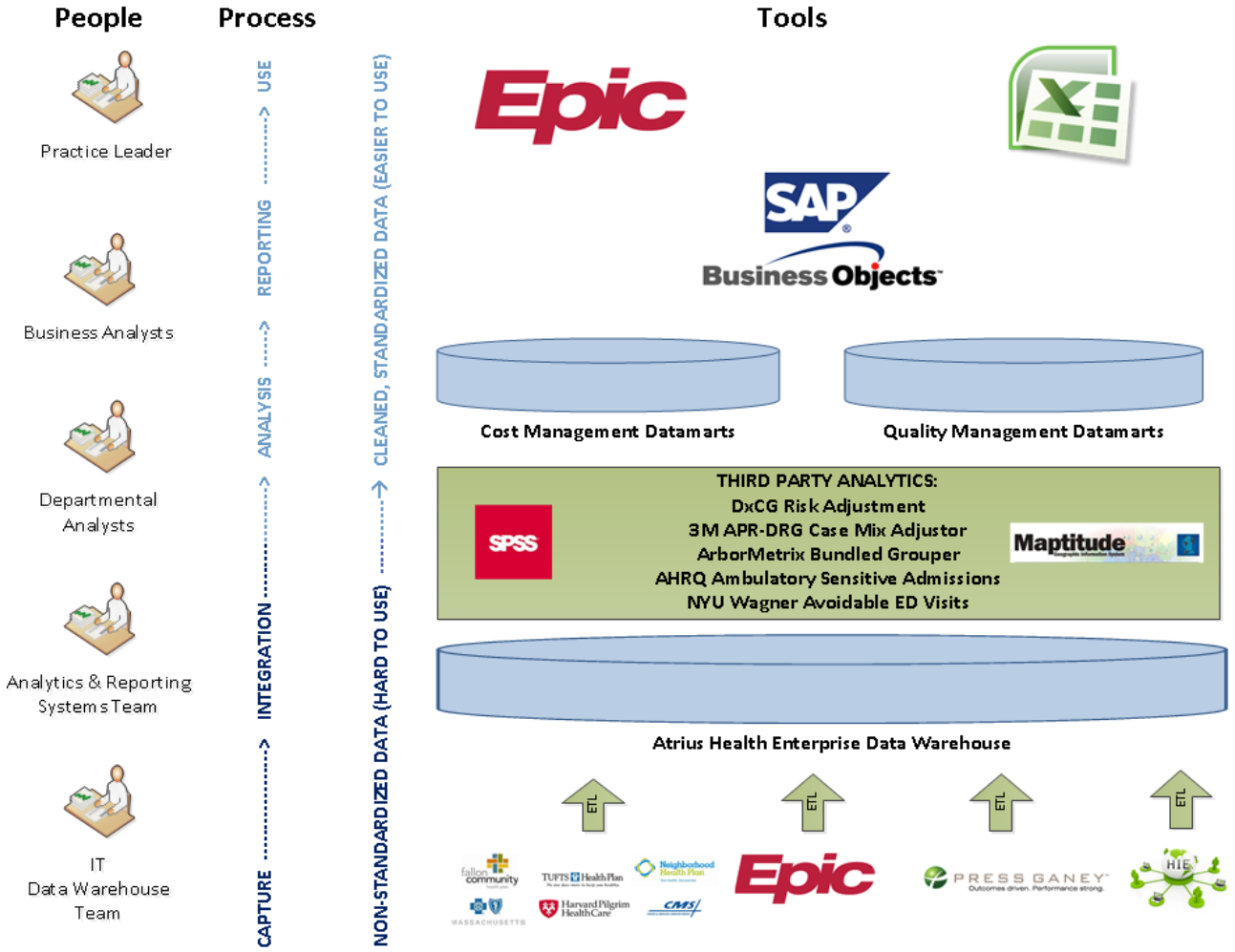
Reliant Medical Group's Interfaces



Clinical and Business Intelligence



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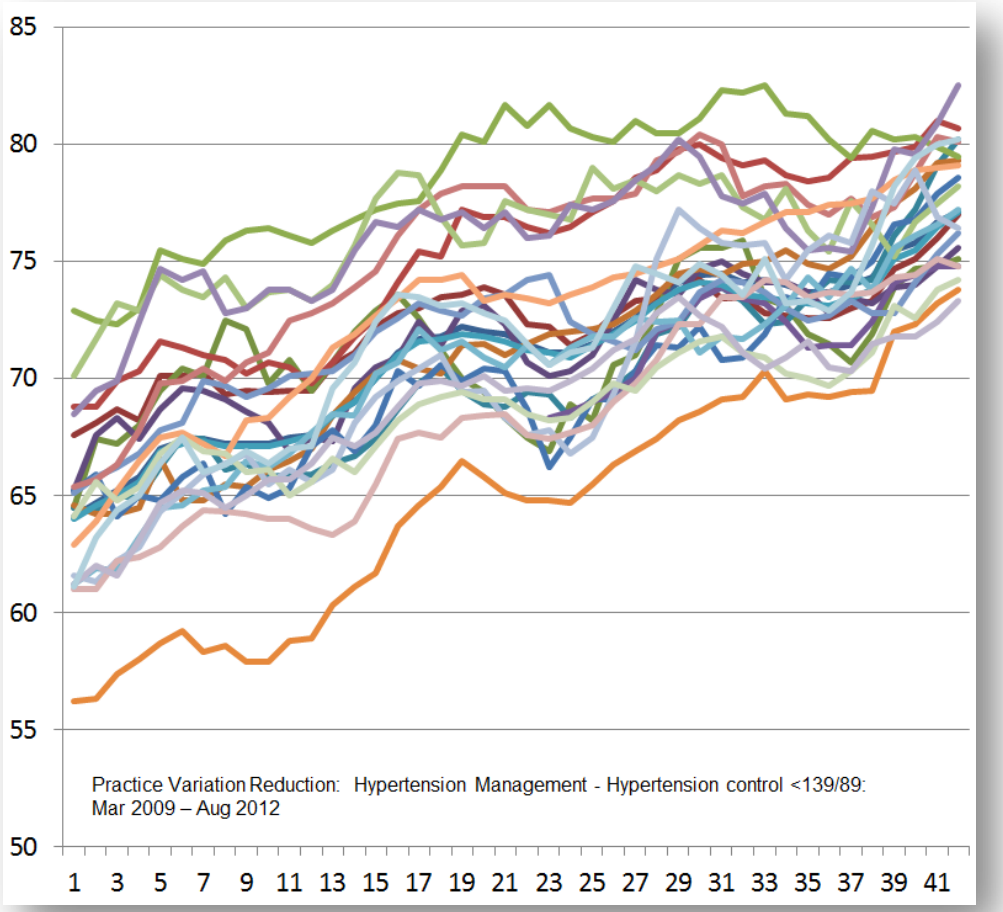
Healthcare Analytics as a Core Competency



Analytics are a core competency of an adaptive learning delivery system.

- Delivery system change is hard; professional knowledge worker organizations inherently resistant to top-down change
- No blueprint for ideal system, so ACOs must innovate, adapt, and improve
- Continuous improvement = Continuous Learning
- Data informed decision making is especially critical as resources and reimbursement levels continue to drop

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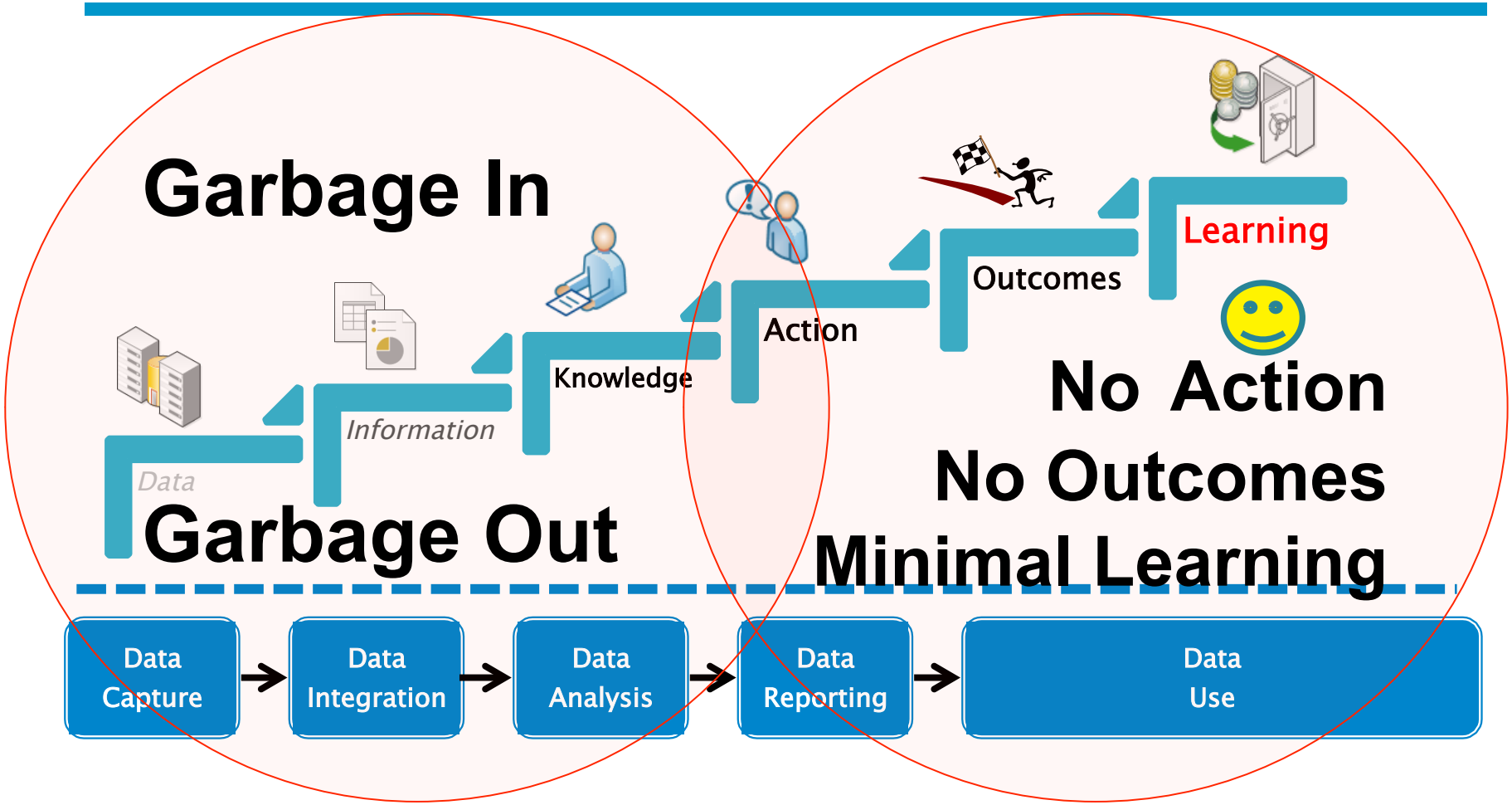
Healthcare Analytics as a Core Competency



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EHR Discrete Data to Drive Analytics

- Choose data elements that benefit the clinicians and patient; Collecting data purely for analytics purposes will result in “Garbage”
- Easy to collect data that can be reused by clinicians (e.g. Meds, Allergies, Problems, Encounter diagnoses, Social Hx, PMSHx…)
- Forms and Flowsheets can record fall risk screening, depression screening (PHQ2/ PHQ9), post-hospitalization med reconciliation, etc…

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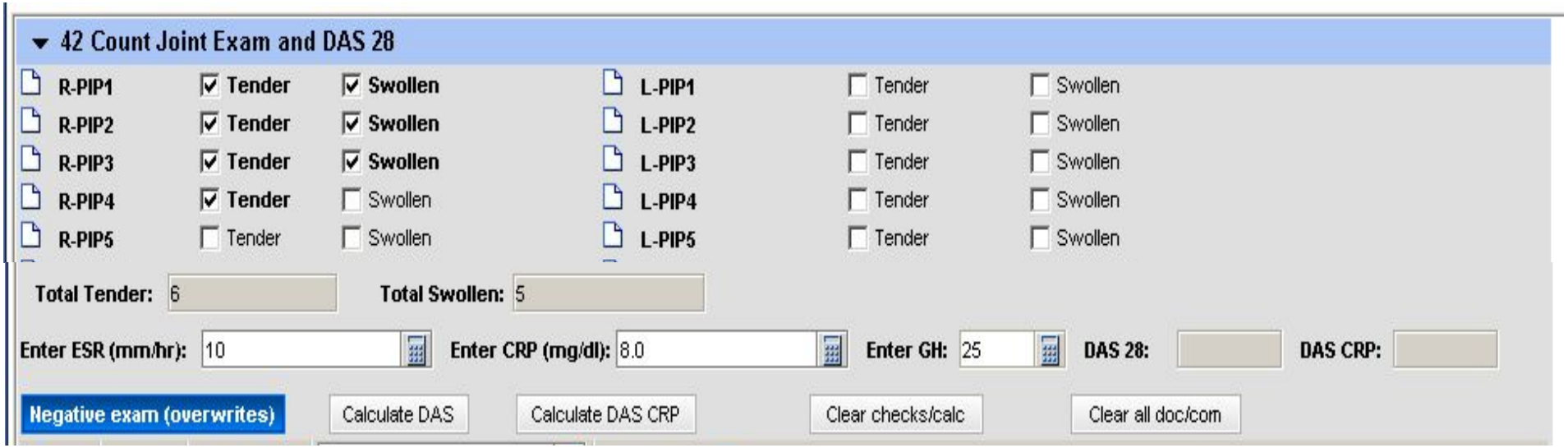
RA Disease Activity Score

- 0.56 * sqrt(tender28) + 0.28 * sqrt(swollen28) + 0.70 * ln(ESR) + 0.014 * GH
- Supports billing
- Can be trended over time



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Pneumonia Severity Index

Physical Exam Findings	
Altered Mental Status ? (Y/N +20)	Yes
Systolic BP (<90mmHg = +20)	136
Temp	102 (38.9)
Pulse	105
SpO2	89
Respiration	20
Lab/Xray Findings (Order Hct/Basic STAT, add and recalculate when available)	
Arterial PH (<7.35 +30)	7.36
BUN (>=30 +20)	50
Sodium Level (<130 +20)	128
Glucose (>250 +10)	150
HCT (<30 +10)	29
Pleural Effusion? (Y/N +10)	No
Pneumonia Risk Evaluation	
Pneumonia Severity Index	214
Pneumonia Severity Class	Class V
Pneumonia Mortality Calculation	26.7%
Pneumonia Treatment Recommendations	ICU

Pre-populates with known data. Clinicians add data and form calculates risk.

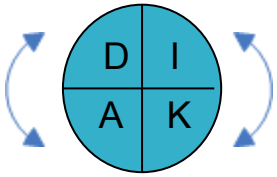
Healthcare Analytics as a Core Competency

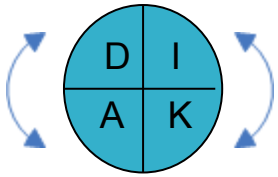
Executives

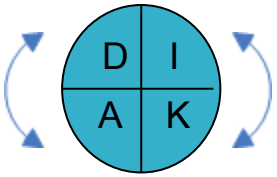
Directors & Chiefs

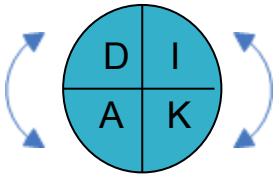
Frontline Clinicians

Patients & Community









Strategic	Tactical	Operational	Individual

Action is Determined by the Report User

Required Report Data & Metrics Defined by Expected Actions & Workflow

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Datamarts to Help Turn Data into Information

Quality & Cost Datamarts

- Accurate & actionable reports using mixed claims & EHR data is difficult for inexperienced data analysts and business analysts
- Organizational improvement activity is microsystem change so the greatest demand for data is at clinic-based management level
- Need to institutionalize analytic knowledge to make information more accessible to the frontlines to drive improvement in the practice
- Single source of truth for organization

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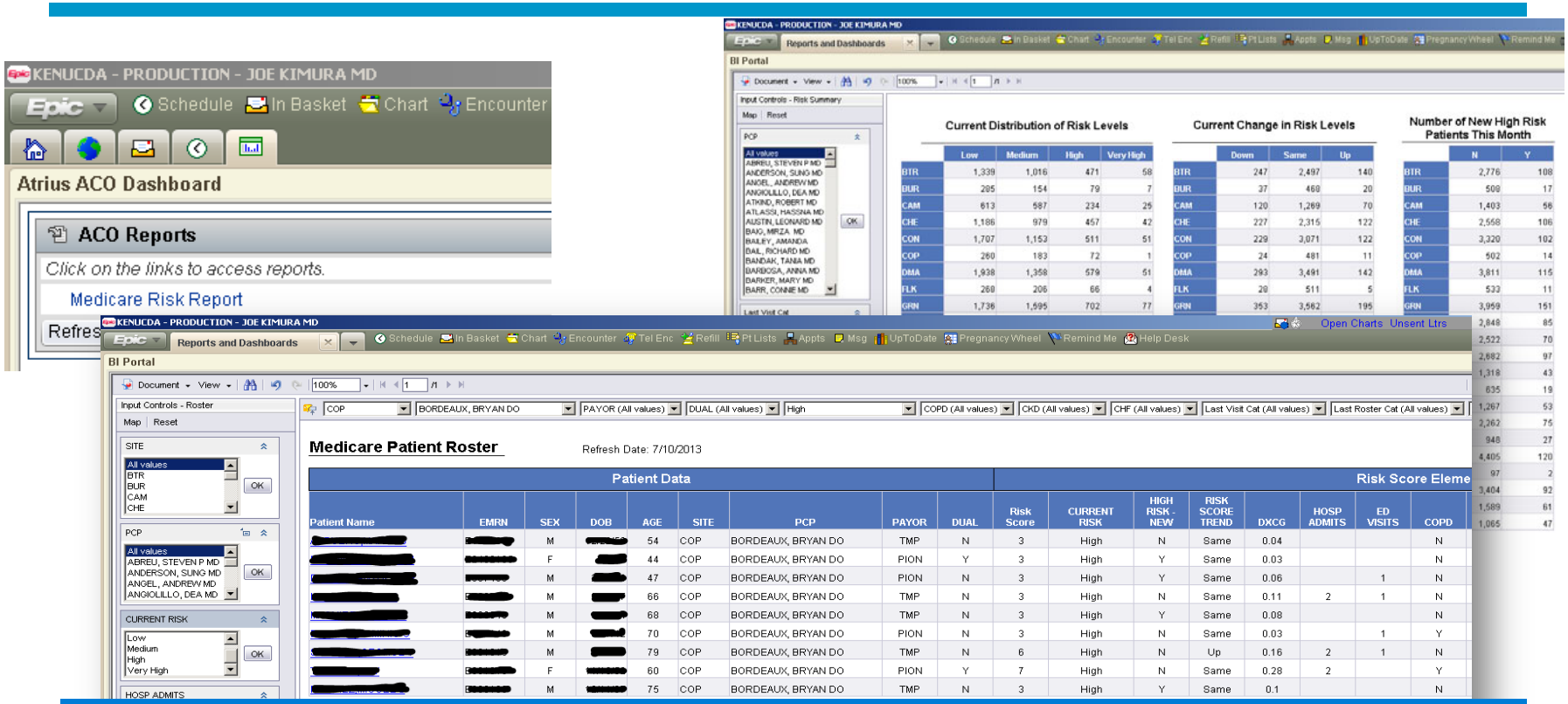
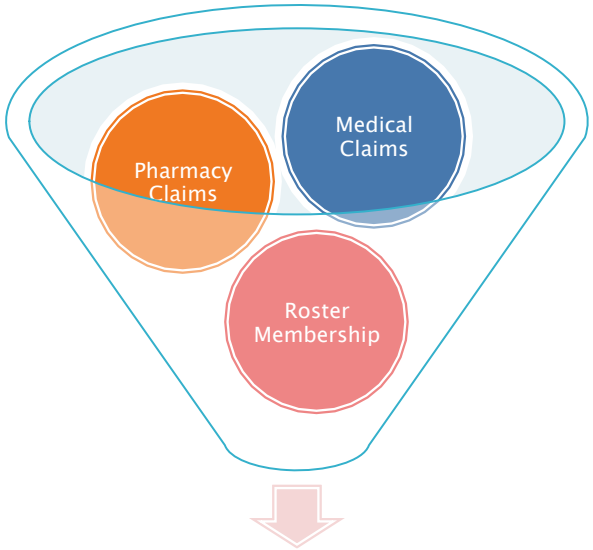
Reporting Dashboard, Registries, DataLink



- Single Sign On Thru EPIC -> BO WebI -> Hyperlink Back to EPIC Patient Chart
- Two Levels: PCP Panel & Population Manager (With Summary Tables)
- Monthly Run and Update (Medicare Advantage + Pioneer ACO)
- Risk Score Details (Current, Trend, New High)
- Upcoming Appointment (Specialty + Date) + Last Appointment (Specialty + Date)
- Roster Review Encounter (Last Date)
- DataLink can populate FYIs, Health Maintenance Modifiers, etc…

Cost Management Datamarts: Events



- 83 million claim lines from Jan 09 – May 13
- Multiple claim lines are mapped to unique & mutually exclusive events row in a datamart
- Sum Datamart Total_Cost = Sum Raw Claim TME

Rows	Datamart Examples	One Row Per Event in Table:
148,126	Acute Inpatient Hospital Care	Admission Event
242,993	Emergency Department Care	Ambulatory ED Visit Event
949,918	Advanced Imaging Studies	Imaging Event (MRI Scan, etc.)
14,895,540	Outpatient Specialty Services	Outpatient Specialty Service Event (Ambulance, DME, Cardiology Visit, etc.)

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Cost Management Datamarts

- Family of datamarts built to work together
  - Inpatient Care (Acute Hospital & SNF/ARF)
  - Observation Care
  - Ambulatory Emergency Department Care
  - Advanced Imaging (MRI, CT, Ultrasound, Digital Mammo)
  - Outpatient Specialty Services (Surg Day Care, Ambulance, DME, etc.)
  - Pharmacy
- Three cornerstone metrics in each datamart:
  - $PMPM (Per Member Per Month)
  - Utilization (Total # events per 1,000)
  - Price (Cost/event)
- Common analytic dimensions to explore drivers of these metrics
- All with drill-down to physician, patient, and unique event level

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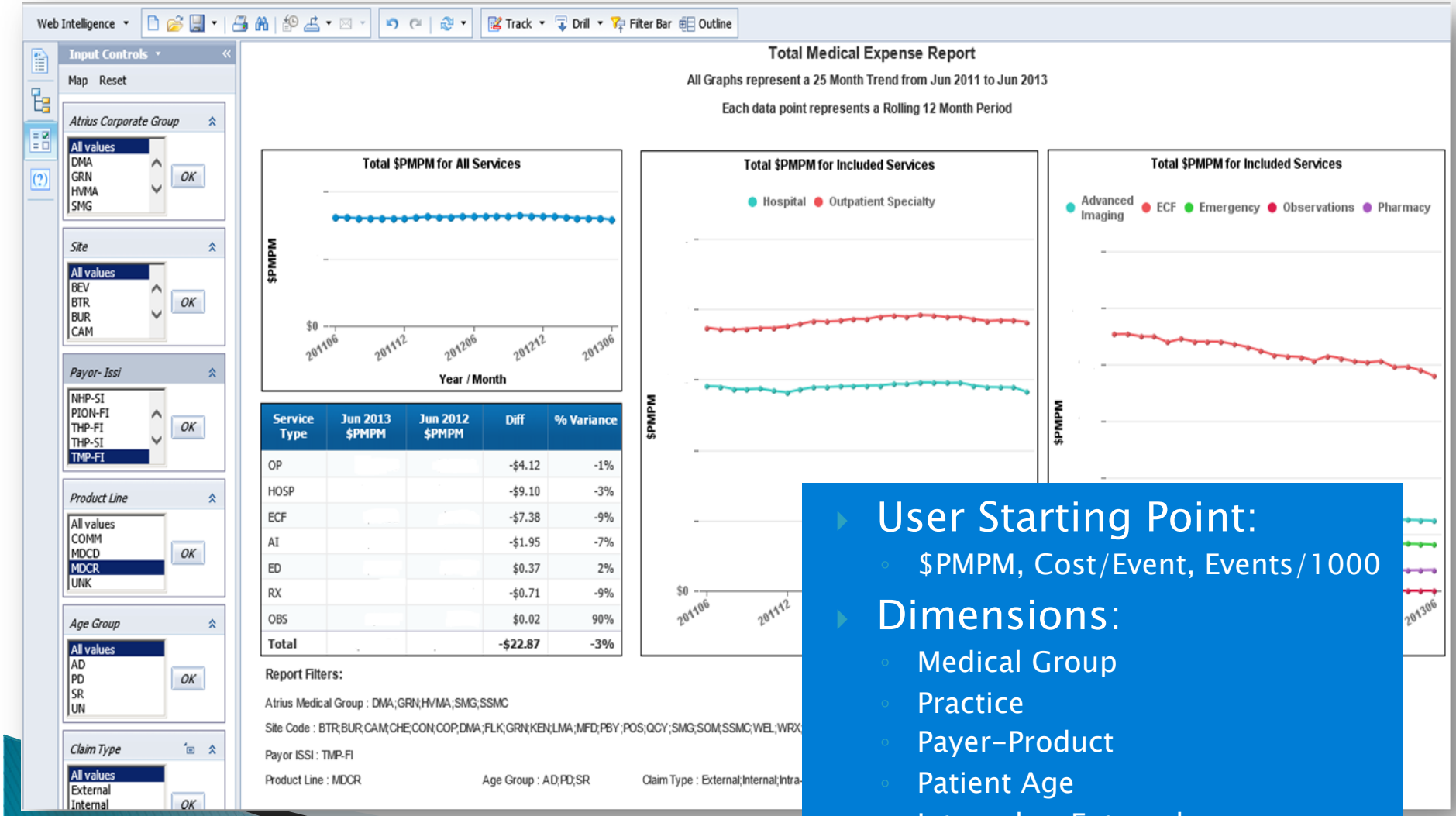
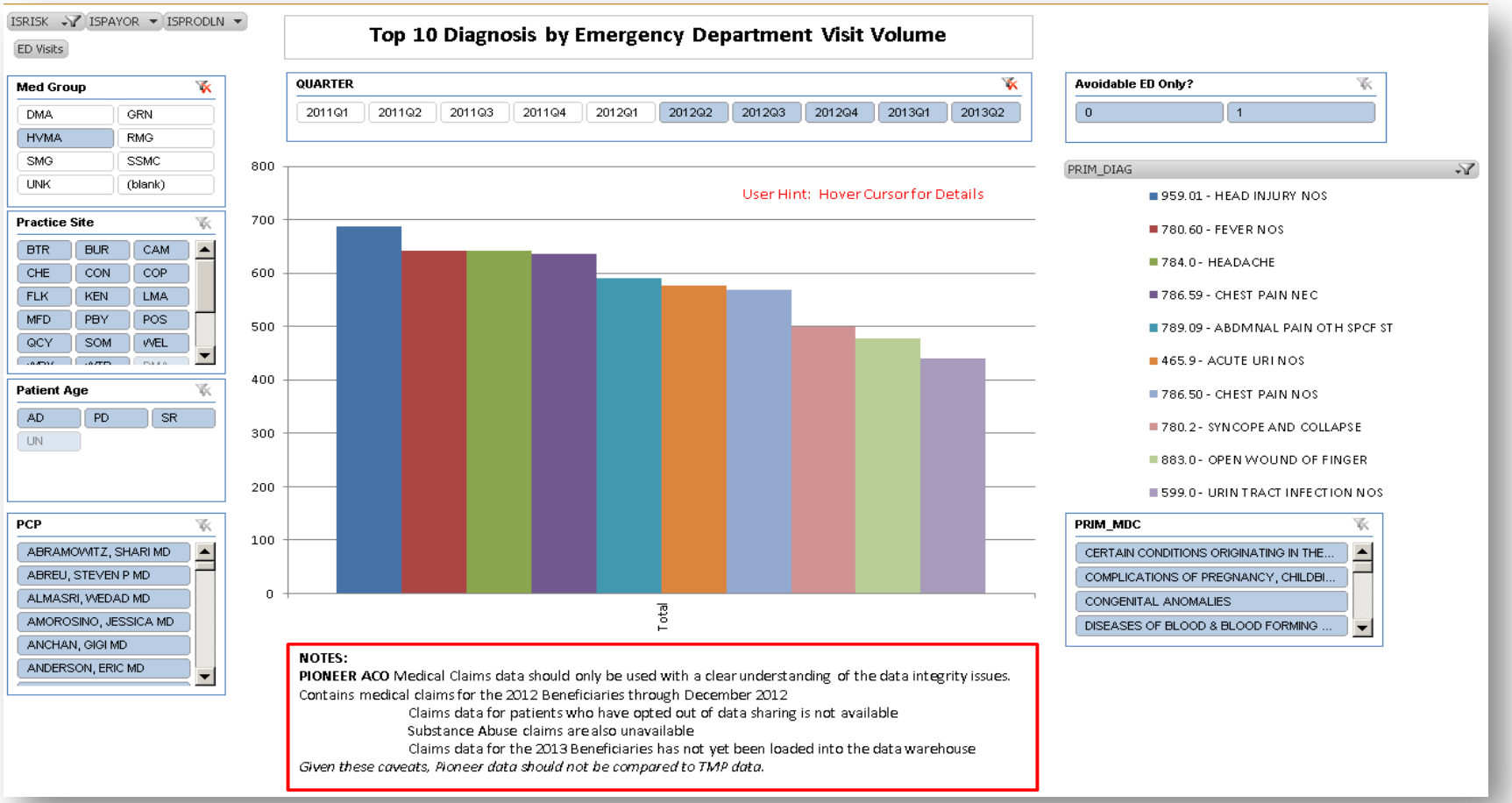
Medical Expense Management: TME Report



- User Starting Point:
  - $PMPM, Cost/Event, Events/1000
- Dimensions:
  - Medical Group
  - Practice
  - Payer-Product
  - Patient Age
  - Internal vs External

Medical Expense Management:



- Quick Pareto Diagrams – Top 10 ED Diagnoses
- Scoping Opportunity for Improvement

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Total Medical Expense Report – Directional Trends Over Time – 3 month Lag

What is the 2 yr PMPM Trend?

What is the 2 yr Utilization trend?

What is the 2 yr Cost/Event trend?

By Payor
By Product
By Site

Total PMPM

- Hospital
- Emergency Department
- Outpatient Specialty
- Observations
- Advanced Imaging
- Pharmacy

2 yrs

Units/1000 Cost/Unit	Units/1000 Cost/Unit	Units/1000 Cost/Unit	Units/1000 Cost/Unit	Units/1000 Cost/Unit	Units/1000 Cost/Unit	Units/1000 Cost/Unit
Hospital	ECF	Observations	Emergency Department	Advanced Imaging	Outpatient Specialty	Pharmacy
2 yrs	2 yrs	2 yrs	2 yrs	2 yrs	2 yrs	2 yrs

Cost Management Pivot Tables - Detailed, Event Level Information – No LAG

Questions:
Who?
For What?
Why?
For Whom?
When?

By PCP
By Patient
By Site
By Payor/Product
By Diagnosis
By Procedure
By Service Provider
By Patient Age

Total Admits Total $$	Total Adm/Days Total $$	Total Visits Total $$	Total Visits Total $$	Total Images Total $$	Total Events Total $$	Total Rx Total $$
Hospital	ECF	Observations	ED	Adv Imaging	Outpt Spec	Pharmacy
2 yrs	2 yrs	2 yrs	2 yrs	2 yrs	2 yrs	2 yrs

Potential Top 10 Lists (By Site or Primary Care Physician)

1. Top Ten Service Providers: Hospitals by Admits or $$, ED by Visits or $$, Cardiology OU Providers by $$, MRI OU Facilities by $$, DME Vendors by $$ External Pharmacies by $$
2. Top Ten Diagnosis: Hospital Admissions by DRG, Avoidable ED by Primary Diagnoses, Cardiology OU $$ by Diagnosis, DME OU $$ by Item
3. Top Ten Patients: Number of Hospitalizations in the Q12013, Number of ED Visits in Q12013
4. Top Ten Drugs: Rank Top Drugs by External Pharmacy Total $$
5. Top Ten Outside OU Specialties: Rank Top OU Specialties by $$

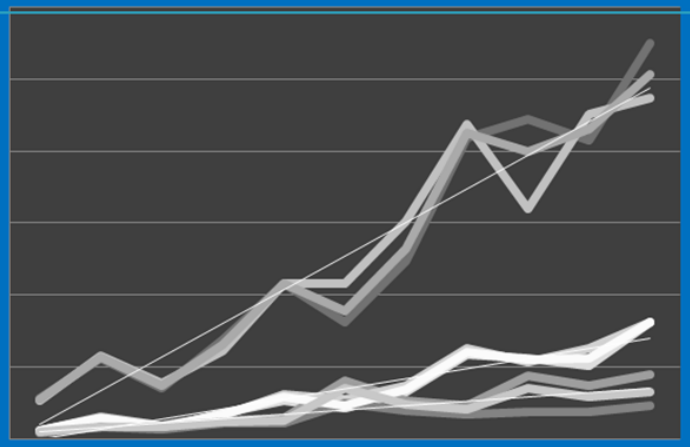
Predictive Datamart: Patient Risk Scores

Factor	Criteria	Points
DxCG Likelihood of Hospitalization Score (Model 71)	Individual Patient Score >= 0.25 (90th Percentile)	3
Hospital Admissions or ED Visits	Three or More in past 12m	3
Behavioral Health (Psychiatric, Substance Abuse, Dementia)	Active Diagnosis (Enc or Prob List)	2
CHF or COPD or CKD	Active Diagnosis (Enc or Prob List)	1
Poly-pharmacy (Exclude topical & supplies)	14+ active medications on current EPIC medication list	1
Maximum Score		10

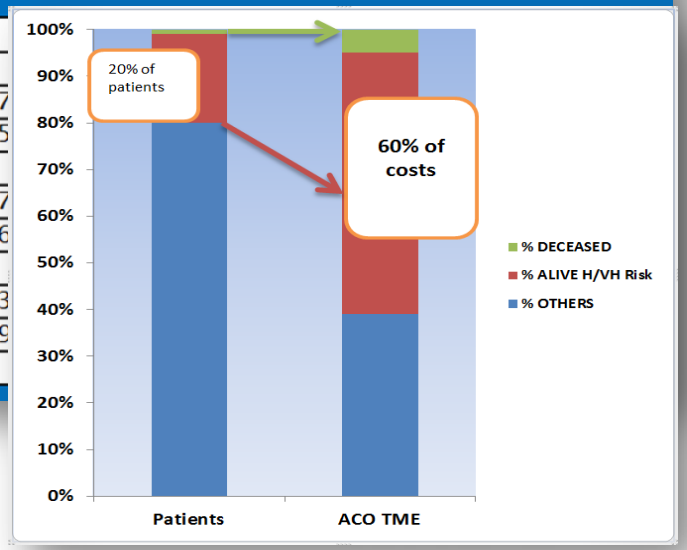
Risk Level Flag	Score	% Total
Low	0	58%
Medium	1 – 2	26%
High	3 – 7	13%
Very High	8 – 10	2%

Validating Predictive Risk

PMPM, Hospital, ED Utilization by Risk Score
6 months After Outcomes

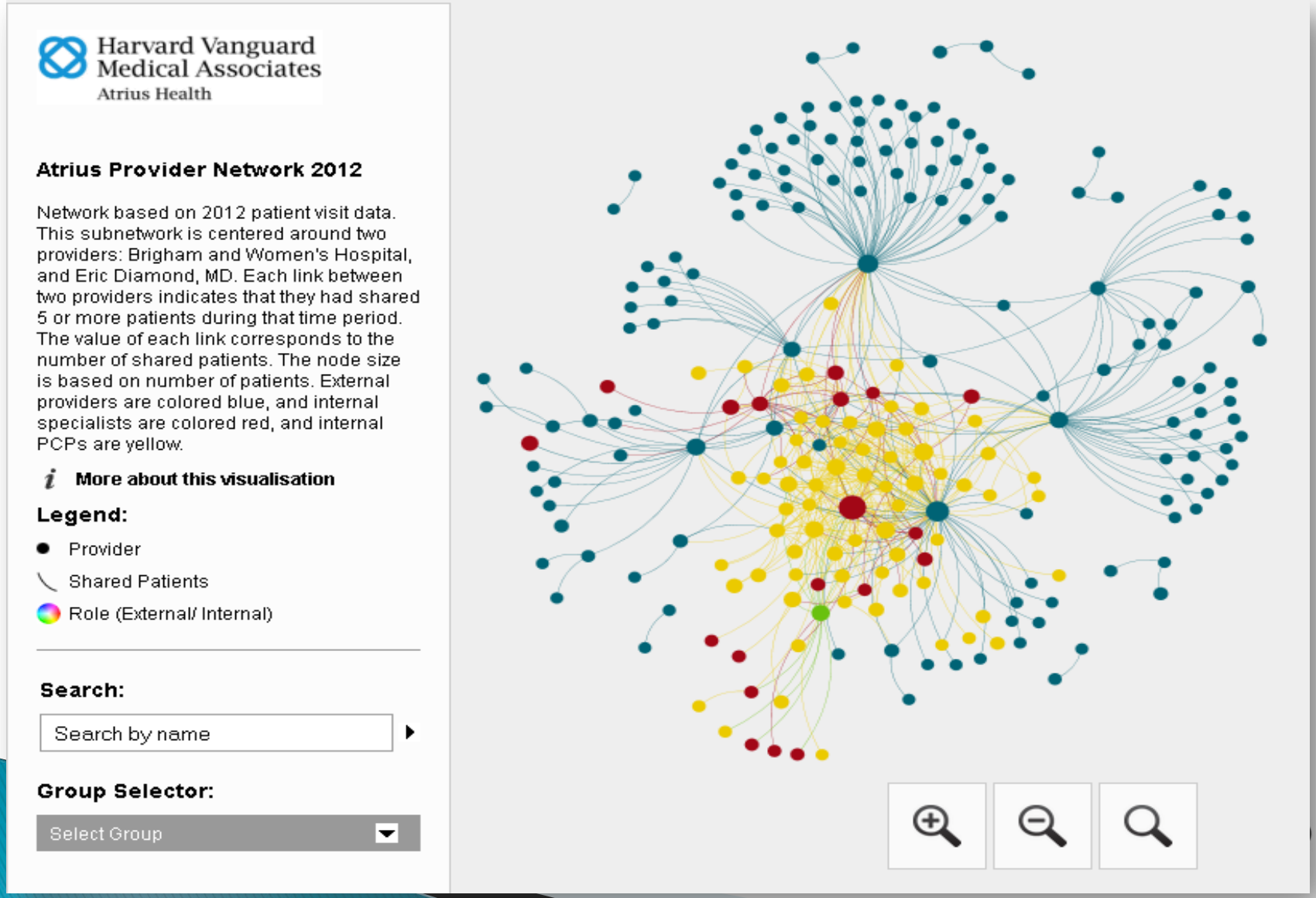


		Total (All Pts)	Low	Medium			
			0	1	2	3	4
CMS Pioneer	Admits/1000	214	120	280	148	349	537
	ED Visits/1000	184	99	173	188	252	285
	TME/PMPM	$	$	$	$	$	$
Medicare Advantage	Admits/1000	199	105	295	181	316	607
	ED Visits/1000	124	83	160	133	216	216
	TME/PMPM	$	$	$	$	$	$
Total	Admits/1000	207	113	288	164	334	573
	ED Visits/1000	155	91	166	162	236	249
	TME/PMPM	$	$	$	$	$	$



Risk Score Calculated with 2011CY data
Outcome Window = 1st 6 months 2012

Referral Pattern Analyses



Operational Metrics

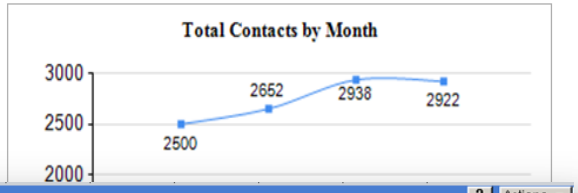
Monthly Telephone Statistics

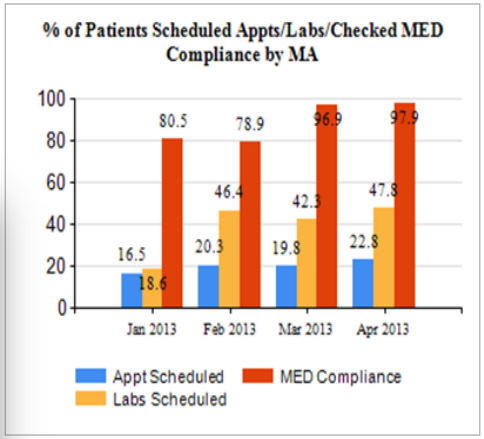
		Current FY Abandon %	Current FY Time to Answer	Abandon %
L1	⊞ Ready Med PSS CC	2.15 %	17.80	0.00 %
L1	⊞ Call Center Priority Queue	5.71 %	19.87	19.23 %
L1	⊞ DME			
L3	DME			
L1	⊞ Anti			
L1	⊞ Aut			

Done

Health Coach Patient Contact Report

--The past 4 months





PB Billing Office Manager Dashboard

Actions

Professional AR Snapshot

	Transaction count	Amount	Amount (%)
Claims pending	19,410		10%
Claims error	1,617		1%
Claims outstanding	153,951		102%
With insurance balance but no claim status	1,062		1%
With insurance credit balance	48,053		-16%
Outstanding insurance debits total	224,093		97%
Self-pay pending statement	17,754		3%
Self-pay outstanding statement	46,600		10%
With self-pay credit balance	4,553		-1%
Outstanding self-pay debits total	68,907		11%
Outstanding debits (Insurance + Self-pay)	291,477		109%
Undistributed credits			9%
AR (Outstanding debits - undistributed credits)			100%
Pre AR total	10,187		6%
AR + Pre AR			

Data collected on: 9/27/2013 12:00:05 AM

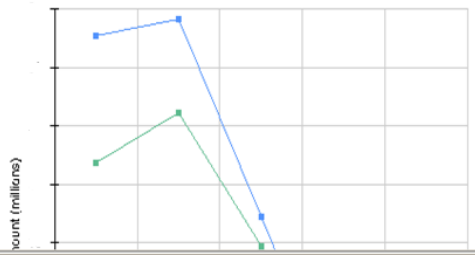
Operational Metrics

Metric	Count	Amount
Visit	6	
Copay due	0	0
Copay collected	0	0
Copay collected rate (%)	0	0
Open encounter	6	
5-day-old encounters w/o charges (count and %)	0	0
Charges triggered to router	0	
Charges routed to PB	0	
Average service to charge entry lag (number of days)	0	
Average charge review lag (number of days)	0	
Average service to charge post lag (number of days)	0	0
Average deposit to payment post lag (number of days)	0	0
AR days	61	
Collection ratio (%)	31	

All metrics are for 9/26/2013

Monthly AR

Show Table



Undistributed Credits

	Transaction count	Amount
Copay less than 14 days	0	0
Copay 14 days or older	73,298	
Self-pay payments	17,897	
Self-pay credit adjustments	113	
Insurance payments	18,820	
Insurance credit adjustments	1,481	
Totals	**111,609**	

Patients Scheduled Appts	% of Patients Scheduled Appts	Patients Overdue Labs	Patients Scheduled Labs	% of Patients Scheduled Labs	Patients Checked MED Compliance	% of Patients Checked MED Compliance
248	**26.0%**	**576**	**322**	**55.9%**	**224**	**82.3%**
31	21.0%	122	63	51.6%	25	65.7%
73	31.7%	122	74	60.6%	35	51.4%
94	28.8%	189	103	54.4%	94	98.9%
50	20%	143	82	57.3%	70	98.5%
18	**5.05%**	**387**	**116**	**29.9%**	**34**	**100%**
11	8.73%	266	47	17.6%	19	100%
2	2.66%	31	8	25.8%	6	100%
2	2.29%	37	22	59.4%	3	100%
3	4.41%	53	39	73.5%	6	100%

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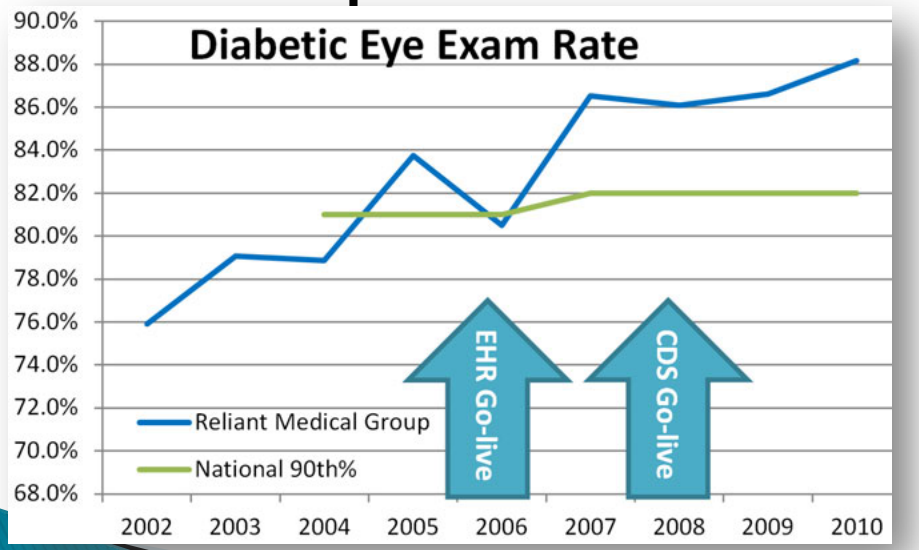
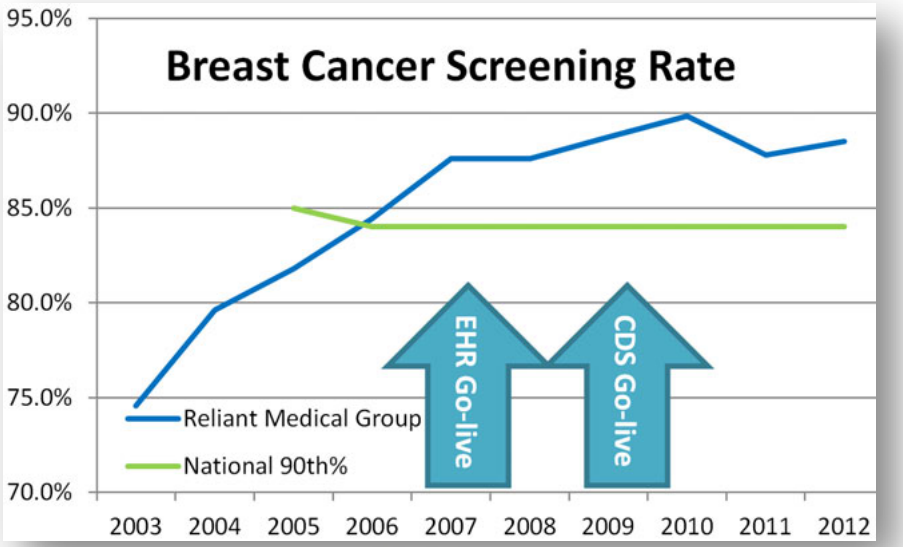
Quality Datamart

- 50+ Quality Measures
- Supports NCQA HEDIS, ACO, and various Payer-specific metrics/targets
- Compared to national benchmarks





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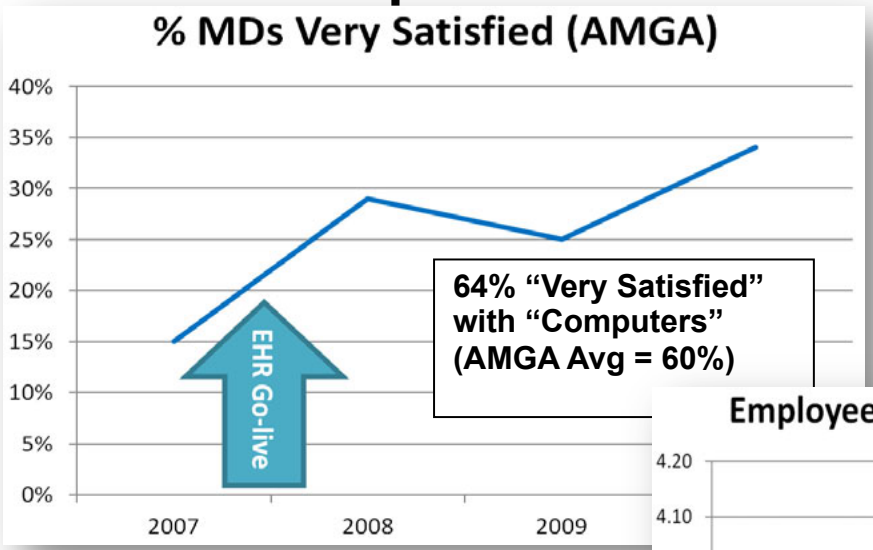
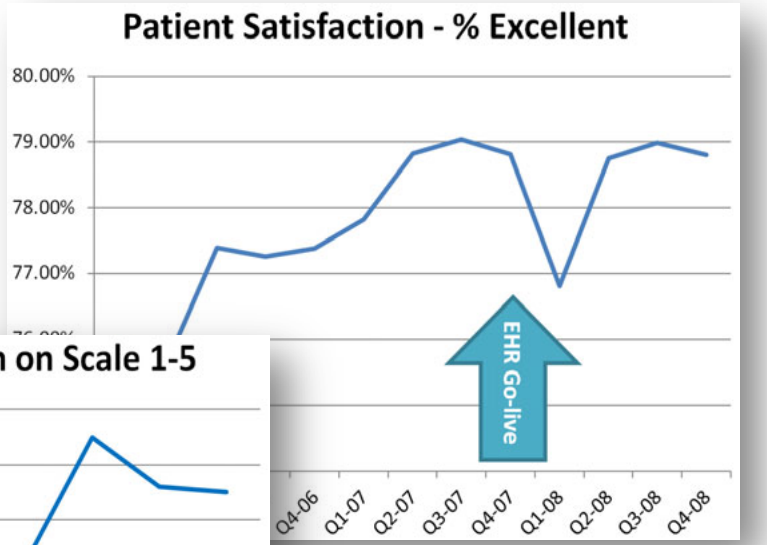
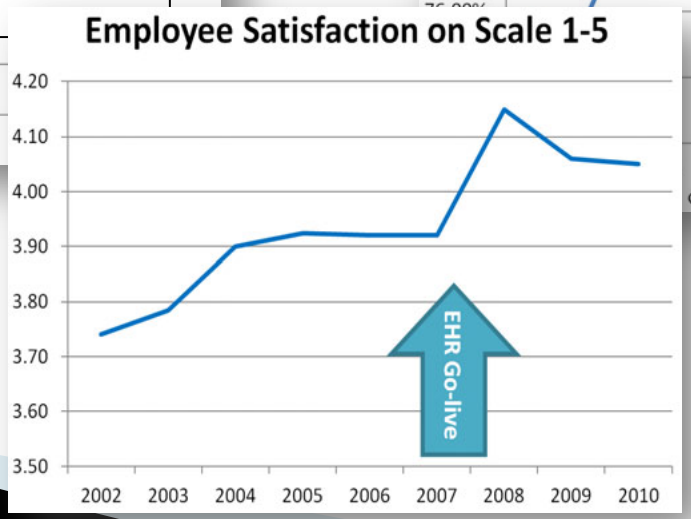
Satisfaction Datamart

- Physicians, employees, and patients
- Compared to benchmarks







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TURNING KNOWLEDGE INTO ACTIONS

TURNING ANALYTICS INTO OUTCOMES

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PROBLEM:

- The total economic burden of diabetes in the United States is estimated at $245 billion, a 41% increase from 2007[1]
- Reliant's Diabetes HbA1c Screening Rate and Control Rate did not change significantly with EHR implementation

1. American Diabetes Association. Economic Costs of Diabetes in the U.S. in 2012. *Diabetes Care*. 2013;36(4):1033–1046.

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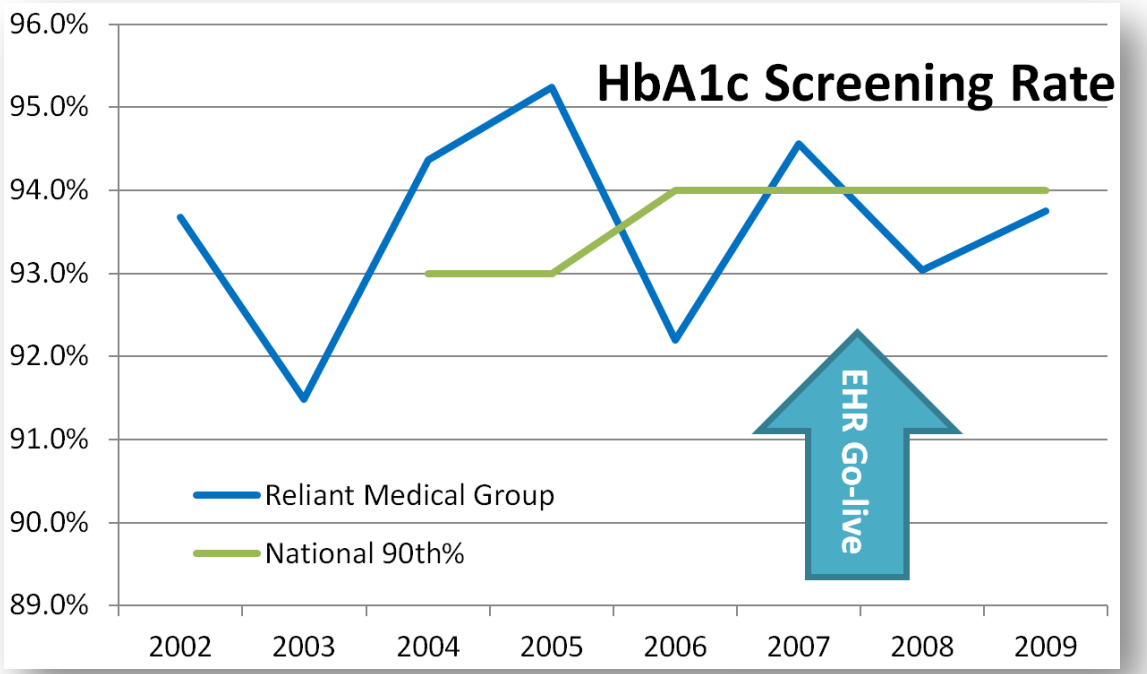
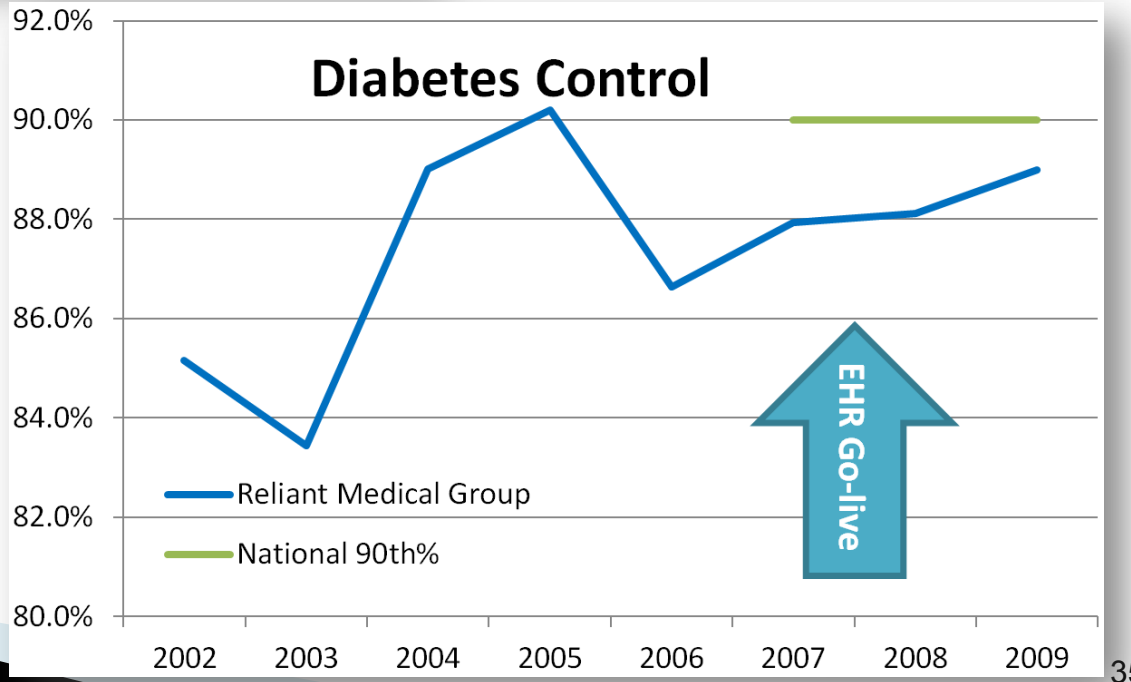
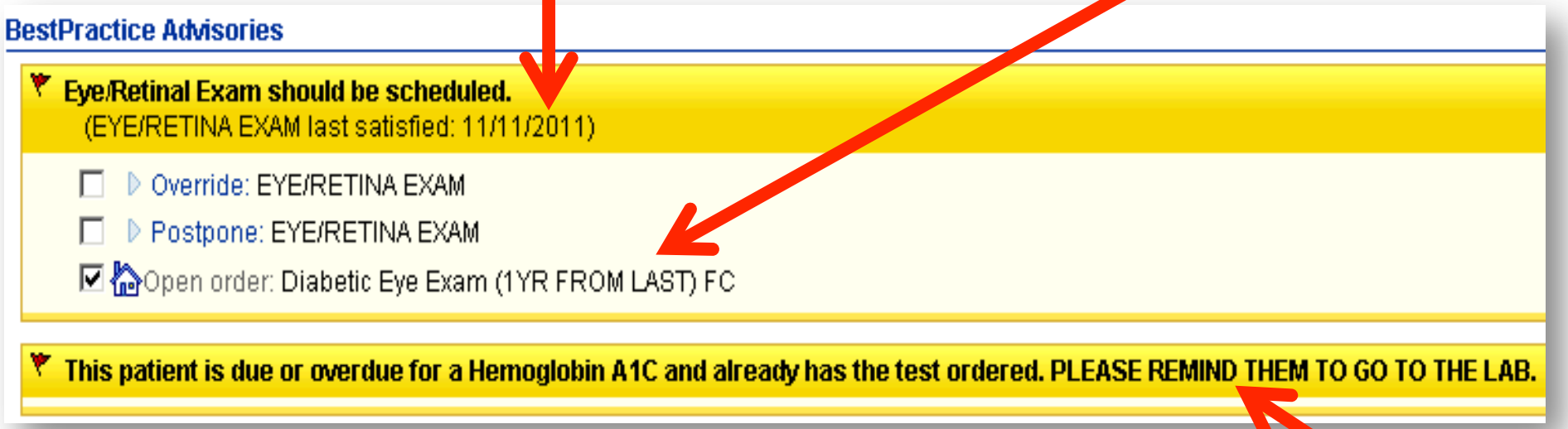

HbA1c Screening Rate
96.0%
95.0%
94.0%
93.0%
92.0%
91.0%
90.0%
89.0%
2002
2003
2004
2005
2006
2007
2008
2009
Reliant Medical Group
National 90th%
EHR Go-live


Diabetes Control
92.0%
90.0%
88.0%
86.0%
84.0%
82.0%
80.0%
2002
2003
2004
2005
2006
2007
2008
2009
Reliant Medical Group
National 90th%
EHR Go-live

MDs order during patient visits

Last date

Next order



But doesn't ask for an order if it's not due or already ordered

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Health Coach Registry

Barometer of
Actionable
Deficiencies

	MRN	Patient Name	B.A.D.	Last A1C Date	Last A1C Value	Last LDL Date	Last Eye Exam	Next Appt. Date
Detail			21		0			9/20/2010
Detail			18	8/22/2007	9.5	12/7/2005	7/3/2003	
Detail			18		0			
			18	8/6/2008	13.1		6/2/2008	
			17	4/29/2008	10.5	4/29/2008		
			16	1/11/2008	8.7	1/11/2008		
			16		0			
			16	10/15/2007	7.5	10/15/2007	7/11/2006	
			16	7/5/2006	6.5	2/3/2005	8/28/2007	
Detail			16	11/9/2007	7.1	11/9/2007	4/26/2007	
Detail			16	7/12/2007	5.6	7/12/2007		
Detail			16		0	9/15/2004	9/25/2007	
Detail			16	9/17/2008	7.4	1/23/2008		
Detail			15	4/9/2010	9.1			10/18/2010
Detail			15	3/9/2008	15.3	3/9/2008		
Detail			15		0			10/5/2010

EHR letters on patient's birthday

Congratulations on your upcoming birthday! As your primary care provider at Fallon Clinic I feel it is very important for you to have timely preventive services to ensure early detection of health problems which are treatable in early stages.

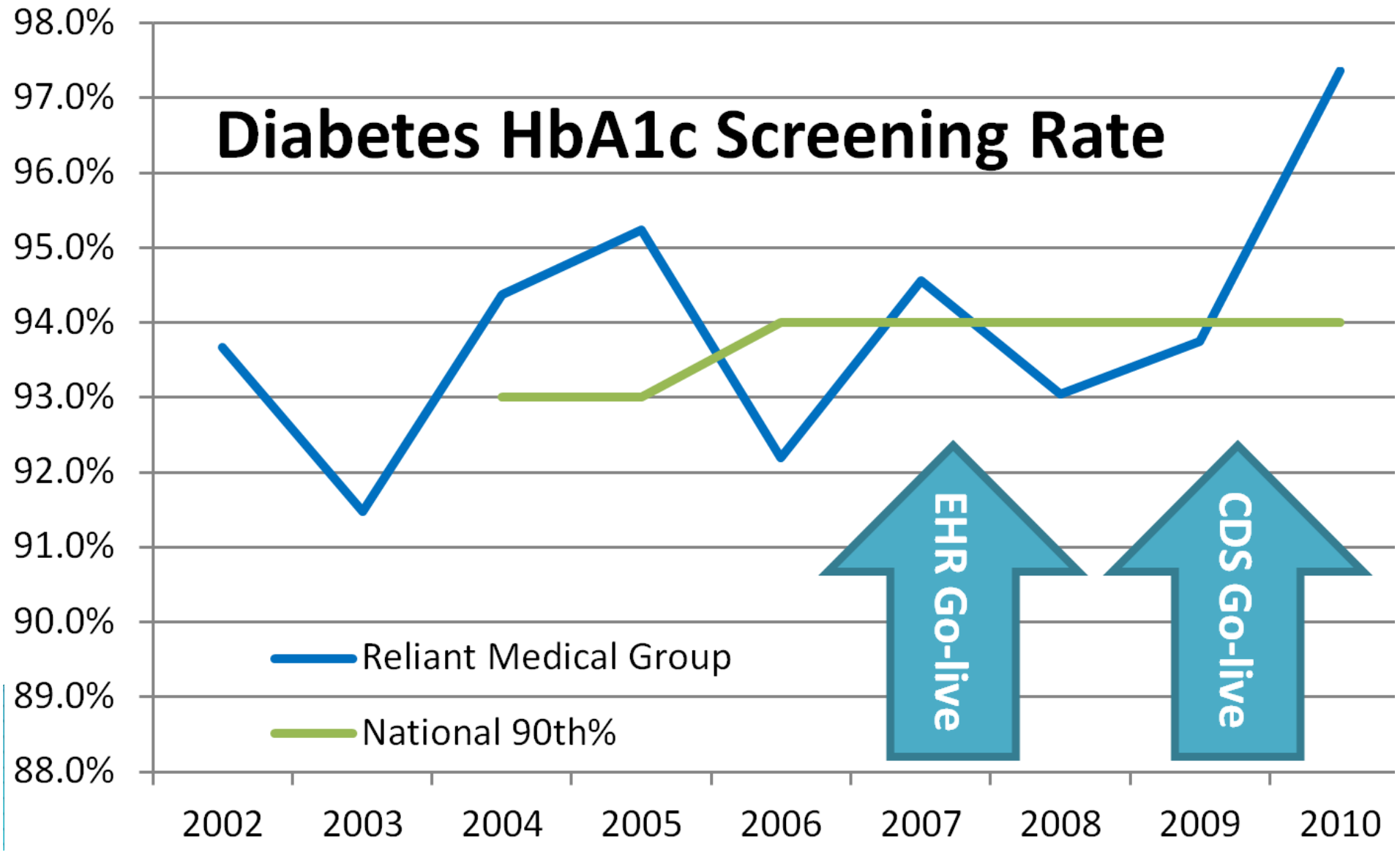
Our records indicate that you are due for the following test/procedure(s):

- PAP smear
- Mammogram
- Bone Density Test
- Colonoscopy
- Tetanus shot
- Pneumovax shot
- A1c (diabetes) Lab test
- Cholesterol Lab test (fasting for 12 hours)
- Eye Exam
- Microalbumin (urine) lab test

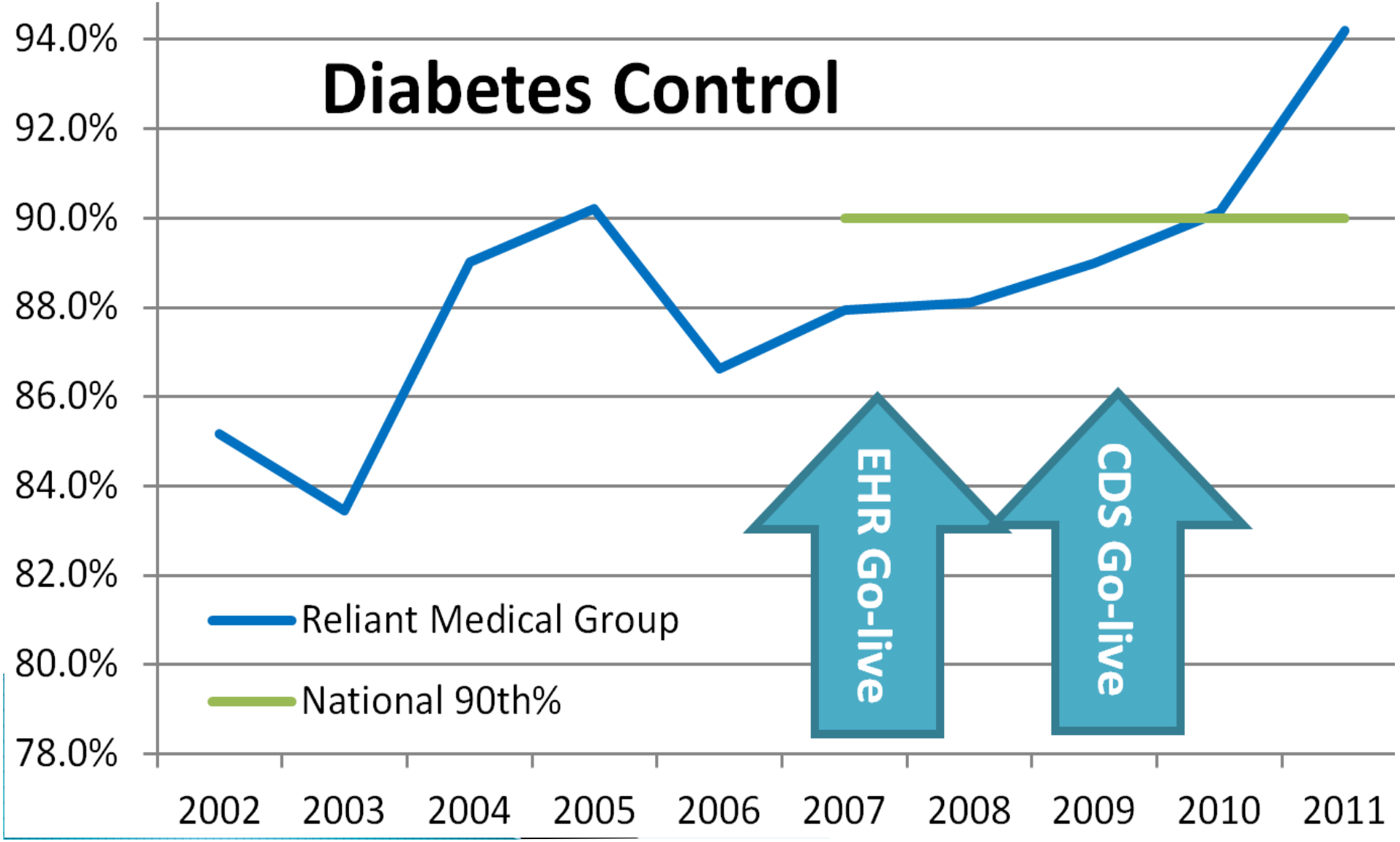
Please call our office at xxx-yyy-zzzz to schedule the test/procedure(s).

Sincerely,

Quality Improvement



Outcomes Improvement



PROBLEM:

- Hypertension Control was 69%, significantly below 90th Percentile of 73% for nation

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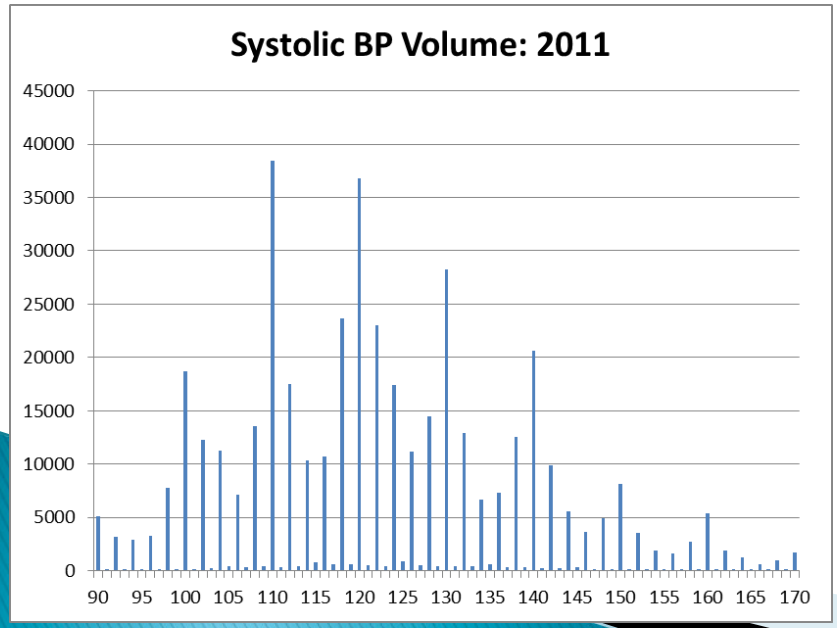
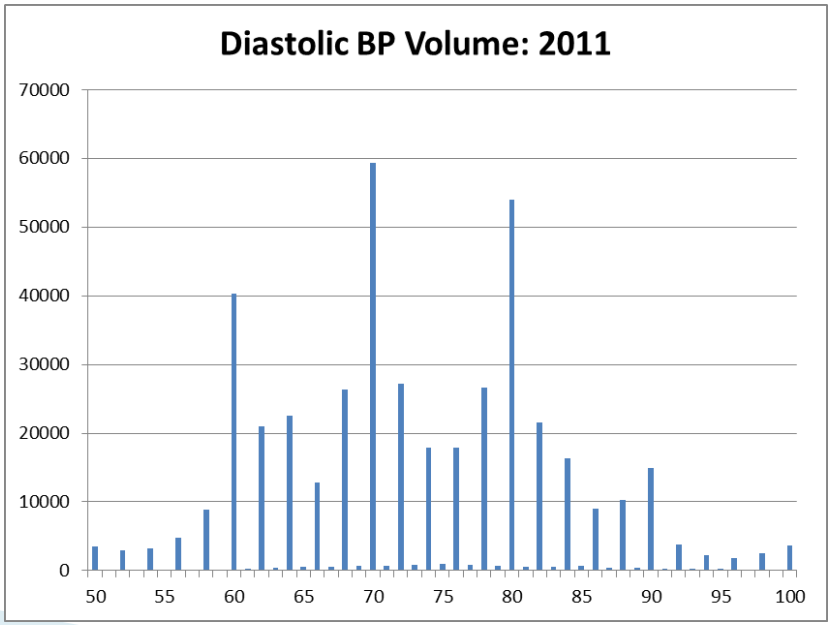
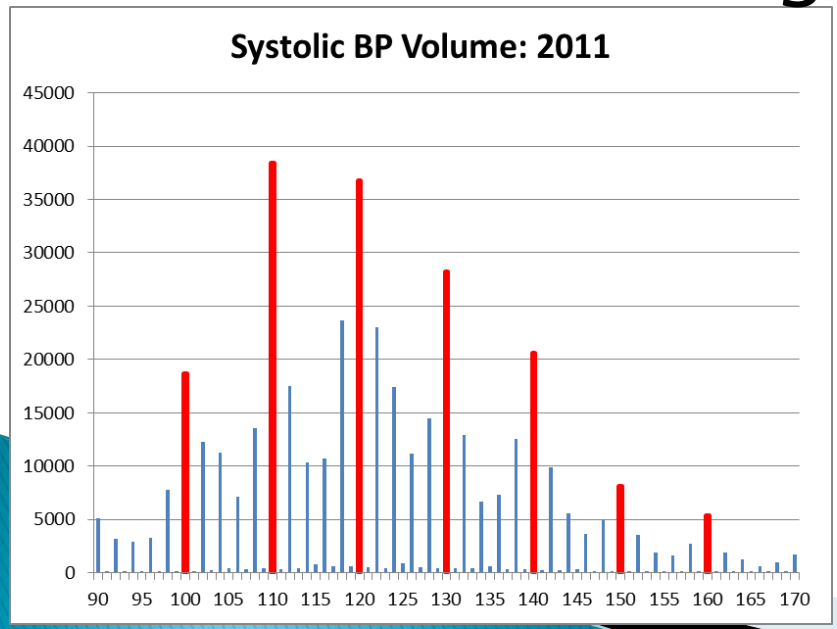
Analysis of EHR BP Data

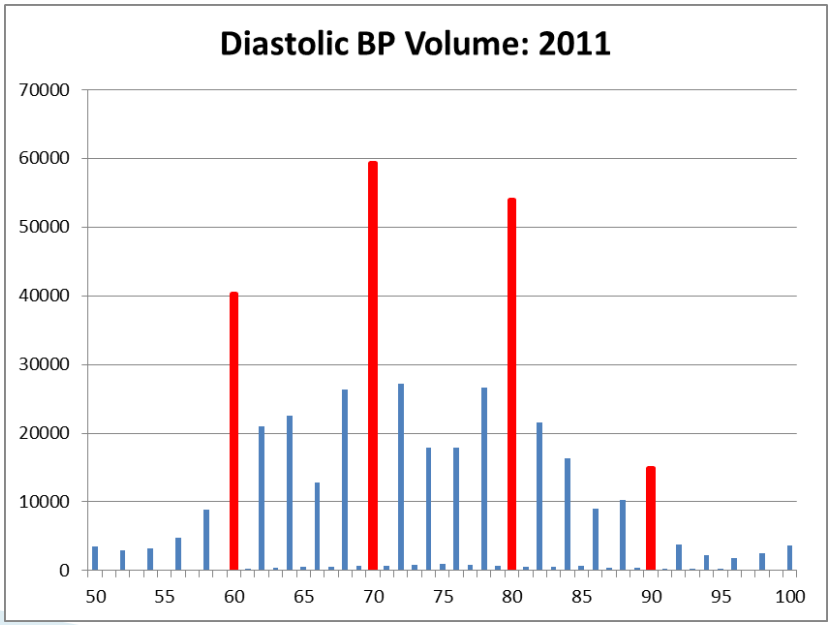




Analysis of EHR BP Data

- Graph of BP readings revealed peaks every 10 mmHg
- Staff were rounding up to the next higher multiple of 10
- Abnormal readings were not rechecked





Interventions

- Digital Cuffs
- Real-time alerts for abnormal readings
- Monitoring compliance with repeating abnormals
- Nurse Blood Pressure Clinics
- Pharmacist review of patients with poor BP control and diabetics not on ACE/ARB
- Report cards showing site-specific performance

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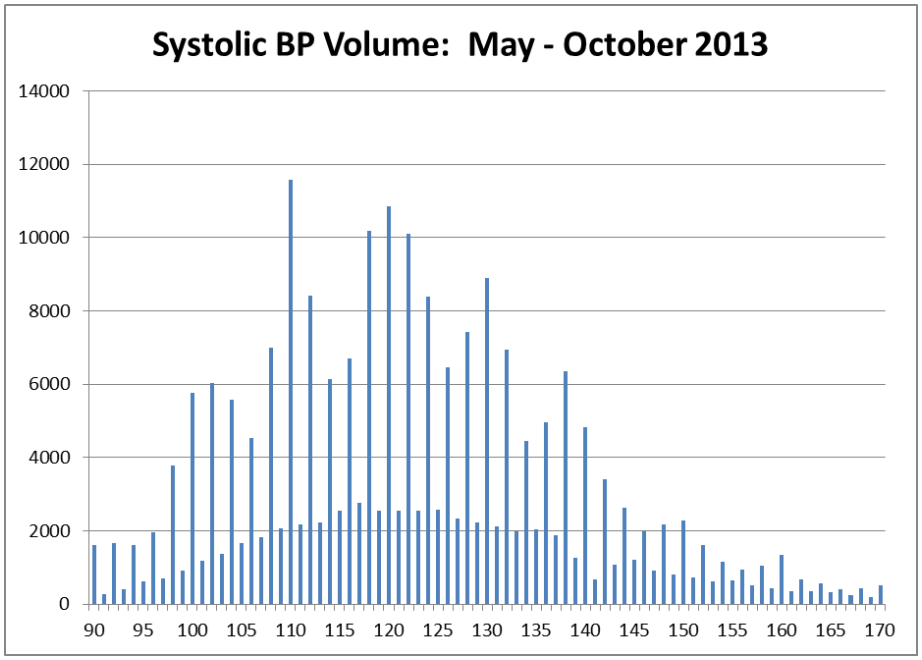
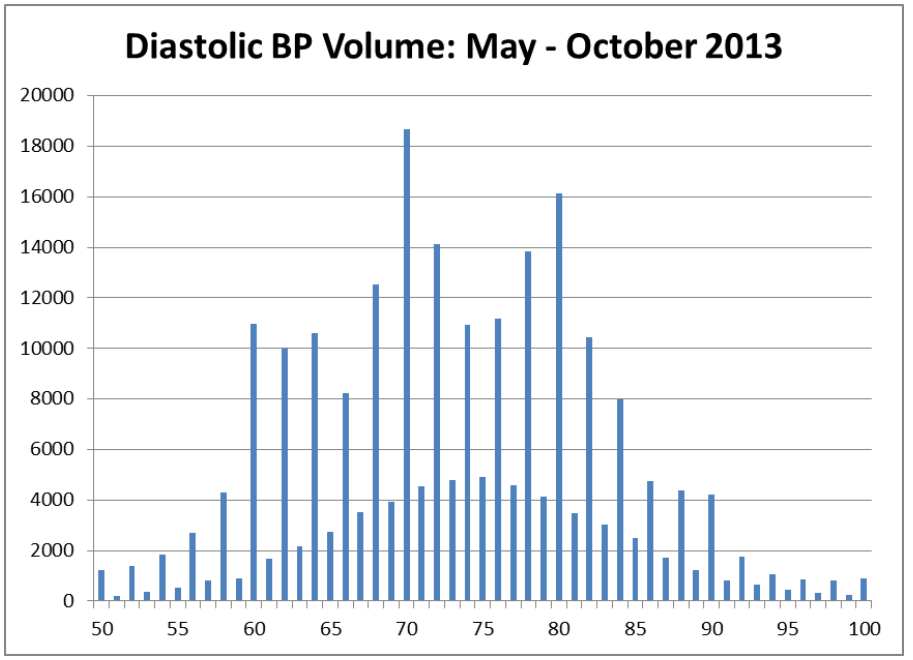
Results – Less BP Rounding





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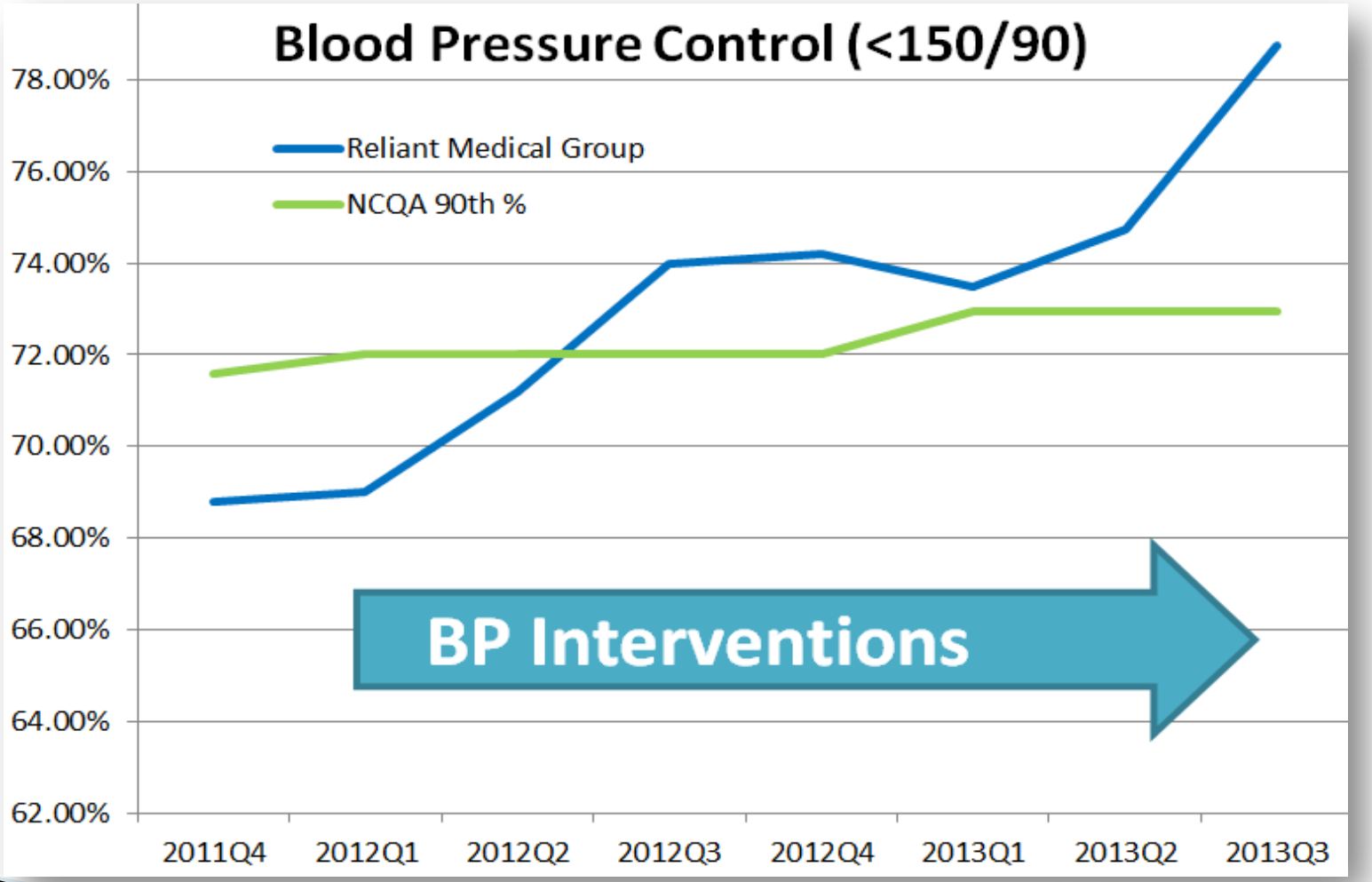
P4P Blood Pressure Outcomes



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PROBLEM:

- 90,000 **preventable** life-threatening or fatal ADEs in the elderly yearly nationwide
- Warfarin is the most common cause of **preventable** life-threatening or fatal ADEs
- 1.4% of Reliant's levels overly thin

(Gurwitz JH, Garber LD, Bates DW, et al. Incidence and preventability of adverse drug events among older persons in the ambulatory setting. *JAMA* 289:1107-1116. 2003.)

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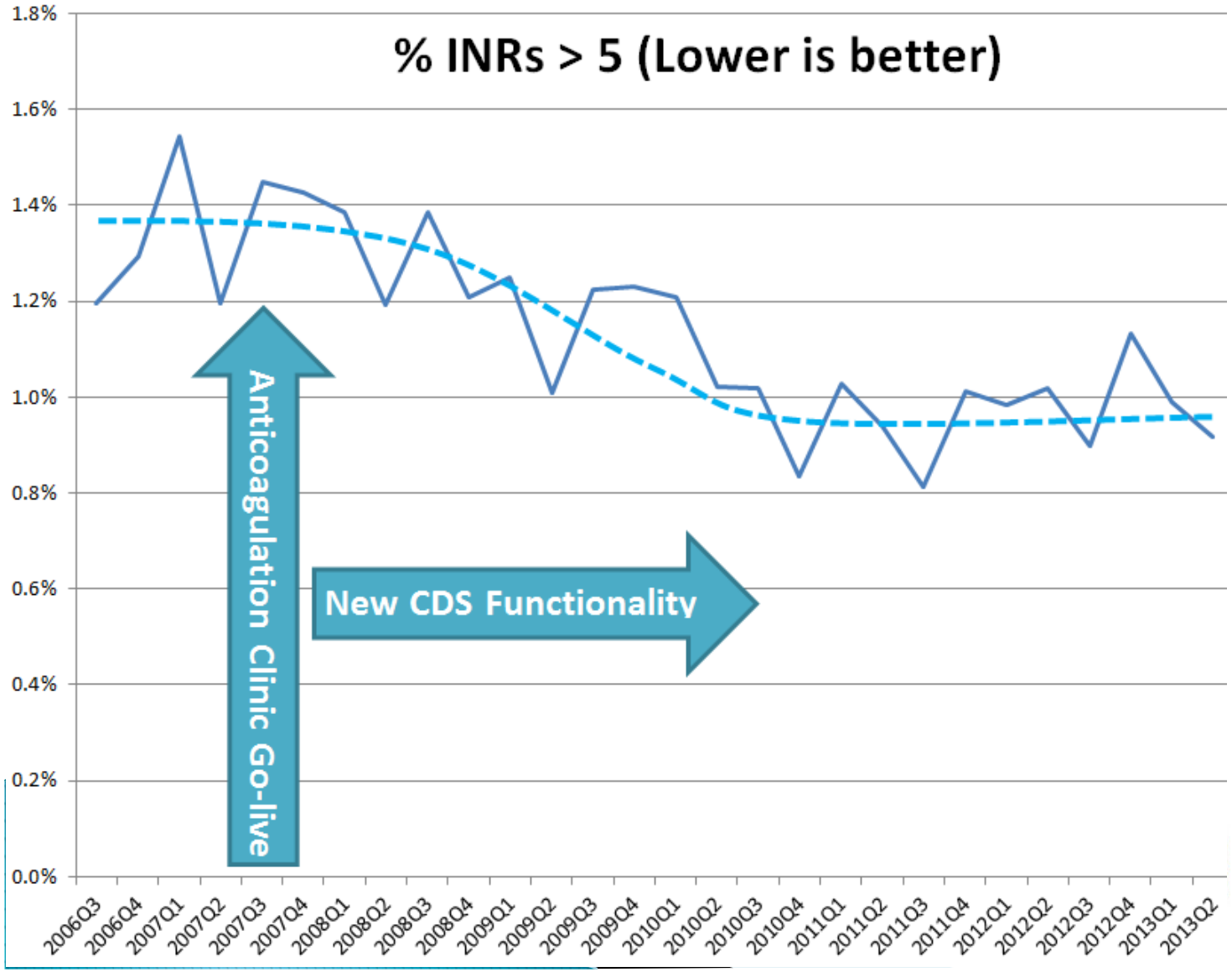
Safety Improvement



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PROBLEM:

10 – 12% of Radiology orders at Reliant were ordered incorrectly and required changing

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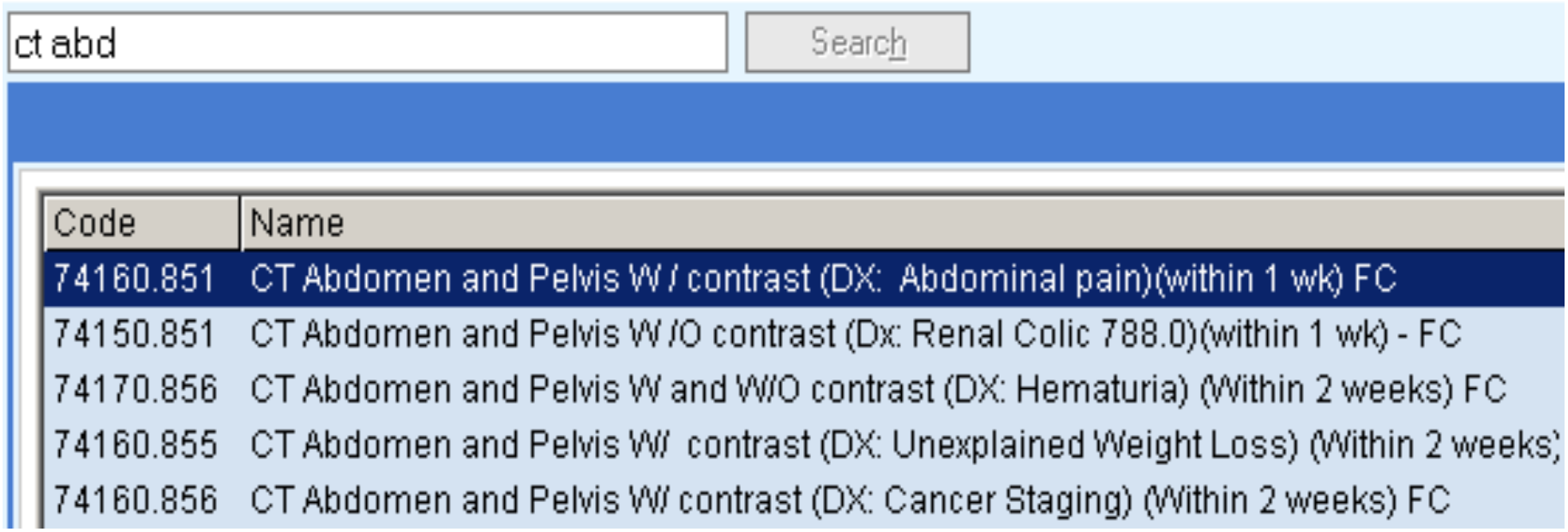
“1-Click” Radiology Orders



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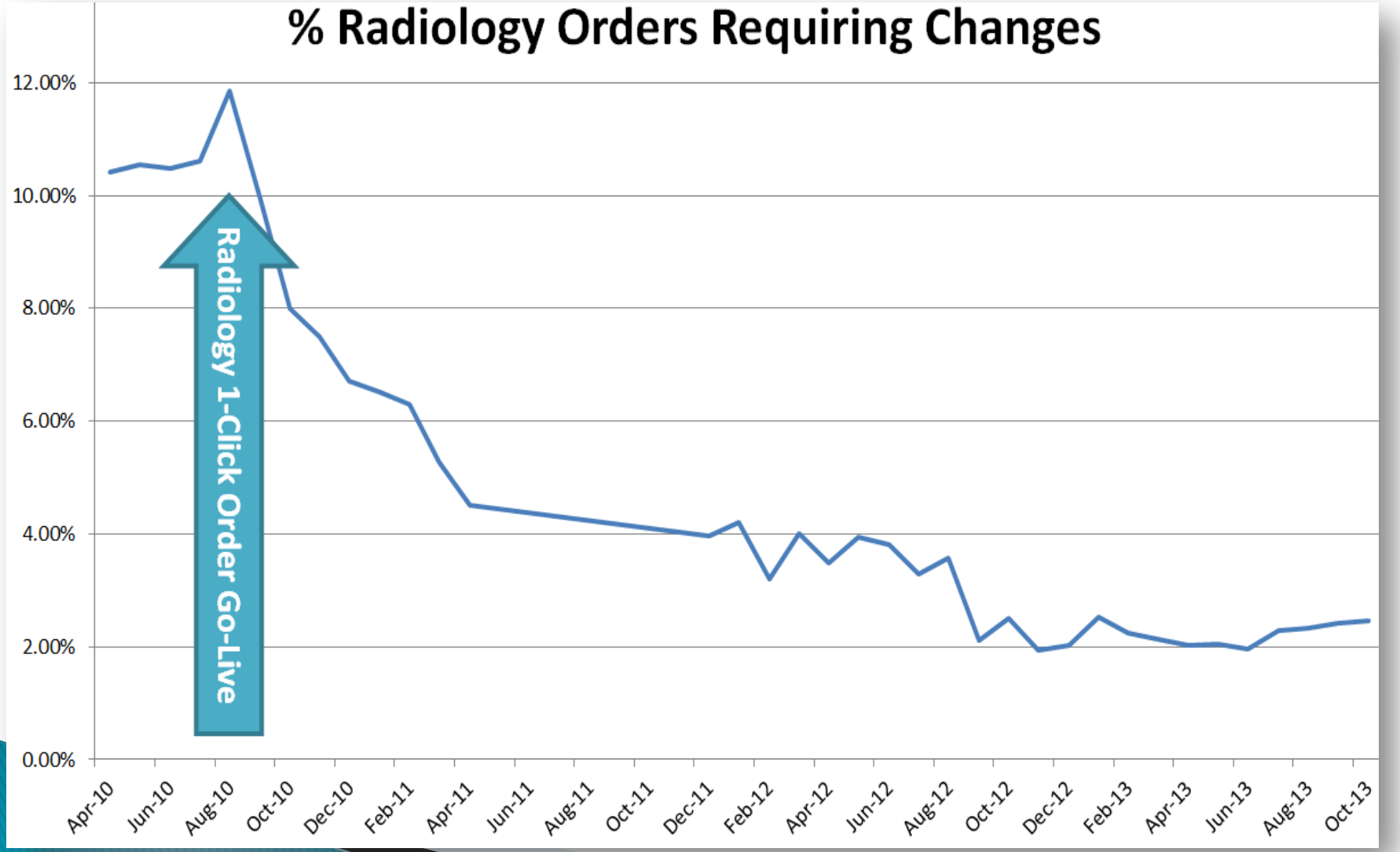
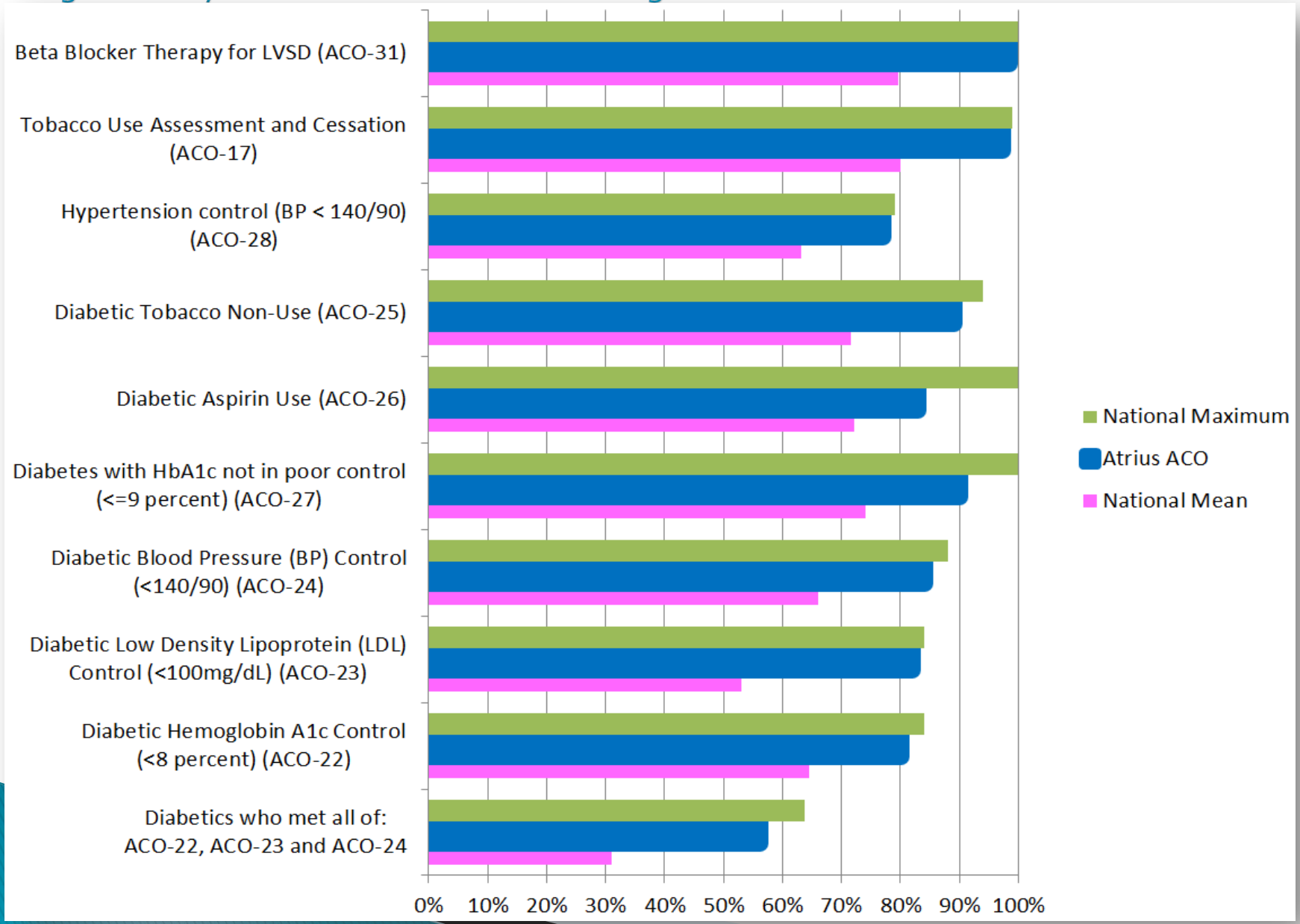
Efficiency Improvements



Atrius ACO Results: Quality

Significantly exceeds Pioneer ACO average on most measures



Atrius ACO Results: Financial

Annual Cost Per Patient (Age 65+)

(12 months ending March 2013)

Avg. Massachusetts FFS: $13,000+

Avg. Massachusetts ACO: $12,000+

Atrius Health ACO: $10,700

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Summary

Improving the quality, outcomes, safety, satisfaction, efficiency, and cost of healthcare can be achieved by building a learning infrastructure that includes:

- EHRs, HIEs, analytics, and clinical decision support
- Moving knowledge to each point of decision making

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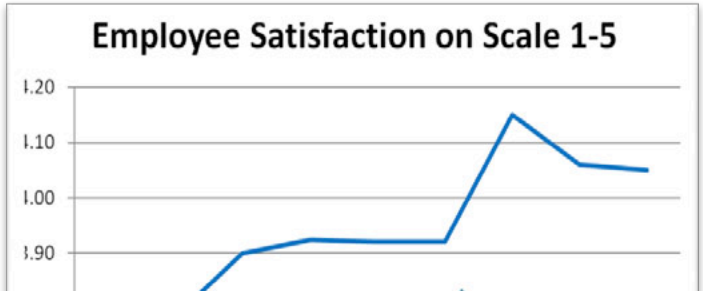
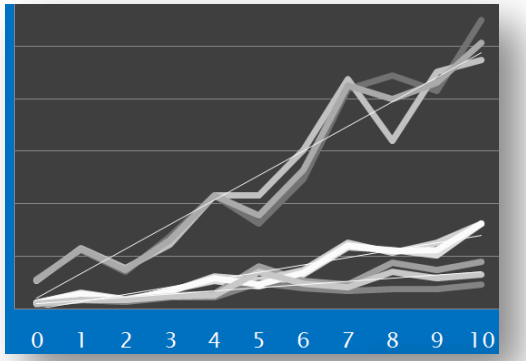
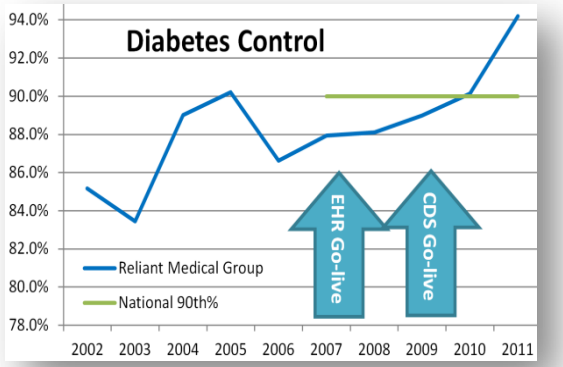
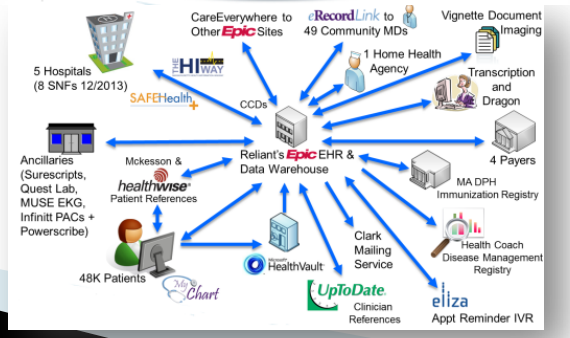
Questions?

Lawrence.Garber@ReliantMedicalGroup.org









Special thanks to
Joe Kimura, MD for assistance

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