


A Hybrid System That Supports Public Reporting in Pennsylvania

RS Johannes, MD, MS

Cardinal Health

June 19, 2007

Serendipity & History

- In the mid 1980s, three people met
  - Dr. Allen Brewster, MediQual Founder
  - Dr. Donald Fetterolf, Highmark BC/BS
  - Ernie Sessa, NAHDO founder, 1st Exec Dir PHC4
    - They all shared a single belief, namely that the precision and face validity of risk adjustment depended upon use of clinical data beyond claims data
- Pennsylvania Health Care Cost Countainment Council
  - Only state to perform uninterrupted annual public reporting of hospital performance data for 20 years
  - Pennsylvania publicly reports 50+ diseases
  - Cardinal Health has provided the data collection and risk adjustment methods over the entire period.

CardinalHealth

Four important themes

- Timing of clinical data is important to admission based severity stratification
- Laboratory data is both objective and powerful as a predictor
- Laboratory data is electronically available
- The face value of clinical data should not be underestimated

CardinalHealth

Clinical data and timing

- Provides for models that can better identify risk in the peri-admission period.
  - Frees the models from the criticism that late hospital stay events are used for adjustment
  - Better separation of comorbidities from complications
  - Position upheld by other published studies
- Is Admission (POA) coding the solution?
  - In order to add a POA flag, the code must first be present
  - How might this work in a situation such as hyponatremia?

CardinalHealth

Can ICD9 codes detect abnormal labs?

Laboratory Abnormality	Sensitivity Admission Period	% Improvement from Full Hospital Stay
Low serum sodium (< 135 mEq/L)	11.8	2.1
High serum sodium (> 145 mEq/L)	12.3	2.5
Low serum potassium (< 3.5 mEq/L)	22.8	4.2
High serum potassium (> 5.0 mEq/L)	18.9	3.9
Low serum hemoglobin (< 12 g/dl (females), < 14 g/dl (males)	9.6	0.6

Laboratory Abnormality	Sensitivity of Claims Data (%)
Low serum sodium recorded >10 times (≤ 135 meq/L)	30.0
High serum sodium recorded >10 times (>145 meq/L)	42.2
Low serum potassium recorded >10 times (< 3.5 meq/L)	19.5
High serum potassium recorded >10 times (> 5.0 meq/L)	20.4
Low serum hemoglobin Hgb recorded >10 times (<12 g/L for females or <14 g/L for males)	9.5

Source: Cardinal Health Response to CMS 1488-P

CardinalHealth

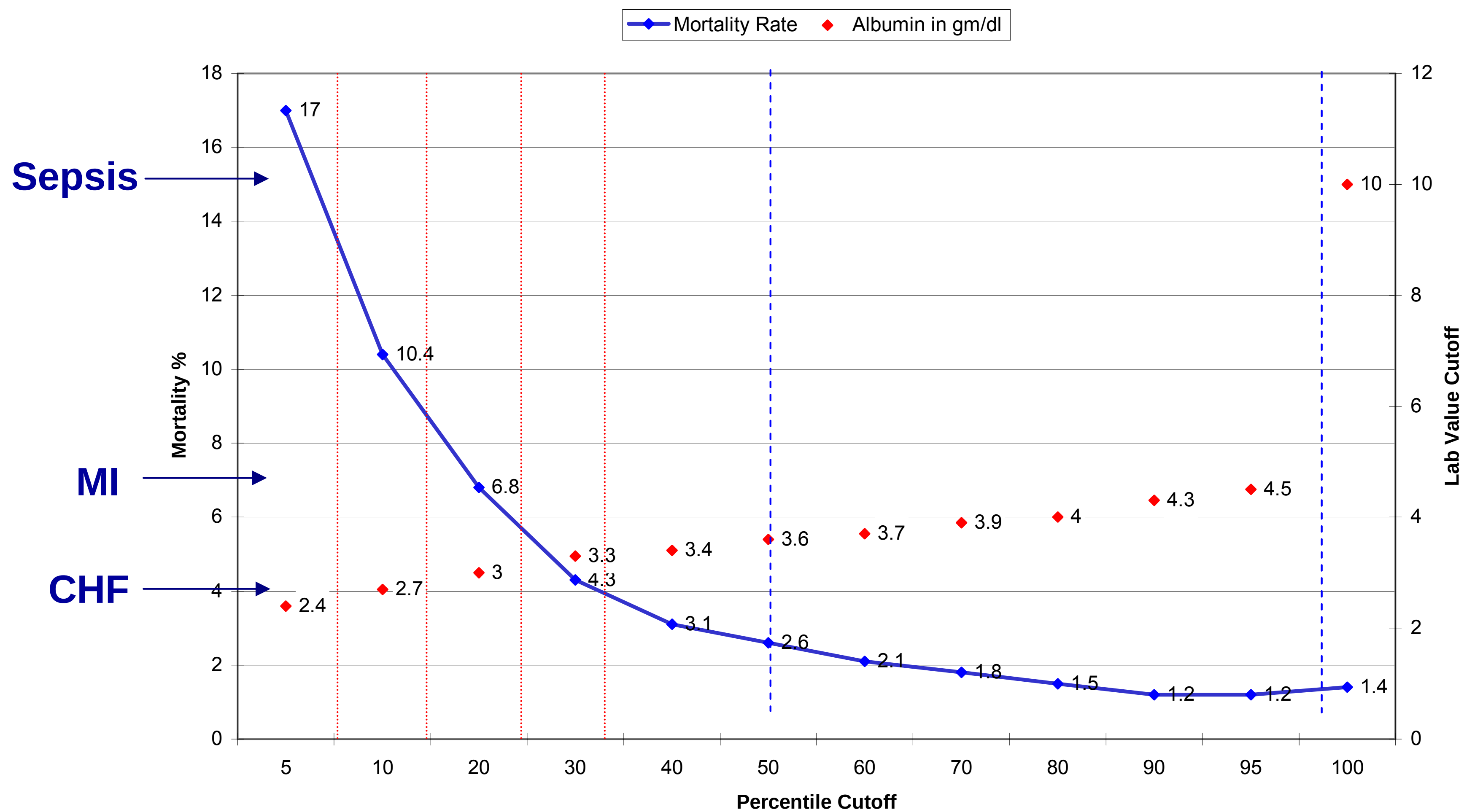
Lab data used for risk adjustment

Hematology & Coagulation	WBC	Hemoglobin
	% Bands	Platelets
	PT & INR	PTT
Chemistry	Na	K
	BUN	Creatinine
	Albumin	Ca
	Total Bilirubin	AST
	Alkaline Phosphatase	Glucose
	Cardiac enzymes	BNP
Blood Gases	pO_2	pCO_2
	pH	HCO_3
	Base Excess	FiO_2

CardinalHealth

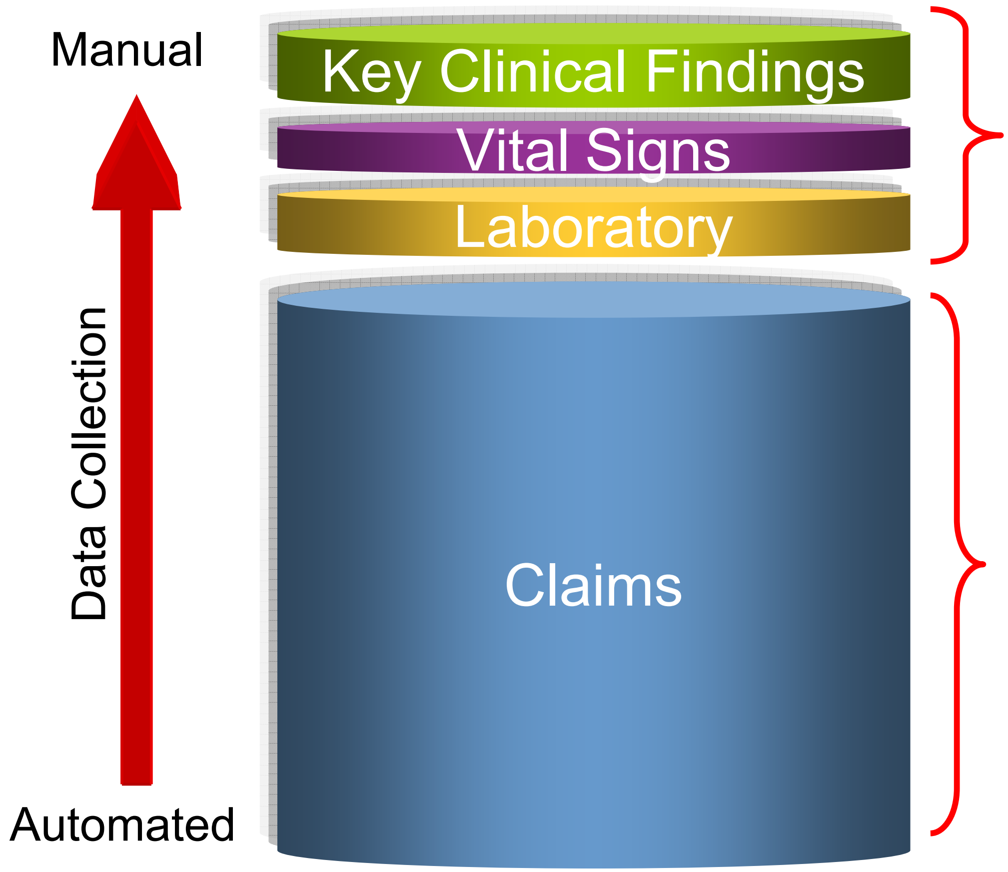
Lab values enable gradation of risk

Distribution of Albumin Levels and Mortality Rates



Source: CMS response 1488-P, June 2006

The Dimensions of Risk



Additional Clinical Data

KCF: physical exam, imaging
Lab: BUN, Na, K, Albumin
Vital Signs: TPR &BP

Claims Data

ICD-9 diagnosis and procedure codes, patient demographics (age, gender, billing charges, disposition, etc.)

Recent studies: AHRQ

- AHRQ has a long standing interest in the risk adjustment process
  - When Dr. Mark McClellan was still at Stanford University, he led an AHRQ supported study to examine the merits of various methods exclusively relying on administrative data
  - This study quite unambiguously argued in favor of 3M APR-DRGs as the method of choice when using administrative data
- In 2003, PHC4 and MediQual began discussions with AHRQ
  - In 2005, a competitive contract was let to Abt Associates with Michael Pine as a collaborator
  - Results of this work were first presented at NAHDO in December 2006
  - First publications appeared in The American Surgeon and JAMA in December 2006 and January 2007

CardinalHealth

What did AHRQ / Abt Assoc do?

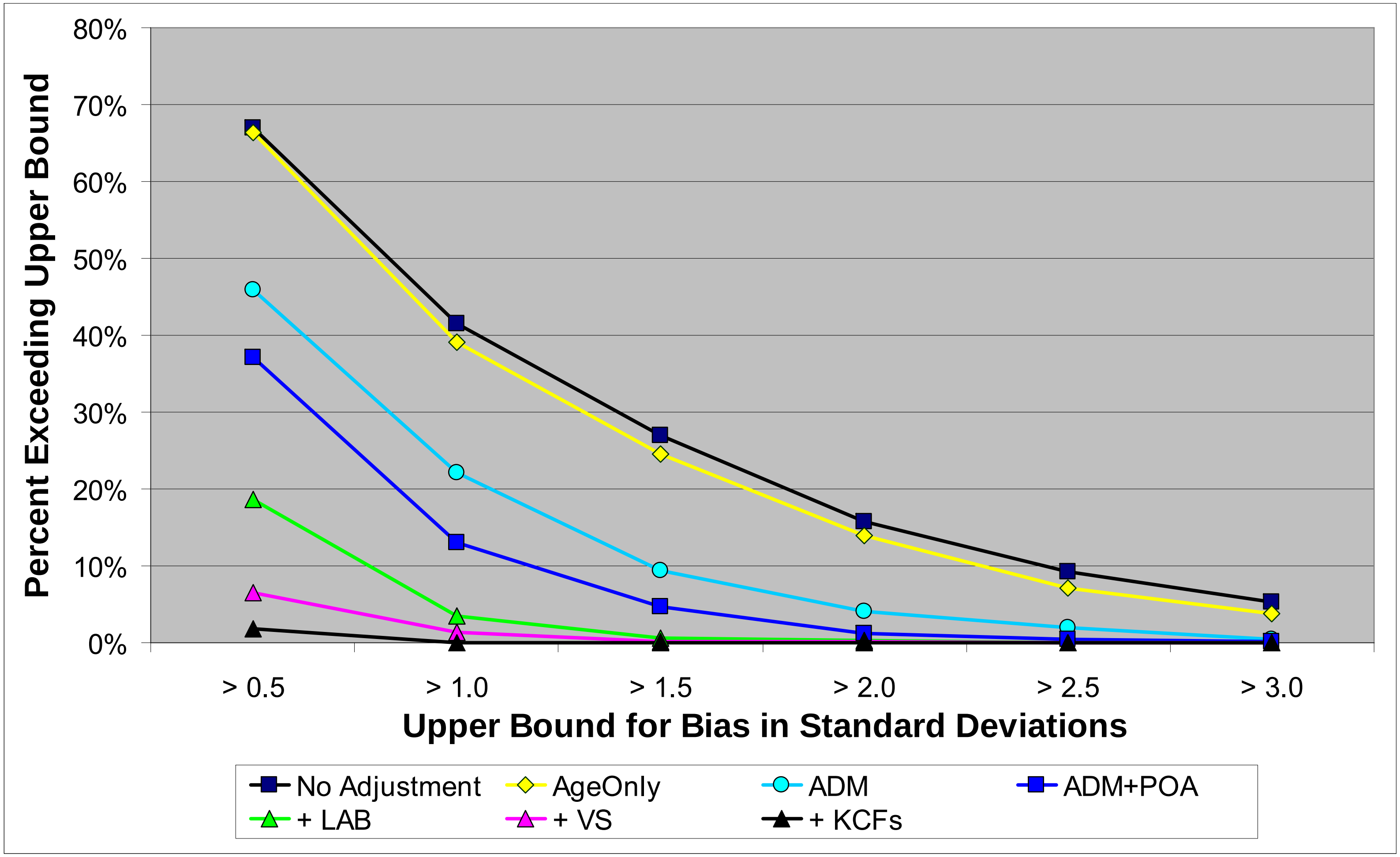
- They examined 3 years (2000-2003) of data provided to them by PHC4/MediQual and:

1. Established an advisory panel with AHRQ
2. Tested the question: Once risk-adjustment models have utilized claims data maximally, is this there any added benefit to clinical data?
   Also addressed cost/benefit ratio.
3. Studied 8 conditions (MI, CHF, Stroke, GI bleed, pneumonia, AAA repair, CABG, craniotomy)
4. Developed a family of models (AgeOnly, Admin, Admin+POA, [Admin+POA]+Lab + [Admin+POA+Lab]+VS, [Admin+POA+Lab+VS]+KCFs)

CardinalHealth

Differences in IQI Hospital-Level Bias

Less bias with increasing amounts of clinical data



Used with permission: Michael Pine & Assoc 2006

Recent studies: Cardinal Health

- Examined 3 years of data from 2000-2003 but divided the population into those hospitals that collected data electronically from those that did not.
- Tested the question: What are the relative merits of the types of data used for risk adjustment?
- Studied 6 conditions: (ischemic and hemorrhagic stroke, pneumonia, MI, CHF, and septicemia)
- This study has been accepted to Medical Care (**Using Automated Clinical Data for Risk Adjustment: Development and Validation of Six Disease-Specific Mortality Predictive Models for Pay-For-Performance**. Ying P Tabak, RS Johannes, Jeffrey H Silber)

CardinalHealth

Results from the Cardinal Health Study

Relative Contribution of Laboratory Variables in Relationship to Other Variables				
Disease Group	**Lab / Age**	**Lab / ICD-9 Var.**	**Lab / VS**	**Lab / AMS**
Ischemic Stroke	1.61 (1.28-2.04)	7.02 (5.12-9.62)	3.18 (2.14-4.75)	0.33 (0.26-0.41)
Hem. Stroke	1.76 (1.45-2.14)	2.26 (1.70-2.99)	3.14 (2.29-4.29)	0.37 (0.29-0.48)
Pneumonia	1.00 (0.89-1.12)	3.59 (3.01-4.28)	2.52 (2.11-3.00)	4.60 (3.79-5.59)
AMI	0.96 (0.87-1.05)	67.4 (51.6-87.9)	2.65 (2.27-3.09)	3.38 (2.93-3.90)
CHF	2.35 (2.07-2.66)	14.1 (10.3-19.5)	2.93 (2.57-3.33)	4.01 (3.46-4.65)
Septicemia	2.75 (2.39-3.15)	8.03 (6.09-10.6)	2.53 (2.14-2.98)	7.66 (5.86-10.0)

Results are shown as Omega (ω) statistics with 95% confidence intervals.

All save Lab/Age for Pneumonia & AMI are $p < 0.0001$

Source: Medical Care (in press)

CardinalHealth

Evaluation of Critical Organ Systems

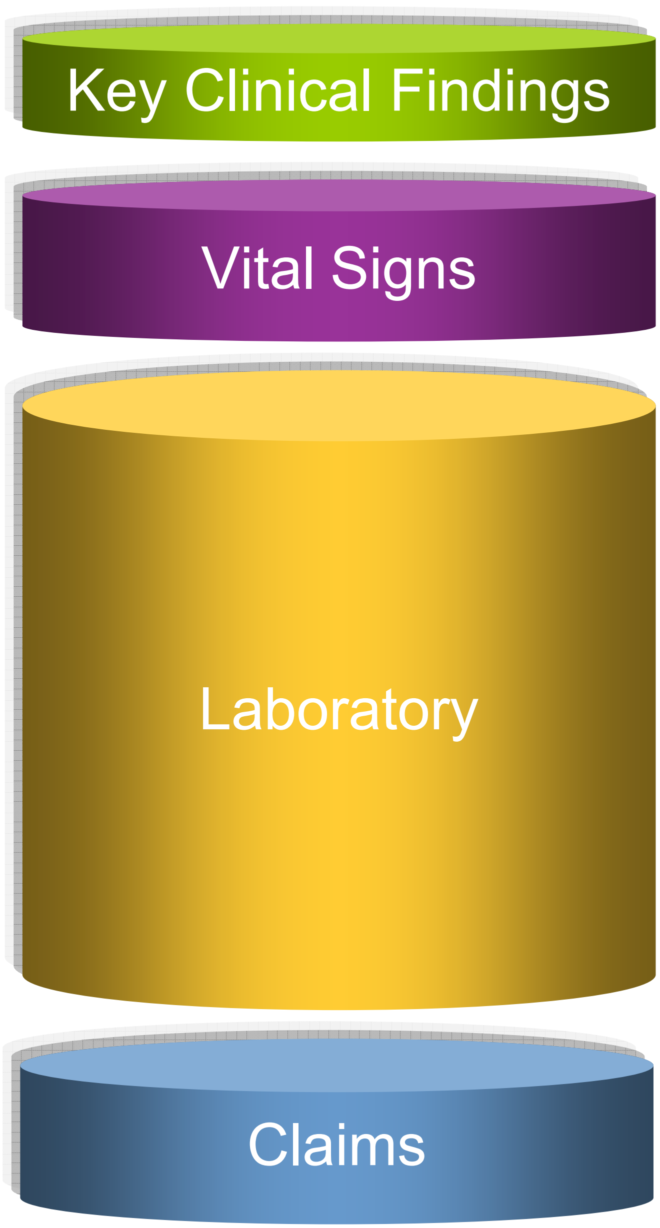
- Where are laboratory results robust?
  - Kidney: BUN, creatinine, Sodium, Potassium
  - Liver: alk phos, bilirubin, albumin, AST
  - Lung: Arterial blood gases, O_2 saturation
  - Heme: Hbg, WBC, bands, platelets, proTime, PTT
  - Endocrine: glucose, Sodium, Potassium
- Where might lab values use some of help?
  - Heart: BNP, Cardiac enzymes
  - Brain: WBC, CPK

CardinalHealth

The Dimensions of Risk: Example

Congestive Heart Failure Model

2004-2005
120,745 cases
4,377 deaths
Mortality rate = 3.6%
c-statistic = 0.802



Available Electronically

Variable	Oddds Ratio	Lower 95CL	Upper 95CL
Moderate or Severe Altered Mental Status	5.18	4.56	5.89
Mild Altered Mental Status	1.23	1.13	1.35
Systolic BP mm Hg ≤ 80	2.39	2.15	2.65
Systolic BP mm Hg (81-100)	1.73	1.59	1.88
Diastolic BP mm Hg ≤ 53	1.68	1.51	1.86
Diastolic BP mm Hg (54-62)	1.23	1.13	1.35
Oral Temp F ≤ 95 or Oral Temp F > 100	1.32	1.19	1.46
Pulse (100-119)	1.46	1.34	1.58
Pulse≥120	1.55	1.41	1.70
Albumin g/dL ≤ 2.4	2.12	1.85	2.44
Albumin g/dL (2.5 -2.7)	1.64	1.43	1.89
<CPK U/L ≤ 35 or CPK U/L>500	1.22	1.13	1.32
Na meq/L ≤130	1.64	1.50	1.87
Na meq/L (131 - 135)	1.22	1.12	1.32
Na > 145	1.46	1.26	1.69
BUN mg/dL (35-50)	1.66	1.53	1.81
BUN mg/dL (51 - 70)	2.22	2.02	2.45
BUN mg/dL>70	3.53	3.19	3.91
pH ≤ 7.25	1.78	1.53	2.08
pH (7.26 - 7.33)	1.67	1.45	1.93
pCO2 Arterial ≤ 35 or pCO2 Arterial>60	1.57	1.42	1.74
Composite Trop I > 1 mg/ml or CPK-MB > 9 IU	1.57	1.40	1.77
Anticoagulatant PT/INR	1.38	1.28	1.48
Toal bilirubin mg/dL > 1.4	1.47	1.31	1.65
WBC > 10.9	1.44	1.34	1.55
BNP ≤ 100 or proBNP ≤ 1000	0.39	0.23	0.66
BNP > 2400 pr proBNP > 18000	1.37	1.21	1.55
Years older than 45	1.03	1.03	1.04
CHRONIC OBST AIRWAY DIS	1.17	1.09	1.25
AMI, SUBSEQUENT	2.33	1.53	3.54
CHRONIC PULMONARY HEART DIS	1.13	1.03	1.24
METASTATIC CANCER	2.08	1.81	2.40

MD acceptance: Enhanced face validity

Box 1 Common themes about what makes data feedback effective in the hospital setting

- Theme 1: Data must be perceived by physicians as valid to motivate change
- Theme 2: It takes time to develop the credibility of data within a hospital

Table 3

1. Inherent problems with the use of billing and administrative databases for profiling
2. Lack of time for physicians to review profiles and use the information they provide
3. Missing data and inability to gather needed information (diagnoses, laboratory test values, physical findings, nonprescription drug use, herbal product use, etc.)

ment. Scores based on administrative data may be of little value to large numbers of older patients whose health conditions do not match limited administrative data performance measurement.

Additionally, performance scores based on administrative data alone greatly overestimate health care quality because performance is much higher for the portion of health care that can be assessed with administrative data relative to the portion that requires data from medical records. Higher performance on the QIs that could be measured using administrative data could result from a number of factors including the ease of performing these processes in clinical practice, the perceived importance of these processes by physicians and reimbursement schedules for these processes. The relatively

Data feedback efforts in quality improvement: lessons learned from US hospitals
Bradley EH, Holmboe ES, Mattera JA, Roumanis SA, Radford MJ and Krumholz HM. Qual. Saf. Health Care 2004; 13; 26-3.

Opinions on provider profiling: Telephone survey of stakeholders
MacKinnon, Neil J.; Lipowski, Earlene E. Am J Health-System Pharm. Sep 2000 (17); 1: 1585-1591.

Comparison of Administrative Data and Medical Records to Measure the Quality of Medical Care Provided to Vulnerable Older Patients
MacLean CH, Louie R, Shekelle PG, Roth CP, Saliba D, Higashi T, Adams J, Chang JT, Kamberg CJ, Solomon DH, Young RT, Wenger NS. Medical Care. 2006 Feb; 44(2): 141-8.

CardinalHealth

Advantages of clinical data

- Objective
- Precise
- Time-stamped
- Suffers from few missing data
- Not susceptible to being gamed
- Verifiable in medical literature
- Accepted by clinicians
- Opportunity for automated data collection

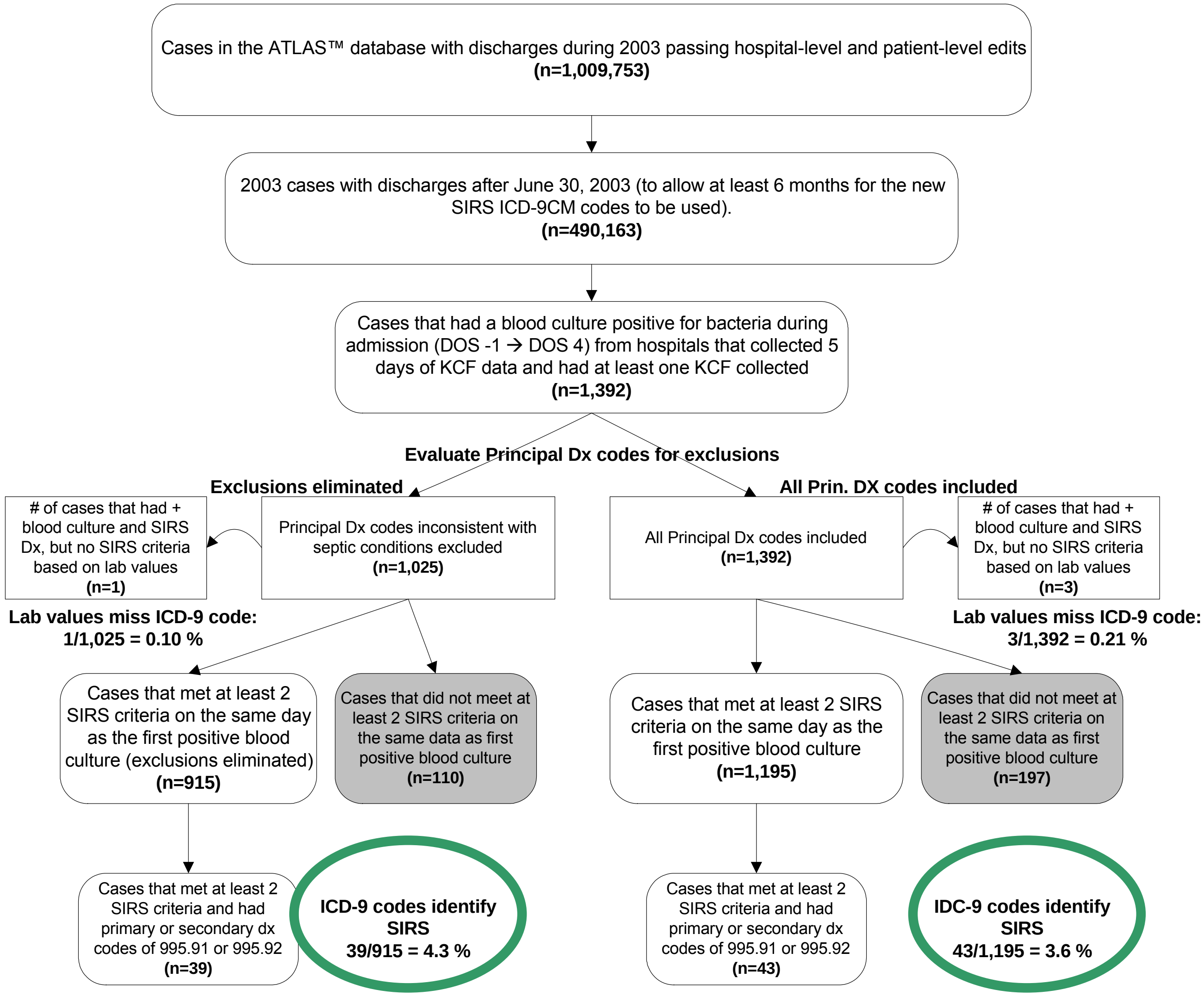
CardinalHealth

Thank You for Your Attention

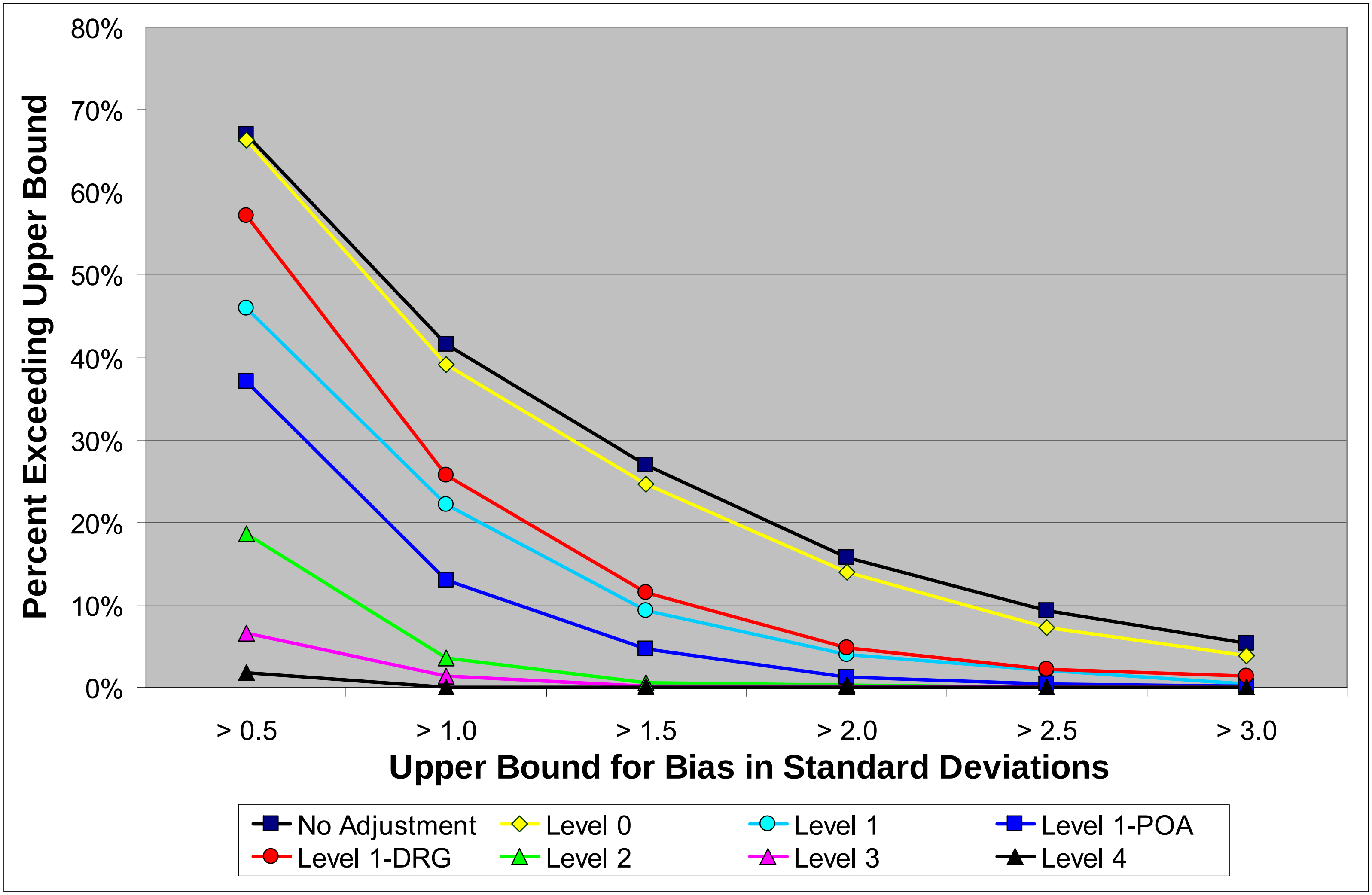
CardinalHealth

Working together. For life.℠

SIRS Study Results



Differences in IQI Hospital-Level Bias



CardinalHealth

Used with permission: Michael Pine & Assoc 2006