

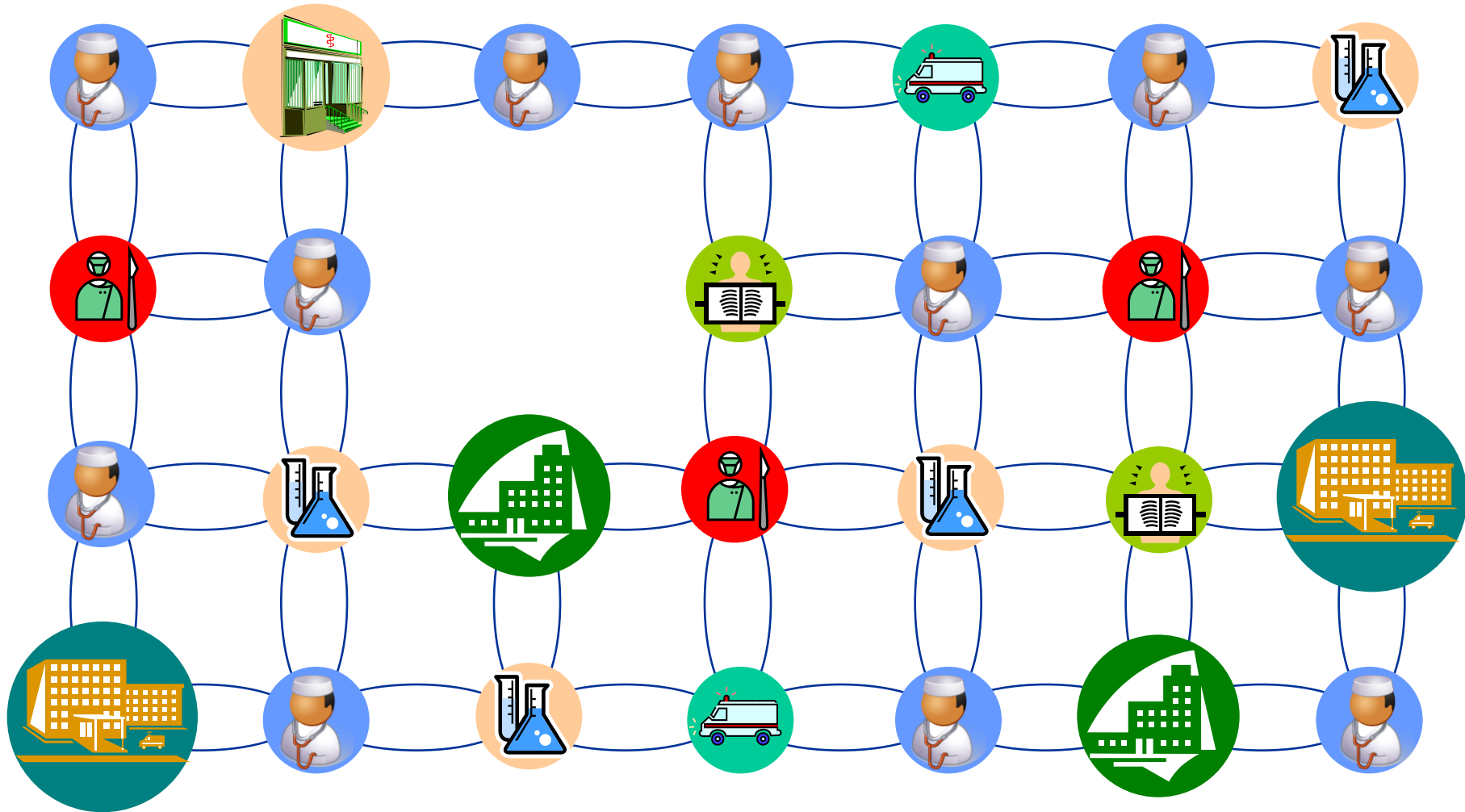
Patient Identification Technology for Health Information Exchanges



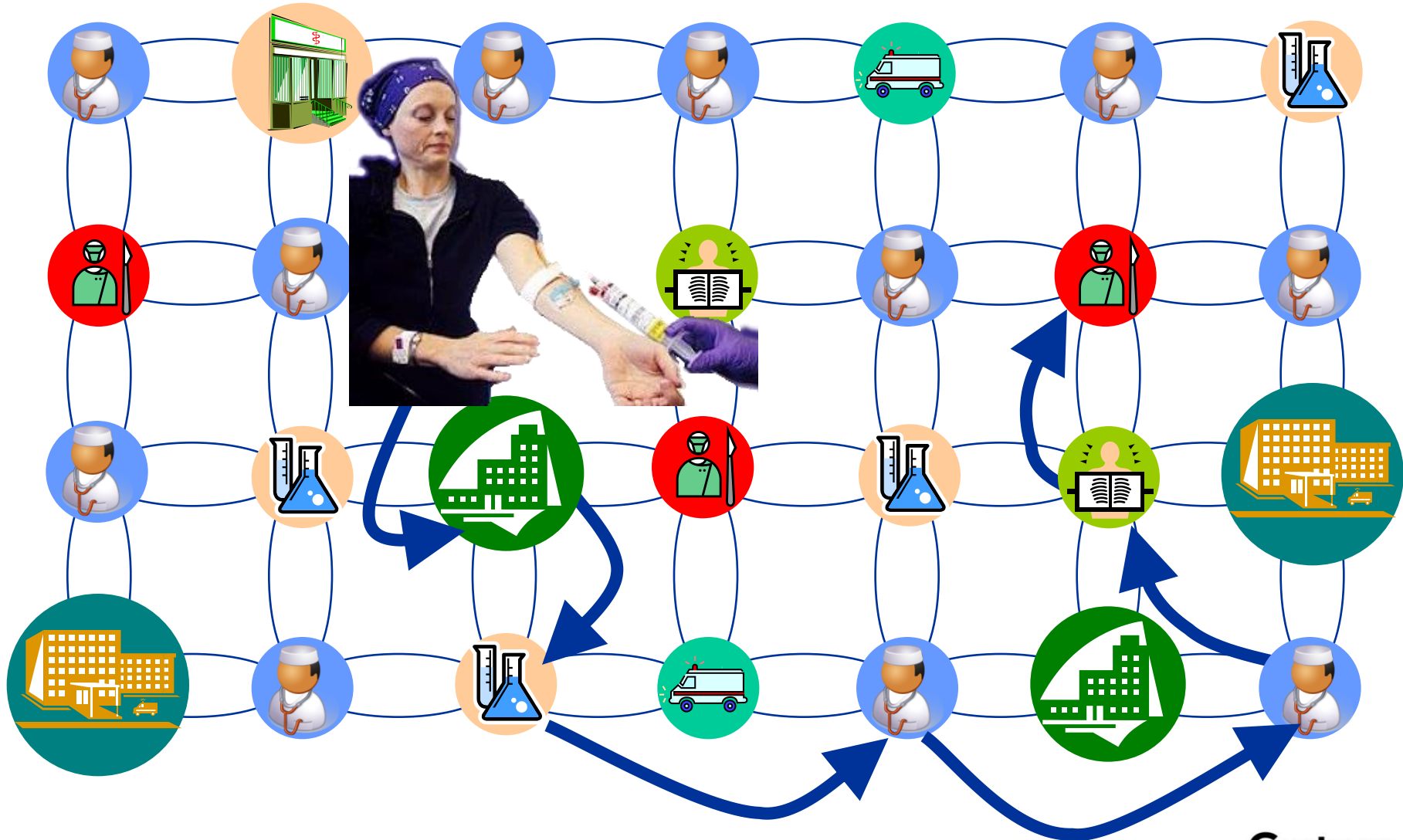
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9 May 2009
For the AHCCCS Steering Committee

Gartner[®]

If the U.S. Healthcare Sector is a “structure”...



... Patients are the “Free Electrons”



What Is a Patient & What Does an EHR Need?

■ As a patient in the healthcare system, *I am known by:*

- My Name
- My Social Security Number
- My Address
- My Phone Number
- My Birth date
- My Insurance Carrier
- My Insurance Carrier Number
- Other Demographics



■ But to my doctor, *I am known by:*

- Payer & plan
- Previous incidents
- Treatments I have received
- Family History
- Active & Historical Medications



■ To my payer, *I am known by:*

- My enrollment data
- My employer
- My plan selections
- Other members related to me
- Treatments/procedures
- Disease / Care Management participation



■ To the emergency room, *I am known by:*

- What's in front of them



What Are the Identity Challenges?

Is This Record Related Too?

- First Name: Bill
- Last Name: Klaver
- Birth Date: 3/12/63
- Phone Number: (815)123-1234
- Address: 20201 Mary Therese Lane
- City: Frankfort
- State: Illinois
- Zip Code: 60423
- Medical Record: 1234
- Allergic: Penicillin
- Date: 5/5/2004

Who's Record Is This?

- First Name: B
- Last Name: Klaver
- Birth Date: 3/12/63
- Phone Number: (630) 789-7890
- Address: RR1
- City: Lemont
- State: Illinois
- Zip Code: 60441
- Medical Record: 2231
- Surgery: Knee
- Allergic: Penicillin
- Date: 11/15/1980

This Record...

- First Name: Bob
- Last Name: Klaver
- Phone Number: (630) 789-7890
- Address: 2213 West 136th Street
- City: Lemont
- State: Illinois
- Zip Code: 60441
- Medical Record: 0423
- Surgery: Colon
- Date: 1/31/1999

How About These?

Is This Record Related Too?

- First Name: William
- Last Name: Klaver
- Birth Date: 3/12/63
- Phone Number: (815)123-1234
- Address: 20201 Mary Therese Lane
- City: Frankfort
- State: Illinois
- Zip Code: 60423
- Medical Record: 1234
- Allergic: Penicillin
- Date: 5/5/2004

Different Birthday or Typo?

- First Name: William
- Last Name: Klaver
- Birth Date: 3/21/63
- Phone Number: (815)123-1234
- Address: 20201 Mary Therese Lane
- City: Frankfort
- State: Illinois
- Zip Code: 60423
- Medical Record: 4567
- Allergic: none
- Date: 5/17/2004

Son at Same Address?

- First Name: Bill
- Last Name: Klaver, Jr
- Birth Date: 3/21/93
- Phone Number: (815)123-1234
- Address: 20201 Mary Therese Lane
- City: Frankfort
- State: Illinois
- Zip Code: 60423
- Medical Record: 9123
- Allergic: Seafood
- Date: 7/22/2007

Errors Comparing Two Hospitals in Indiana

Table 2: Identifier Error Rates Among Correct SSN-based Links Error Rates (%)		
	Hospital A (n=5450)	Hospital B (n=5719)
Last Name	5.9	2.1
First Name	12.5	8.2
Name Sum	16.7	9.9
NYSIIS Last Name	3.9	1.5
NYSIIS First Name	9.5	7.2
NYSIIS Sum	12.3	8.3
Gender	0.6	0.6
Month of Birth	3.7	1.8
Day of Birth	8.4	5.3
Year of Birth	8.2	4.2

Source: Analysis of Identifier Performance using a Deterministic Linkage Algorithm

Shaun J. Grannis MD, J. Marc Overhage MD PhD, Clement J. McDonald
MDRegenstrief Institute for Health Care, Indiana University, Indianapolis IN

Proceedings of the AMIA 2002 Annual Symposium, Page 305

Using Multiple Fields with Rules

False Positives vs False Negatives

Linked Identifiers	Links		Non-Links		Sensitivity (%)	Specificity (%)
	Correct	Incorrect	Correct	Incorrect		
SSN Alone	5450	550	0	0	100	--
Name Criteria:						
SSN, LN, FN	4541	7	543	916	83.2	98.7
SSN, LNY, FNY	4775	7	543	675	87.6	98.7
SSN, SNY	4782	7	543	668	87.7	98.7
Date Criteria:						
SSN, MB, DB, YB	4557	2	548	893	83.6	99.6
Name/Date Criteria with SSN:						
SSN, FN, YB, G	4350	0	550	1100	79.8	100
SSN, FNY, YB, G	4496	0	550	954	82.5	100
SSN, FNY, MB, G	4724	0	550	726	86.7	100
Name /Date Criteria without SSN:						
LN, FN, MB, DB, YB, G	3996*	0	550	1650	70.1	100
Union of (FNY,YB,G), (FNY, MB, G), and (LN,FN,MB,DB,YB)	5053	0	550	593	89.5	100

sensitivity -- matches correctly

specificity -- avoids false matches

False Positive vs. False Negative

■ False Positive: linking the records of two different patients

- Errors based on history information not confirmed with patient
- Failure to use best therapy because of false contraindications (less optimal therapy is usually degrades outcomes and increases cost)

■ False Negative: failing to link records of the same patient

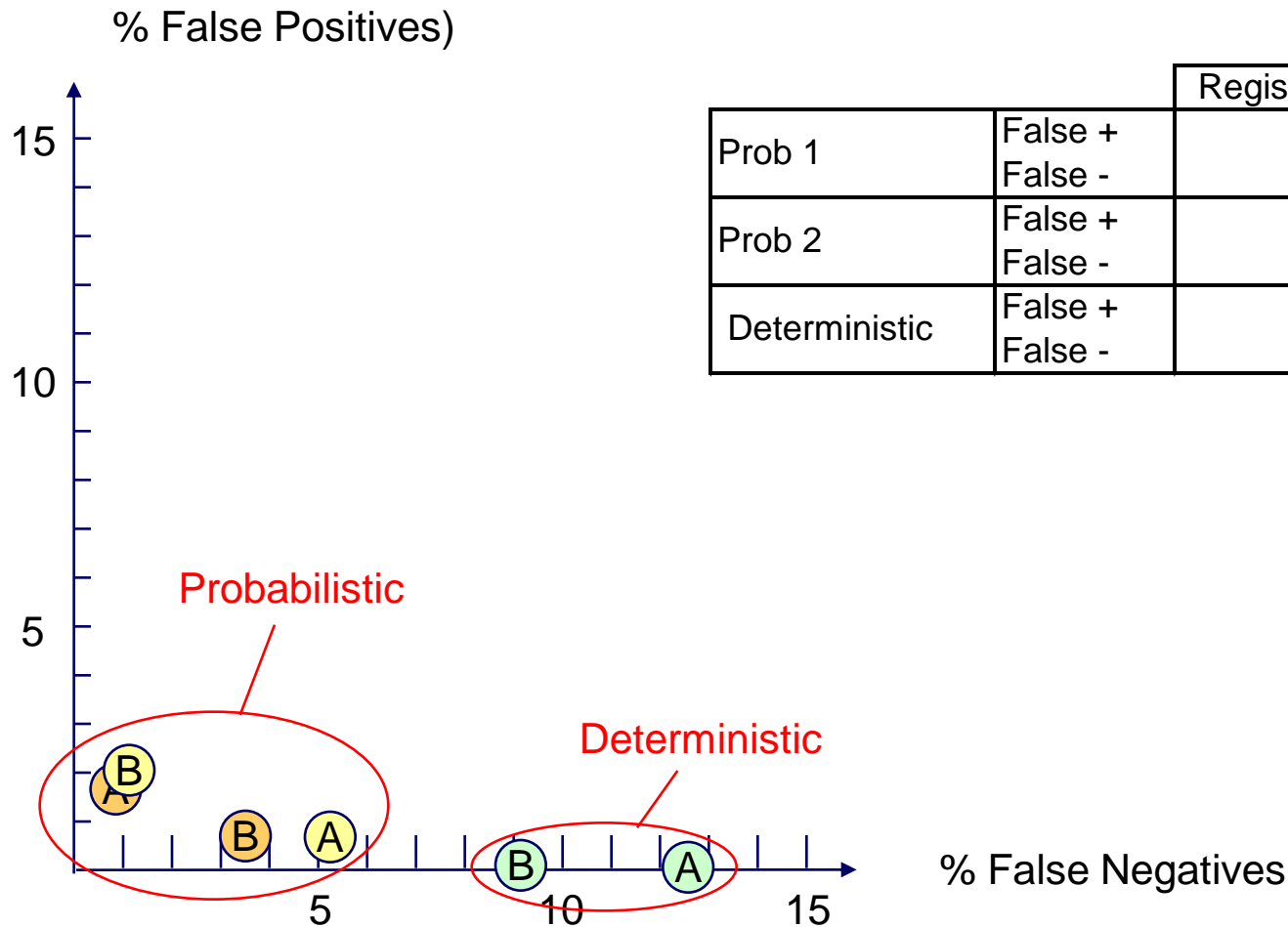
- Failure to catch important history
- Inability to resolve history reported by patient
- Failure to use best therapy because of missing indication
- Failure to recognize allergies or drug-drug interactions
- Duplicate orders
- Discourage clinicians from trying and using the HIE regularly
- Loss of credibility with consumers

Are false positives more scary? It depends on who you ask and how you ask the question.

Matching Rules Improve the Balance Between False Positives and False Negatives

Enterprise ID	<p>Not generally useful for HIE because of the lack of a common enterprise ID.</p> <p>Error rate within an enterprise much higher if there is no check-digit on the enterprise ID</p>
first name, last name, gender, date of birth	<p>Variable accuracy based on how common the name is.</p> <ul style="list-style-type: none">• Having the name Smith in two records is 90 times more likely to be a false positive than the last name Abelman• Nguyen is 38x more likely to be an error than McDougal• Garcia 53x more likely to be an error than Shipman
Date of birth	<p>Two identical DOBs in the 1980s are far more likely to represent a false positive than two identical DOBS in the 1920s.</p> <p>A DOB of 2/12/91 is more likely to be a true match with 2/21/91 than it is to 2/17/91</p> <p><u>The question is “how much more likely?”</u></p>
Other identifiers	<p>Phone number, address and driver’s license number can each add varying degrees of credibility to reconciling similar but not identical demographics <u>if it is possible to know how to say “how much”</u></p>

Deterministic vs. Probabilistic Matching

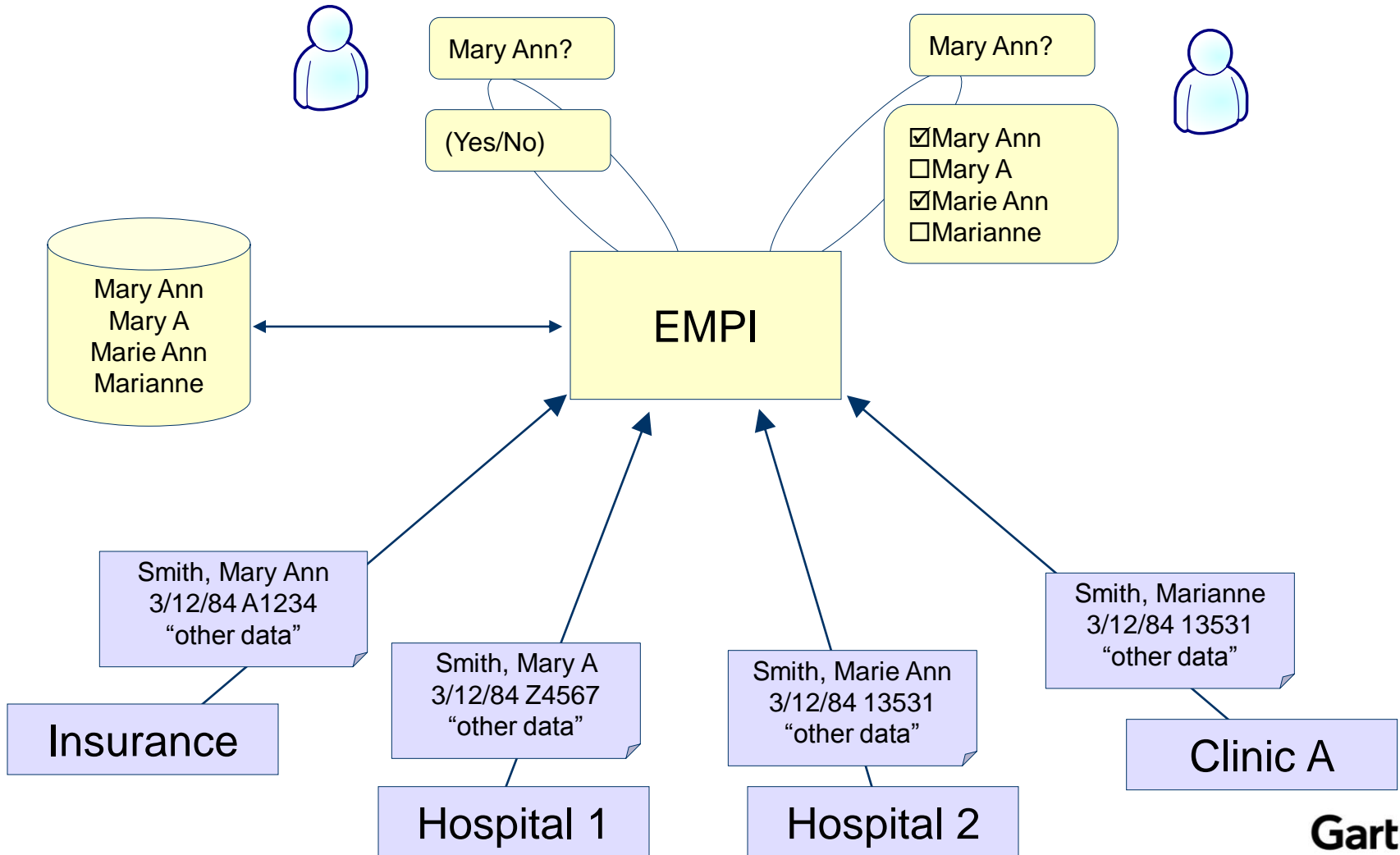


Source: Grannis, et al, "Analysis of a Probabilistic Record Linkage Technique without Human Review" *Proceedings of the AMIA 2003 Annual Symposium*, p 261





Active and Passive Workflows

Passive




Active



Vendors: Stand-alone

Vendor	Initiate	Orion	Quadramed	Sun
Trade Name/Product	Initiate Patient	Concerto EMPI	Smart Identity Exchange	eIndex Single Patient View
Size of EMPI Business				
Scope of EMPI Business	Enterprise and HIE	Embedded in Portal	Embedded or standalone	Enterprise and HIE
% in Healthcare	100%	100%	100%	90%
Related services	Remediation, Tuning	Remediation, Tuning	Remediation, Tuning	Remediation, Tuning
Passive Matching	Yes	Yes	Yes	Default
Active Matching	Yes	Yes	Yes	By contract
Includes probabilistic rules?	Yes	Yes	Yes	Yes
Standards	IHE, OMG	Canada Infoway	IHE	IHE
Number of clients	54	5	16	143
Largest population	> 5,000,000	> 500,000	> 5,000,000	> 5,000,000
HIEs	20	2	4	17
Largest HIE	RxHub	Northwestern Medical Center	Dallas Fort Worth Hospital Council	Geisinger

Vendors – Embedded

Vendor	Axlotl	Medicity	Wellogic
Trade Name/Product	Elysium	MediTrust CMPI	Platform for Healthcare
Size of EMPI Business			
Scope of EMPI Business	Embedded in HIE Product	Embedded in HIE/Portal	Embedded in HIE Product
% in Healthcare	100%	100%	100%
Related services	Remediation, Tuning	Remediation, Tuning	Remediation, Tuning
Passive Matching	Yes	Yes	Yes
Active Matching	Yes	No	Yes
Includes probabilistic rules?	Passive -- no Active -- yes	Yes	No
Standards	IHE	IHE	IHE
Number of clients	4	49	>30
Largest population	< 5,000,000	> 5,000,000	< 5,000,000
HIEs	10	3	8
Largest HIE	HealthBridge, Cincinnati	DHIN	MedVirginia

Deal Sizes

“Your Mileage May Vary”

■ Variables

- Population size
- Number of separate data sources to be reconciled
- “Dirtiness” of Data
- Number of client systems

■ Pricing Elements

- Software license fee \$80-\$500 K
- Implementation costs 50-150% of license fee
- Interfaces typically about \$30K each

Summary

- Enterprise patient cross-index is essential to achieving the usefulness and credibility of an HIE
- Probabilistic matching greatly reduces false negative matches while only minimally impacting false positives
- To be most effective, probabilistic matches are tuned to the population being indexed and the quality of the source data systems
- There is a robust market of enterprise master patient index vendors
- Costs can range from \$250K to in excess of \$1 million