


A Regional Enterprise Master Patient Index Approach to Re-admission Analysis

Dallas-Fort Worth Hospital Council
Education & Research Foundation


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DFWHC Data Initiative: Regional Collaboration

- Data Initiative started in 1997
- Data collection and reporting began in 1998
- Focus on data and staying in front of public reporting initiatives and the issues surrounding the programs
- Major transition from the UB92/1450 format for exports to the HIPAA transactions format/Tx837
- We now have over 8 years of data in the DI warehouse
 - 1999-2007
 - Data 90 days out from close of quarter
 - Over 7,000,000 million encounters in the DI warehouse to date
 - Report on over 70 measures of patient safety and quality
- And,....the region recognizes:


POWER IN COLLABORATION!



REMPI Record Linkage Project


Applying advanced probabilistic matching algorithms to accurately link disparate person / patient records within and across healthcare organizations for improving patient safety, quality & health.

A Patient Safety & Quality Use Case



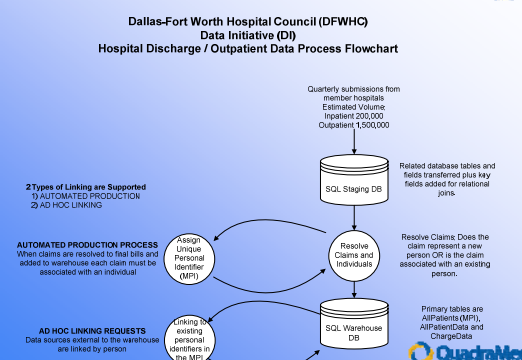
Linkage Project Overview

- Evaluated vendors
- Narrowed to three vendors
- Requested proof of concept
- Two vendors agreed to proof of concept
- Selected QuadraMed as a development partner for our Record Linkage project
- Implementation is underway



Overview provided to Vendors

Dallas-Fort Worth Hospital Council (DFWHC)
Data Initiative (DI)
Hospital Discharge / Outpatient Data Process Flowchart



Quarterly submissions from member hospitals
Estimated Volume: Inpatient 200,000, Outpatient 1,500,000

Related database tables and fields transferred plus key fields added for relational joins


2 Types of Linking are Supported
1) AUTOMATED PRODUCTION
2) AD HOC LINKING

AUTOMATED PRODUCTION PROCESS
When claims are resolved to final bills and added to warehouse each claim must be associated with an individual

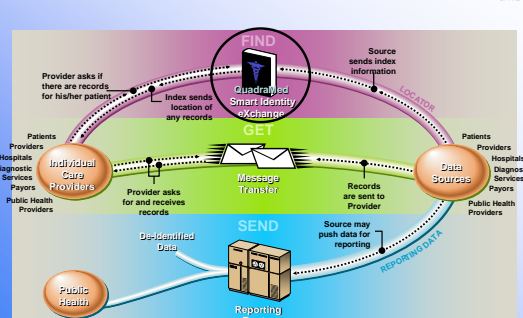
AD HOC LINKING REQUESTS
Data sources external to the warehouse are linked by person

Resolve Claims: Does the claim represent a new person OR is the claim associated with an existing person.

Primary tables are AllPatients (MPI), AllPatientDis and ChargeData



QuadraMed's Part of the HIE Landscape




FIND: Provider asks if there are records for his/her patient. Index sends location of any records. Source sends index information.

GET: Provider asks for and receives records. Records are sent to Provider.

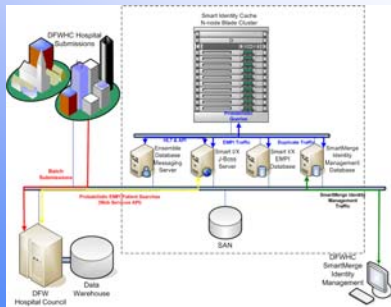
SEND: De-Identified Data. Source may push data for reporting.

REPORTING DATA: Reporting Router.

Source: © 2004 The Markle Foundation. Graphic adapted from Tom Benlini original.



Configurability & Scalability



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Getting Started: *The Partnership Plan*

○ QuadraMed

- Perform SmartScan Weight File Generation
- Install Ensemble
- Implement Smart Identity eXchange
- Complete SmartScan and load data
- Install SmartMerge
- Provide Training on QuadraMed Products

○ DFW Hospital Council ERF

- Purchase Dedicated Windows Server
- Provide Remote Access to Smart Identity eXchange
- InterSystems Ensemble Training

Cooperatively Define Initial Auto-Linking Process Rules

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So what does this process look like?

Initial Process

- Data extracted from DFWHC Warehouse
- Data runs through Smart I/X and then extracted for SmartScan Analysis
- SmartScan scientifically computes the probabilistic weights for all demographic database record elements and performs the initial detection of duplicates
 - Approximately 45% of the records in the database were identified as potential linkages, as expected in a regional database
- Auto-link of High Probability patient matches will occur based on linkage weight and predefined deterministic matching criteria
- Moderate to Low Probability duplicate records will be output to SmartMerge for review
 - Examine patterns that may result in further auto-linking rules
 - Amplify auto-linking as DFW HC tolerance for error is higher than typical hospital

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Ongoing Batch Process

- Quarterly data extractions will flow through the same process for analysis and potential linkages
- Data will load into Smart I/X on quarterly production
- Auto-linking will occur
- Again, records not meeting the weight threshold and criteria for auto-link will be left for review in SmartMerge

NOTE:

- All existing records based on site specific ID will be updated with the most current information.
- All updated records will be reevaluated to see if they represent a duplicate individual.

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The SmartMerge View of a “Fictitious” Duplicate Pair

Selection	Duplicate Management	Report Preview
EM007218	EM007218	EM007218
EM007219	EM007219	EM007219
EM007220	EM007220	EM007220
EM007221	EM007221	EM007221
EM007222	EM007222	EM007222
EM007223	EM007223	EM007223
EM007224	EM007224	EM007224
EM007225	EM007225	EM007225
EM007226	EM007226	EM007226
EM007227	EM007227	EM007227
EM007228	EM007228	EM007228
EM007229	EM007229	EM007229
EM007230	EM007230	EM007230
EM007231	EM007231	EM007231
EM007232	EM007232	EM007232
EM007233	EM007233	EM007233
EM007234	EM007234	EM007234
EM007235	EM007235	EM007235
EM007236	EM007236	EM007236
EM007237	EM007237	EM007237
EM007238	EM007238	EM007238
EM007239	EM007239	EM007239
EM007240	EM007240	EM007240
EM007241	EM007241	EM007241
EM007242	EM007242	EM007242
EM007243	EM007243	EM007243
EM007244	EM007244	EM007244
EM007245	EM007245	EM007245
EM007246	EM007246	EM007246
EM007247	EM007247	EM007247
EM007248	EM007248	EM007248
EM007249	EM007249	EM007249
EM007250	EM007250	EM007250
EM007251	EM007251	EM007251
EM007252	EM007252	EM007252
EM007253	EM007253	EM007253
EM007254	EM007254	EM007254
EM007255	EM007255	EM007255
EM007256	EM007256	EM007256
EM007257	EM007257	EM007257
EM007258	EM007258	EM007258
EM007259	EM007259	EM007259
EM007260	EM007260	EM007260
EM007261	EM007261	EM007261
EM007262	EM007262	EM007262
EM007263	EM007263	EM007263
EM007264	EM007264	EM007264
EM007265	EM007265	EM007265
EM007266	EM007266	EM007266
EM007267	EM007267	EM007267
EM007268	EM007268	EM007268
EM007269	EM007269	EM007269
EM007270	EM007270	EM007270
EM007271	EM007271	EM007271
EM007272	EM007272	EM007272
EM007273	EM007273	EM007273
EM007274	EM007274	EM007274
EM007275	EM007275	EM007275
EM007276	EM007276	EM007276
EM007277	EM007277	EM007277
EM007278	EM007278	EM007278
EM007279	EM007279	EM007279
EM007280	EM007280	EM007280
EM007281	EM007281	EM007281
EM007282	EM007282	EM007282
EM007283	EM007283	EM007283
EM007284	EM007284	EM007284
EM007285	EM007285	EM007285
EM007286	EM007286	EM007286
EM007287	EM007287	EM007287
EM007288	EM007288	EM007288
EM007289	EM007289	EM007289
EM007290	EM007290	EM007290
EM007291	EM007291	EM007291
EM007292	EM007292	EM007292
EM007293	EM007293	EM007293
EM007294	EM007294	EM007294
EM007295	EM007295	EM007295
EM007296	EM007296	EM007296
EM007297	EM007297	EM007297
EM007298	EM007298	EM007298
EM007299	EM007299	EM007299
EM007300	EM007300	EM007300

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QuadraMed SmartScan Results:

Master Patient Index Records

Total Records Submitted	4,443,938
Records Excluded from SmartScan ¹	8,060
Records Used in SmartScan Analysis	4,435,878

Duplicate Information

Overlap Rate	45%
Total Number of Records in Duplicate Groups ¹	1,997,145
Number of Distinct Duplicate Records	1,048,780
Number of Distinct Multiple Records	948,365
Number of Potential Duplicate Pairs	524,390
Number of Potential Multiple Groups	228,040
Number of Potential Retired Records in Multiple Groups	720,325

QuadraMed SmartScan Results Continued:

Multiple Group Distribution Details

Multiple Group Size	Multiple Group Count Retirees
3 Records Per Group	282,270
4 Records Per Group	142,011
>4 Records Per Group	198,463

Duplicate Distribution by Weight

Total duplicates with weight > 20	228,702
Total pairs with auto-link status of 1	175,048
Total duplicates with weight > 10 and < 14.99	66,079
Total duplicates with weight < 9.99	54,561

QuadraMed SmartScan Results Continued:

Category	Group Size	Total Survivors	Total Retirees	Total Patients
Multiples	>4	37,156	198,463	235,619
Multiples	4	47,337	142,011	189,348
Multiples	3	141,135	282,270	423,405
RS Babies	2	10,999	10,999	21,998
RS Low Probability	2	22,125	22,125	44,250
RS Moderate Probability	2	63,668	63,668	127,336
RTM Babies	2	1,278	1,278	2,556
RTM Exact Matches	2	302,916	302,916	605,832
RTM High Probability	2	98,696	98,696	197,392
RTM Moderate Probability	2	8,576	8,576	17,152
Grand Total:		733,806	1,131,862	1,864,388

RTM = "Ready To Merge" RS = "Review Suggested"

What a Hospital or System would review manually

\$\$\$ Cost Prohibitive for our purpose!

Auto-Link Rules:

Nine Auto-Link rules were created and tested by the Foundation and are currently being implemented. The rules are a combination of probabilistic elements (e.g. a match weight threshold of 12) and deterministic elements (e.g. the SSN if present on both records, must match exactly) that were jointly determined by the Foundation and QuadraMed.

Duplicate Distribution by Auto-Link Status

Auto-Link Status	Duplicates
Total pairs with auto-link status of 0	163,803
Total pairs with auto-link status of 1	311,568
Total pairs with auto-link status of 2	4,220
Total pairs with auto-link status of 3	154
Total pairs with auto-link status of 4	18,462
Total pairs with auto-link status of 5	590
Total pairs with auto-link status of 6	16,804
Total pairs with auto-link status of 7	6,704
Total pairs with auto-link status of 8	359
Total pairs with auto-link status of 9	1,726
Count of pairs with an auto-link status	360,587

69% of Duplicates resolved

A duplicate pair contains two records that have been identified as potential duplicates (i.e. same person). A multiple group contains three or more records that have been identified as potential duplicates. The Multiple Group consists of a Survivor record and two or more Retiree records (referred to as "members")

For the Multiples the Auto-Link Status defines the relationship of the individual Retiree record to the Survivor record

Due to the nature of the warehouse, many patients have more than two records in the warehouse. Auto-linking can be used to aggregate these individual records under one REMPI number in order to provide a person-centric view of the data.

Multiple Distribution by Auto-Link Status

Auto-Link Status	Multiples
Retirees with auto-link status of 1	401,153
Retirees with auto-link status of 2	4,861
Retirees with auto-link status of 3	83
Retirees with auto-link status of 4	16,456
Retirees with auto-link status of 5	320
Retirees with auto-link status of 6	10,468
Retirees with auto-link status of 7	8,943
Retirees with auto-link status of 8	241
Retirees with auto-link status of 9	2,305
Count of retirees in multiples with auto-link status	444,830
Count of survivors in multiples with auto-link status	199,603
Total multiple records involved in an auto-link	644,433

68% of the Multiples meet an auto-linking rule. The existing multiples can be programmatically merged based on the auto-link status. By applying the auto-linking rules as each new file is loaded, fewer and fewer multiple groups will be formed.

Sample Auto-Link Rules

- The records match exactly on the following elements (Exact Matches):
 - Last Name
 - First Name
 - DOB
 - Gender
 - SSN
- The records match on the following elements (Swapped First and Last Names):
 - First name and last name match exactly but are swapped (reversed)
 - SSN
 - Gender
 - DOB
- The records match on the following elements (Female Last Name Disagrees):
 - Gender of Female
 - Exact Match on First Name
 - DOB
 - SSN

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What we do with this data in the Regional EMPI . . .

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REMPE Data Uses

- Link Inpatient to Outpatient Hospitalization Encounters
- Link Multiple Outpatient Encounters
- Calculate 30, 60, and 90 day Re-admission Rates
- Develop episodic metrics & analytic capability to evaluate chronic illness models for congestive heart failure, pneumonia, and other identified chronic illnesses.
- Link cardiovascular, stroke, and chronic disease research data to our Inpatient and Outpatient databases
- Support research activity to improve healthcare delivery
- Improve patient safety and quality efforts
- Track infections and other complication rates
- Track patient home address distance from hospital
- Track survival via Medicare Death Master file
- Trend admitting and operating physician IDs/names

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Regional Enterprise Master Patient Index

Hip Replacement Admissions and Readmission Characteristics

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Readmit Status of Total Hip Replacement with DVT Complication

Unique ID per Discharge	REMPI	Participating Hospital	ReAdmit Facility	Admission Date	LOS	ReAdmit Date	PRP/CDAG	Diagnosis Description	DIAG2
13131313	1234567	Hospital A	Hospital A	2008-02-21	5	06/25/2008	V57.89	OTH REHABILITATION	V48.4
14141414	1234567	Hospital A	Hospital A	2008-09-29	8		V13.25	LOCALIZED OSTEOARTHR UNSPEC PELVIS	V45.41

Admitted for total hip replacement procedure

Diagnosis Position 2: 453.41
Venous embolism and thrombosis of deep vessels of proximal lower extremity

First admission in Regional Enterprise Master Patient Index

V57.89 = Other specified rehabilitation procedure, multiple training or therapy

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Readmit Status of Total Hip Replacement without Complication(s)

Unique ID	REMPI	ReAdmit Facility	Admission Date	PRP/CDAG	Diagnosis Description	ReAdmission Day Group	Date of Death
11111111	1234567	Hospital A	2004-06-05	565.09	POSSCN OPERATES OTH	0-30 Days	
22222222	1234567	Hospital A	2004-06-05	706.33	RECLUR MAJOR DEPRESSIVE SEVERE	0-30 Days	
33333333	1234567	Hospital B	2004-06-06	706.33	RECLUR MAJOR DEPRESSIVE SEVERE	Over 90 Days	
33333333	1234567	Hospital B	2004-09-14	486.	PHELMONGIA ORGANISM UNSPEC	0-30 Days	
44444444	1234567	Hospital D	2004-10-13	486.	PHELMONGIA ORGANISM UNSPEC	61-90 Days	
55555555	1234567	Hospital D	2004-12-30	486.	PHELMONGIA ORGANISM UNSPEC	Over 90 Days	
66666666	1234567	Hospital B	2005-09-23	905.4	POSSCN ARROW ANALGESICS OTH	Over 90 Days	
77777777	1234567	Hospital B	2005-10-12	909.0	POSSCN ANTIDEPRESSANT	Over 90 Days	
88888888	1234567	Hospital B	2006-12-30	182.6	CELLULITIS/ABCESS LEG	31-60 Days	
99999999	1234567	Hospital B	2007-02-15	486.	PHELMONGIA ORGANISM UNSPEC	Over 90 Days	
10101010	1234567	Hospital B	2008-08-25	720.42	ASPTIC NECROSIS HEAD & NECK PRMAR	0-30 Days	
12121212	1234567	Hospital B	2008-09-09	682.8	CELLULITIS/ABCESS LEG	No ReAdmit	

Less than 30 Days Since Last Admission

Total Hip Replacement

Not readmitted as of 2008Q3

Not deceased

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Sample Report Created w/Business Intelligence Tool [Cognos]



Readmission	Readmission Date	Readmission Reason	ICD-9-CM	ICD-9-CM Description	ICD-9-CM Category	ICD-9-CM Subcategory	ICD-9-CM Code	ICD-9-CM Description	ICD-9-CM Category	ICD-9-CM Subcategory	ICD-9-CM Code	ICD-9-CM Description
100000	2014Q1	017.0	51.10	017.01 Acute myocardial infarction of unspecified site	Medicine Part 4	Public Health Emergency System Provision Referral	612,127	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.011 Coronary atherosclerosis without angina pectoris	Medicine Part 4	Personal Physician Referral	612,128	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.012 Coronary atherosclerosis with angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,129	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.013 Coronary atherosclerosis with myocardial infarction	Medicine Part 4	Public Health Emergency System Provision Referral	612,130	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.014 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,131	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.015 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,132	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.016 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,133	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.017 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,134	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.018 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,135	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.019 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,136	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.020 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,137	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.021 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,138	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.022 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,139	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.023 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,140	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.024 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,141	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.025 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,142	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.026 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,143	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.027 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,144	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.028 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,145	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.029 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,146	01.00	Over 90 Days			
100000	2014Q1	51.01	51.01	51.030 Coronary atherosclerosis with myocardial infarction and angina pectoris	Medicine Part 4	Public Health Emergency System Provision Referral	612,147	01.00	Over 90 Days			

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Live Demonstration followed by Questions & Discussion

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