



Office of the State Auditor
Suzanne M. Bump

Making government work better



Investment in Data Analytics by the Massachusetts Office of the State Auditor

Fraud Detection & Prevention:
Using Technology for Auditing
Jan. 15, 2014



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Laura Marlin, First Deputy Auditor

Investment in Data Analytics to Enhance Audits and Investigations

MA Office of the State Auditor

- ◉ Independent Constitutional Office
- ◉ State Auditor is elected every 4 years
- ◉ Mandated to audit every state agency, department, and authority every 3 years
- ◉ About 100 auditors on staff
- ◉ Conducts primarily compliance and performance audits
- ◉ Also has a Bureau of Special Investigations that conducts investigations into public assistance fraud

Auditor Bump's Priorities

State Auditor Suzanne Bump took office 3 years ago:

- ◎ 21st Century Audit Office
- ◎ Use Resources Strategically
Focus resources on high-risk areas
- ◎ Provide Solutions
Champion reforms that make government more efficient, more effective, and more accountable

Prior to Data Analytics

Factors for Selecting Audits

- ◉ Staff availability
- ◉ Staff location (regional office & residence)
- ◉ Agency's audit history; prior findings
- ◉ Funding levels

Selection process was blind to potential waste, fraud, or abuse

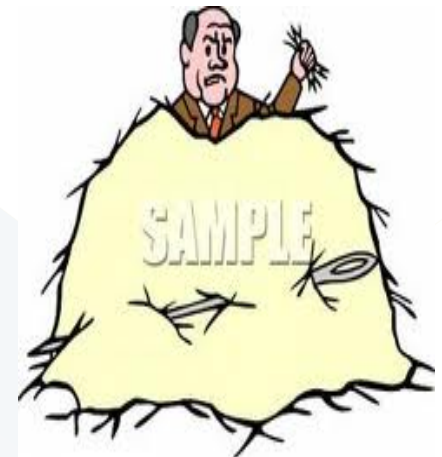


Prior to Data Analytics

Conducting the Audit:

- ◉ Identify laws, rules, and regulations
- ◉ Document and test internal controls
- ◉ Random sample testing of member files and claims
- ◉ Verify compliance

Hit or miss approach; majority of files and claims not tested



Prior to Data Analytics

Audit Results and Recommendations:

- Closeout letters
- Low dollar impact
- Specific to the members sample
- Specific to the service provider audited



Systemic problems not addressed (e.g. deficiencies within claims processing system, program regulations, etc.)

Why invest in Data Analytics?



Why invest in Data Analytics?

Use Resources Strategically:

- ⦿ Risk-based audit selection
- ⦿ Enhanced risk analysis once audit is commenced
- ⦿ Data-driven, proactive fraud investigations

Why invest in Data Analytics?

Providing Solutions

- ◉ Audit focuses on systemic issues
- ◉ More meaningful recommendations
- ◉ More useful reporting of results; addressing more, if not all, transactions

Introduction of Presenters

- ◎ **Kleber Gallardo, Consultant**
Big Data and Analytics
- ◎ **Paul Albano, Director**
Medicaid and Health Care Audits
- ◎ **Allie Alland, Director**
Bureau of Special Investigations
- ◎ **Paul McLaughlin, Director**
Information Technology



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Kleber Gallardo, Consultant
Big Data and Analytics

OSA Data Analytics Engine

What is Big Data?

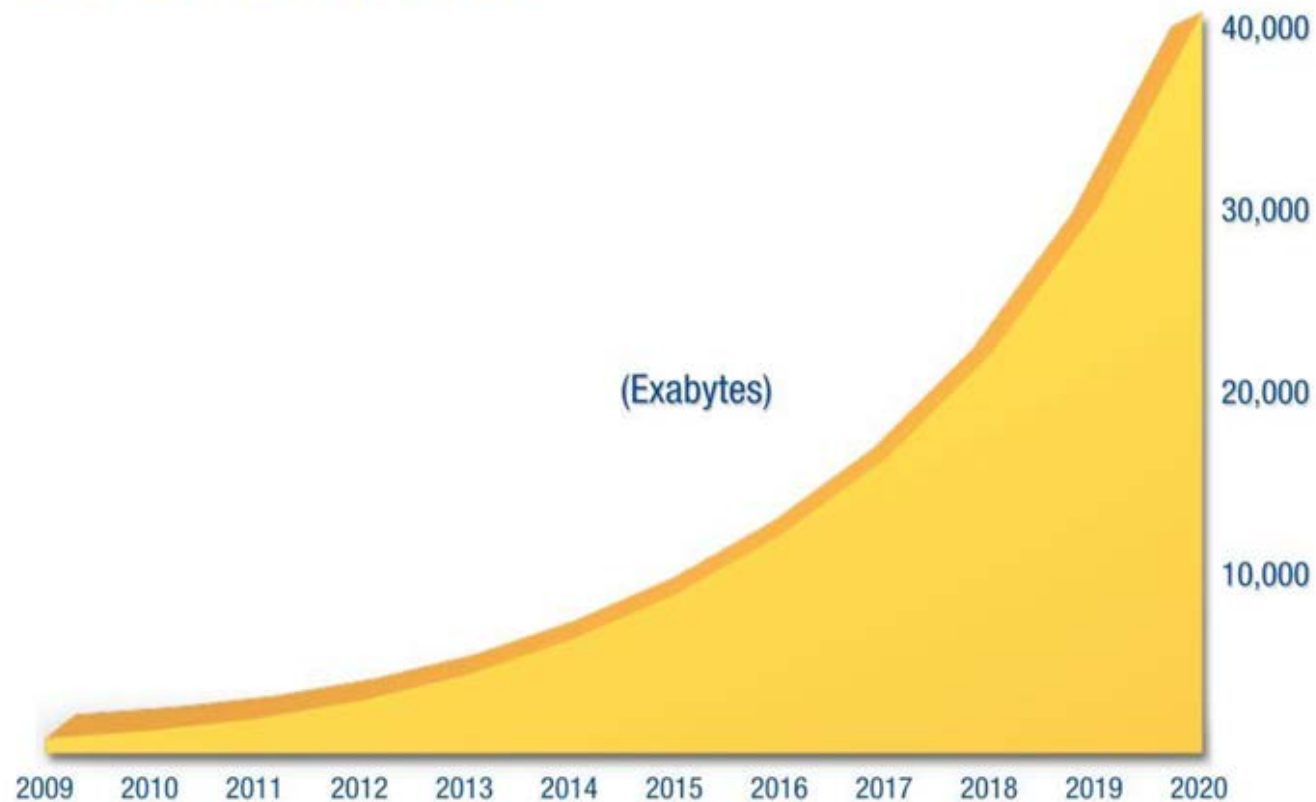
- ◎ Big data is the term for a collection of data sets so large and complex that it becomes difficult to process using traditional tools
- ◎ The challenges of Big Data include capture, archiving, storage, search, sharing, transfer, analysis, and visualization
- ◎ The information contained within stores of Big Data is of high value, high variability, and high volume

Why is it Significant?

- ⦿ Entities like Homeland Security, Department of Energy, Department of Defense, and National Science Foundation have been dealing with big data for years
- ⦿ Annual federal outlays for Big Data and related purposes were estimated to be over \$5 billion in 2013
- ⦿ Commercial technologies are now available for us to effectively use big data
- ⦿ Data integration, transformation, computation, statistics, analytics, modeling and data visualizations
- ⦿ More and more organizations are generating big data and using the data effectively to make business decisions

2020 Data Growth Projections

The Digital Universe: 50-fold Growth from the Beginning of 2010 to the End of 2020



Source: IDC's Digital Universe Study, sponsored by EMC, December 2012

What is the OSA Doing?

Business and Technology
Identify Need



Identify and
Access Data
Sources



Pilot



Build Analytics Engine

Infrastructure



Collaborative Process

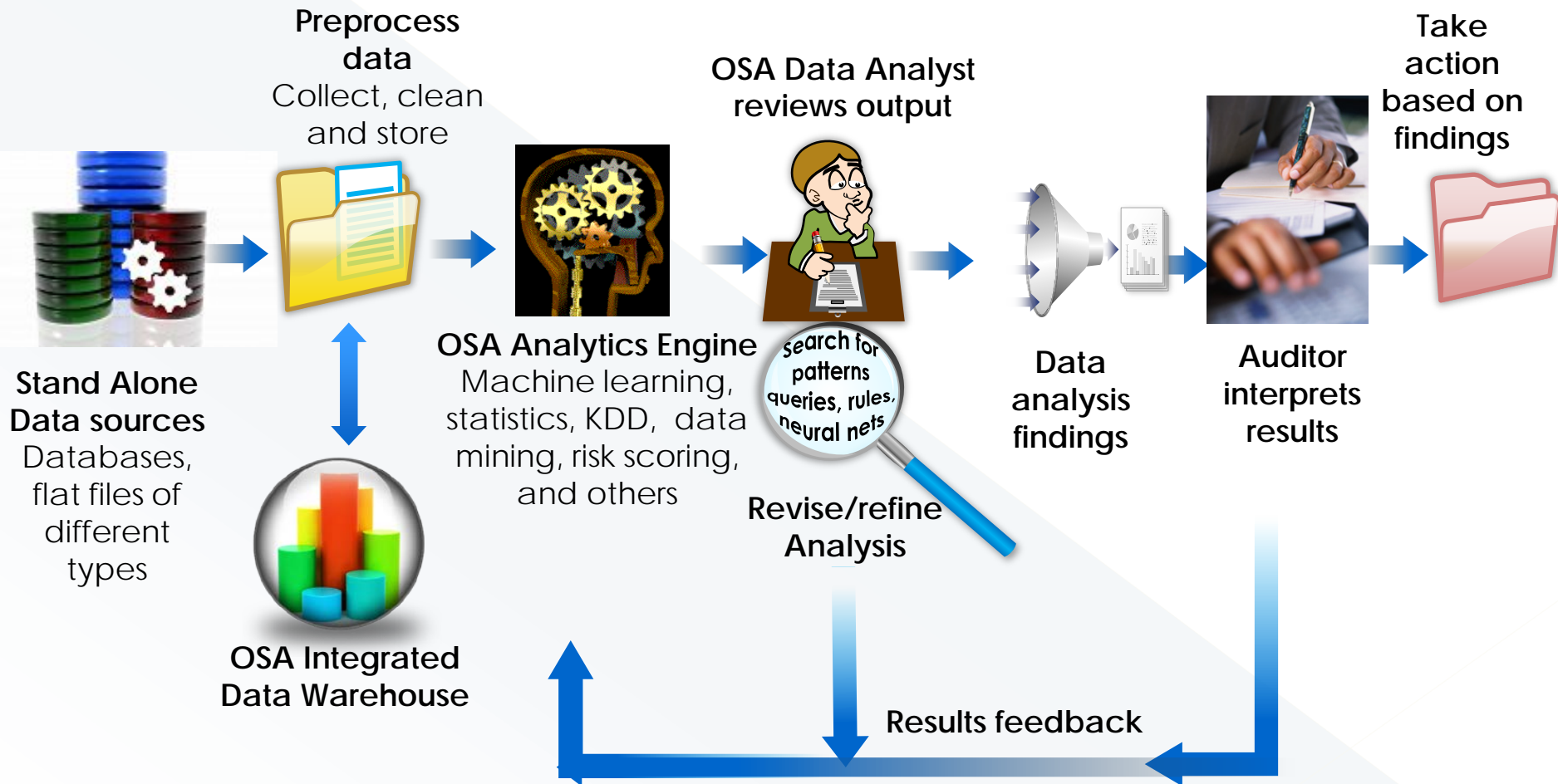


Hire and Train
Team



Data Warehouse and Data Analytics Software

Audit Data Analytics Process



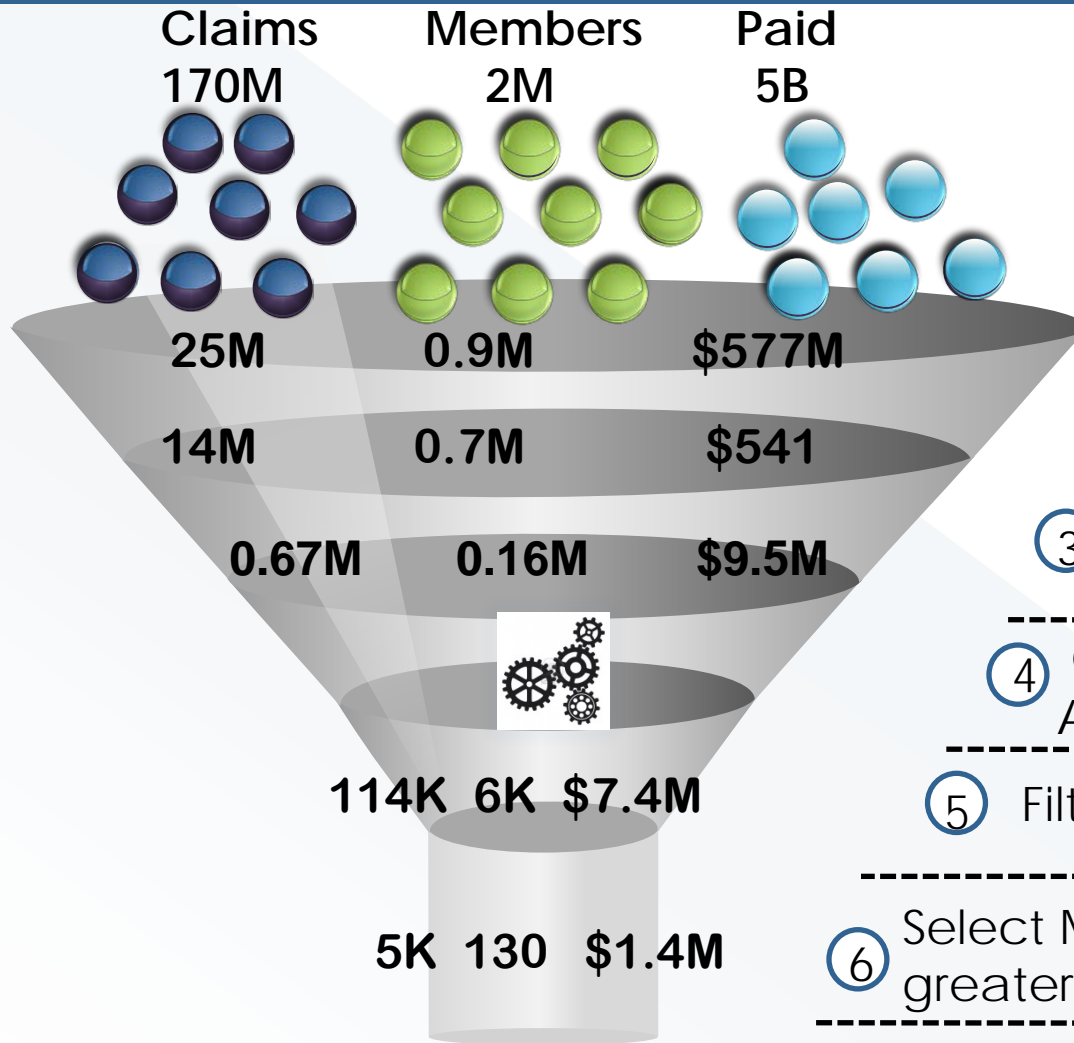
Audit Risk Matrix

FINANCIAL OR SYSTEMIC RISK LEVEL

	Marginal	Minor	Moderate	Major	Severe
Almost Certain	MEDIUM	HIGH	HIGH	CRITICAL	CRITICAL
Likely	MEDIUM	MEDIUM	HIGH	HIGH	CRITICAL
Possible	LOW	MEDIUM	MEDIUM	HIGH	CRITICAL
Unlikely	LOW	MEDIUM	MEDIUM	MEDIUM	HIGH
Rare	LOW	LOW	MEDIUM	MEDIUM	HIGH

EVENT LIKELIHOOD

Pharmacy Claims Example



① Filter for year 2012

② Get Paid Claims

③ Filter Narcotics

④ Calculate Risk Score with Analytics Engine

⑤ Filter Paid > \$250/Year

⑥ Select Members with Risk Score greater than 25

OSA Analytics Engine



Commonwealth of Massachusetts
Office of the State Auditor
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OSA DATA ANALYTICS ENGINE



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Paul Albano, Director
Medicaid and Health Care Audits

Data Analytics and Proactive Fraud Identification

MassHealth Program

- Is the Massachusetts Medicaid Program
- \$11 to \$12 Billion in Annual Paid Claims
 - › 1/3 of the Commonwealth's budget
- 1.3 million members
 - › 20% of the Commonwealth's population
- 70 Health Care Programs
 - › In-Patient Hospital Care to Nurse Mid Wives
- 112,952 Contracted Service Providers

OSA's Medicaid Audit Unit

- ◉ Dedicated to Auditing MassHealth Programs and Service Providers
- ◉ \$800,000 Annual Budget
- ◉ 10 members
- ◉ 4 audit teams

Current Audit Approach

Two Pronged Approach To MassHealth Audits:

- ◉ Data Analytics Utilizing Business Rules
- ◉ Data Analytics Combined With Professional Skepticism

Current Audit Approach

Service Provider Selection Process:

- ◉ Download **all** paid claims for selected areas
- ◉ Analyze claims data for **Red Flags** such as:
 - duplicate payments
 - unusual dollar volume
 - unusual service levels
 - pricing variations

Current process targets high risk providers and potential audit issues



Current Audit Approach

Conducting the Audit:

- ◎ Focus on validating **Red Flags**
- ◎ Target specific member files and claims for review
- ◎ Ask pointed questions
- ◎ Seek out underlying causes

Focused approach reduces field work time and increases efficiency and effectiveness



Current Audit Approach

Business Rules For Data Analytics:

- ⦿ Program Laws, Rules, and Regulations
 - Establish Frequency Limits
 - Establish Pricing/ Limit Payment
 - Establish Age Restrictions
 - Detail Unallowable Services
 - Establish Prior Authorization Requirements

Current Audit Approach

Examples of Program Rules & Regulations:

Frequency of services:

- (2) check-ups per year

Pricing Restrictions:

- Payments based upon current pricing schedules

Age Restrictions

- Orthodontics for members over (20) years of age prohibited

Current Audit Approach

Examples of Rules and Regulations

Unallowable Services

- Photographic images unless prior authorization obtained

Unallowable Payments

- Duplicate payments

Example of Audit Finding

- ◎ Dental Regulations Allow Periapical X-rays, if
 - › Extraction is anticipated
 - › Infection present
 - › Dental anomaly suspected
- ◎ Audit Finding
 - › (10) dental providers
 - › 361,673 periapical X-rays
 - › \$ 5 million in unallowable payments
 - › X-rays as part of routine preventive dental care

Member Age	Date of	Procedure	Procedure Code Description	Amount Paid
7	20060413	D0150	COMPREHENSIVE ORAL EVALUATION (UNDER 21 ONLY)	\$42.00
7	20060413	D0220	INTRAORAL - PERIAPICAL - FIRST FILM	\$16.00
7	20060413	D0230	INTRAORAL - PERIAPICAL - EACH ADDITIONAL FILM	\$14.00
7	20060413	D0272	BITEWINGS TWO FILMS	\$24.00
7	20060413	D0330	PANORAMIC FILM	\$70.00
7	20060413	D1120	PROPHYLAXIS - CHILD (UP TO AGE 14)	\$40.00
7	20060413	D1203	TOPICAL APPLICATION FLUORIDE(PROPHY NOT INCL)CHILD	\$21.00
8	20061026	D0120	PERIODIC ORAL EXAMINATION	\$26.00
8	20061026	D0220	INTRAORAL - PERIAPICAL - FIRST FILM	\$18.00
8	20061026	D0230	INTRAORAL - PERIAPICAL - EACH ADDITIONAL FILM	\$15.00
8	20061026	D0272	BITEWINGS TWO FILMS	\$27.00
8	20061026	D1120	PROPHYLAXIS - CHILD (UP TO AGE 14)	\$45.00
8	20061026	D1203	TOPICAL APPLICATION FLUORIDE(PROPHY NOT INCL)CHILD	\$24.00
9	20070516	D0120	PERIODIC ORAL EXAMINATION	\$26.00
9	20070516	D0220	INTRAORAL - PERIAPICAL - FIRST FILM	\$18.00
9	20070516	D0230	INTRAORAL - PERIAPICAL - EACH ADDITIONAL FILM	\$15.00
9	20070516	D0272	BITEWINGS TWO FILMS	\$27.00
9	20070516	D1120	PROPHYLAXIS - CHILD (UP TO AGE 14)	\$45.00
9	20070516	D1203	TOPICAL APPLICATION FLUORIDE(PROPHY NOT INCL)CHILD	\$24.00
9	20070531	D8660	PRE-ORTHODONTIC VISIT	\$31.00
9	20071204	D0120	PERIODIC ORAL EXAMINATION	\$27.00
9	20071204	D0220	INTRAORAL - PERIAPICAL - FIRST FILM	\$19.00
9	20071204	D0272	BITEWINGS TWO FILMS	\$28.00
9	20071204	D1120	PROPHYLAXIS - CHILD (UP TO AGE 14)	\$47.00
9	20071204	D1203	TOPICAL APPLICATION FLUORIDE(PROPHY NOT INCL)CHILD	\$24.00
9	20080505	D8660	PRE-ORTHODONTIC VISIT	\$31.00
10	20080716	D0120	PERIODIC ORAL EXAMINATION	\$27.00
10	20080716	D0220	INTRAORAL - PERIAPICAL - FIRST FILM	\$19.00
10	20080716	D0230	INTRAORAL - PERIAPICAL - EACH ADDITIONAL FILM	\$15.00
10	20080716	D0272	BITEWINGS TWO FILMS	\$28.00
10	20080716	D1120	PROPHYLAXIS - CHILD (UP TO AGE 14)	\$47.00
10	20080716	D1203	TOPICAL APPLICATION FLUORIDE(PROPHY NOT INCL)CHILD	\$24.00
10	20090119	D0120	PERIODIC ORAL EXAMINATION	\$29.00
10	20090119	D0220	INTRAORAL - PERIAPICAL - FIRST FILM	\$20.00
10	20090119	D0230	INTRAORAL - PERIAPICAL - EACH ADDITIONAL FILM	\$16.00

Fraud Detected During Audit Field Work

- › Orthodontists billed separately for Oral Facial Images (Photographs), contrary to regulations
- › Auditors initially believed simple billing error
- › Field work found that 41% of claims unsubstantiated
- › Member dental records did not contain actual photographs.
- › Case referred to state Attorney General
- › Settlement included full cost recovery, expulsion from MassHealth, Dental Program and possible loss of licenses

Current Audit Approach

Data Analytics Combined with Professional Skepticism:

- ◉ Data Analytics Identify Unusual Patterns, Trends, and Anomalies in Claims Data
- ◉ Not directly prohibited by regulations
- ◉ Professional skepticism raises concerns over:
 - High Dollar Volume and/or Units of Service
 - Frequent Testing (every day testing)
 - Mapping Issues (residency vs. service location)
 - Unbundling of Services (billing for component parts)
- ◉ Requires Input From Outside Medical Experts
- ◉ Lead to Significant Recommendations and Recoveries

Example of Program Findings

Drug Testing Program

- ◎ \$7.8 Million: Excessive testing
- ◎ \$7.0 Million: Unnecessary testing
- ◎ \$4.5 Million: Unbundled services
- ◎ \$1.3 Million: Unallowable testing
- ◎ \$422,000: Duplicate payments

\$21.022 Million Total

Excessive Drug Testing

Date of Service	Procedure Code	# of Paid Claims	# of Units Billed	Billed Amount	Paid Amount
7/2/2008	80101	1	11	\$297.00	\$149.71
7/3/2008	80101	1	11	\$297.00	\$149.71
7/7/2008	80101	1	11	\$297.00	\$149.71
7/9/2008	80101	1	11	\$297.00	\$149.71
7/11/2008	80101	1	11	\$297.00	\$149.71
7/14/2008	80101	1	11	\$297.00	\$149.71
7/16/2008	80101	1	11	\$297.00	\$149.71
7/18/2008	80101	1	11	\$297.00	\$149.71
7/21/2008	80101	1	11	\$297.00	\$149.71
7/23/2008	80101	1	11	\$297.00	\$149.71
7/25/2008	80101	1	11	\$297.00	\$149.71
7/28/2008	80101	1	11	\$297.00	\$149.71
7/30/2008	80101	1	11	\$297.00	\$149.71
8/1/2008	80101	1	11	\$297.00	\$149.71
8/4/2008	80101	1	11	\$297.00	\$149.71
8/6/2008	80101	1	11	\$297.00	\$149.71
8/7/2008	80101	1	11	\$297.00	\$149.71
8/11/2008	80101	1	11	\$297.00	\$149.71
8/13/2008	80101	1	11	\$297.00	\$149.71
8/15/2008	80101	1	11	\$297.00	\$149.71
8/18/2008	80101	1	11	\$297.00	\$149.71
8/20/2008	80101	1	11	\$297.00	\$149.71
8/22/2008	80101	1	11	\$297.00	\$149.71
8/25/2008	80101	1	11	\$297.00	\$149.71

Unbundling of Drug Testing

Date of Service	Procedure Code and Description	Units Billed	Amount Billed	Amount Paid
12/22/2010	80101 Drug, screen; single drug class	4	\$120.00	\$38.32
12/22/2010	80154 Benzodiazepines	1	30.00	19.29
12/22/2010	82055 Alcohol (ethanol), blood; chemical	1	30.00	11.28
12/22/2010	82145 Amphetamine or methamphetamine	1	30.00	16.22
12/22/2010	82205 Barbiturates; quantitative	1	30.00	11.95
12/22/2010	82520 Cocaine, quantitative	1	30.00	15.81
12/22/2010	83840 Methadone	1	30.00	17.03
12/22/2010	83925 Opiates (e.g., morphine, meperidine)	1	30.00	20.30
12/22/2010	83992 Phencyclidine (PCP)	1	30.00	15.34
Total		12		\$165.54
Allowed	80101 Drug, screen; single drug class	8		<u>76.64</u>
Overbilling				\$88.90

Current Audit Approach

Audit Results and Recommendations:

- ⦿ Greater financial impact
- ⦿ Recommend program changes to reflect “best practices”
- ⦿ Recommend system edits to identify and deny unallowable claims
- ⦿ Refer potential instances of fraud to investigators and prosecutors



Audit Collaboration

Auditors Identified Major Issues (Dr. Dental)

- ◉ Unallowable detailed oral screenings
- ◉ High number of emergency visits
- ◉ Excessive fluoride treatments
- ◉ Unallowable tooth restorations
- ◉ Unallowable case management
- ◉ Questionable denture implants and x-rays



Audit Collaboration

Dr. Dental

- ◉ Refused auditors access to member records
- ◉ Cited HIPAA
- ◉ Questioned Auditor's Legal Authority
- ◉ Engaged legal representation



Audit Collaboration

- ⦿ Successfully litigated case in state court
- ⦿ Provider required to provide member files
- ⦿ File review identified suspected fraud involving the provider's relatives
 - › Sample of 40 files included 6 relatives
 - › Relatives received highest level of questionable services
 - › Lived together in exclusive Boston suburb

Audit Collaboration

Bureau of Special Investigations (BSI)

- ◎ Yellow Book suggests working with investigators on potential fraud cases
- ◎ Audit operations, BSI, Legal staff collaborated
- ◎ Audit suspended
- ◎ Dr. Dental case turned over to BSI



Effectiveness Improves With Collaboration



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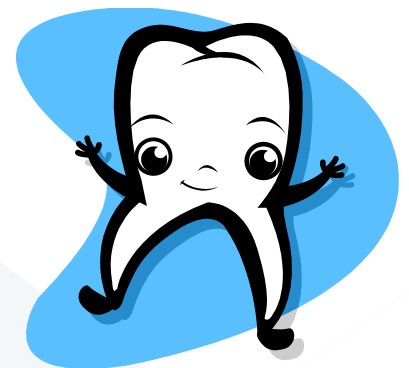


Allie Alland, Director
Bureau of Special Investigations

Data Analytics and Proactive Fraud Identification

Data Analytics Driven Investigation

- Targeted investigation was derived from OSA's dental audit with a focus on Dr. Dental
- BSI expanded time frame from Audit's sample
 - Audit scope:
 - January 2008 - December 2010
 - BSI scope:
 - January 2006 - December 2012



Dr. Dental's Story

◎ Background

- › Married
 - Husband is also a Doctor
- › 2 Kids
- › Living in exclusive Boston suburb
 - Huge Estate
 - Numerous family members living with her



Dr. Dental Data Analysis Approach

1. Dental procedure codes
2. Dr. Dental and peer dental providers
3. Bank records
4. Individual patients
5. Tax analysis
6. Provider service and childbirth
7. Geographic analysis
8. Other toothaches

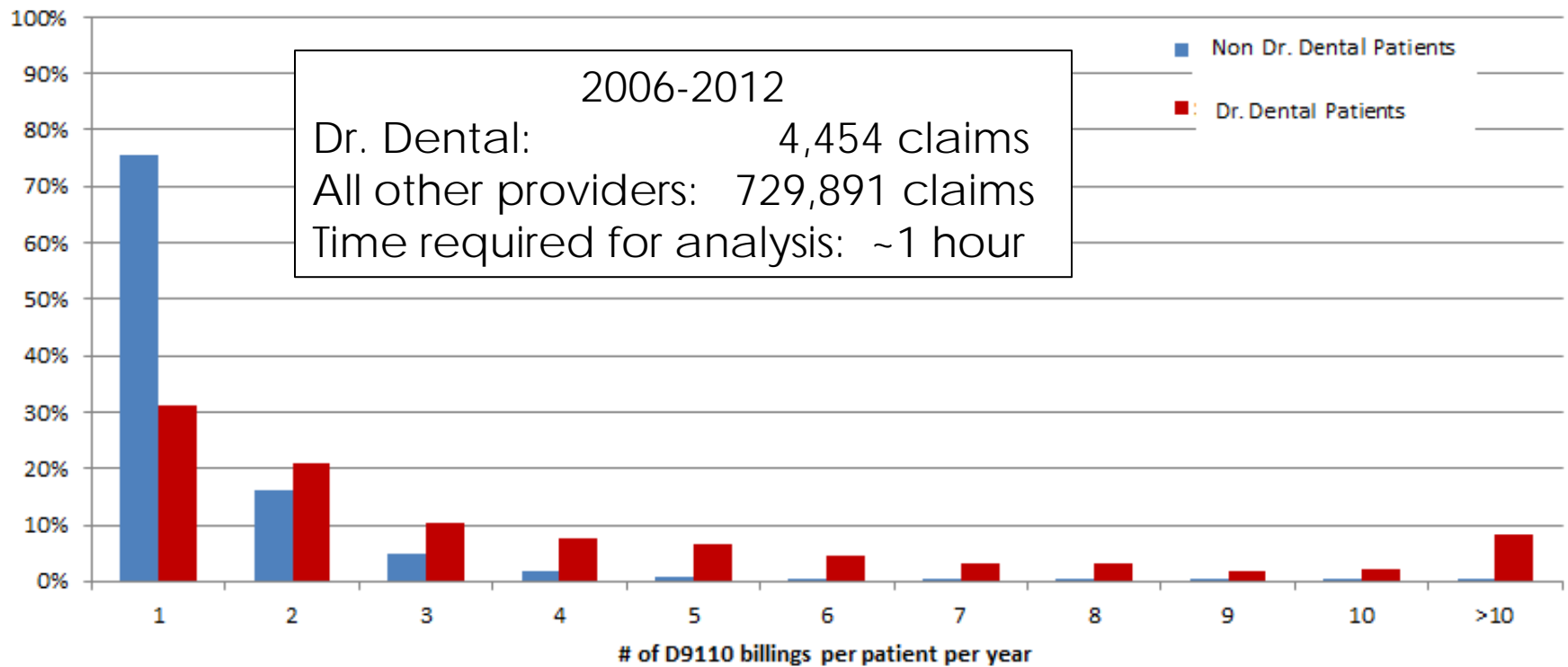
Dental Codes – D9110 & D0160

- Observation: Within the audit sample, many of Dr. Dental's patients received frequent D9110 (emergency palliative treatment of dental pain) and D0160 (detailed oral evaluations for chemotherapy, transplant, amputation patients) services
- Investigation goal: Determine whether frequency of 2 specific codes was common for all MassHealth patients or only Dr. Dental's
- Data analytical steps: BSI queried claims data for all MassHealth patients who received D0160 and D9110 services from January 1, 2006, through December 31, 2012 and separated Dr. Dental's from all other MassHealth providers for comparison
- Determination: Following graph analysis shows that Dr. Dental's patients received significantly more frequent D9110 and D0160 treatments than other MassHealth members who received those treatments

Code D9110- (Emergency Palliative Treatment)

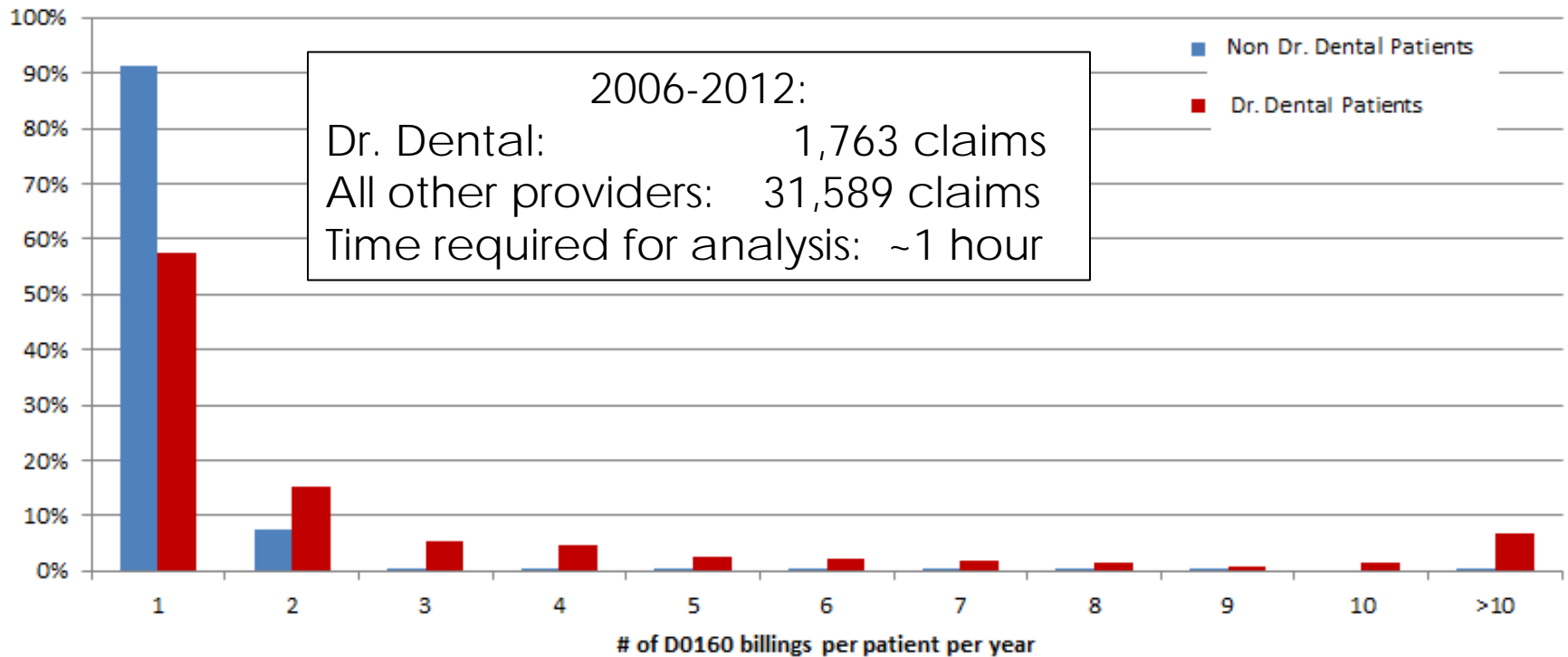
Comparison of Dr. Dental Patients and All Other Patients

(Patients who received at least one D9110 treatment)



Code D0160- (Detailed Evaluations for Chemotherapy, Transplant, Amputation Patients)

Comparison of Dr. Dental Patients and All Other Patients (Patients who received at least one D0160 treatment)



Dental Provider Comparisons

- ◎ Using what was learned from this billing pattern, the MassHealth claims database was queried for other dental codes during the 7 year time frame
 - › Two dentists emerged as billing for a high number of D5520 (replacement of missing or broken teeth) claims per patient
 - › A single dental practitioner submitted more claims than both Boston University School of Dental Medicine and Tufts Dental Clinic
- ◎ While this analysis did not directly benefit the Dr. Dental investigation, it provides the basis for future investigations of additional dental providers

Following the Money



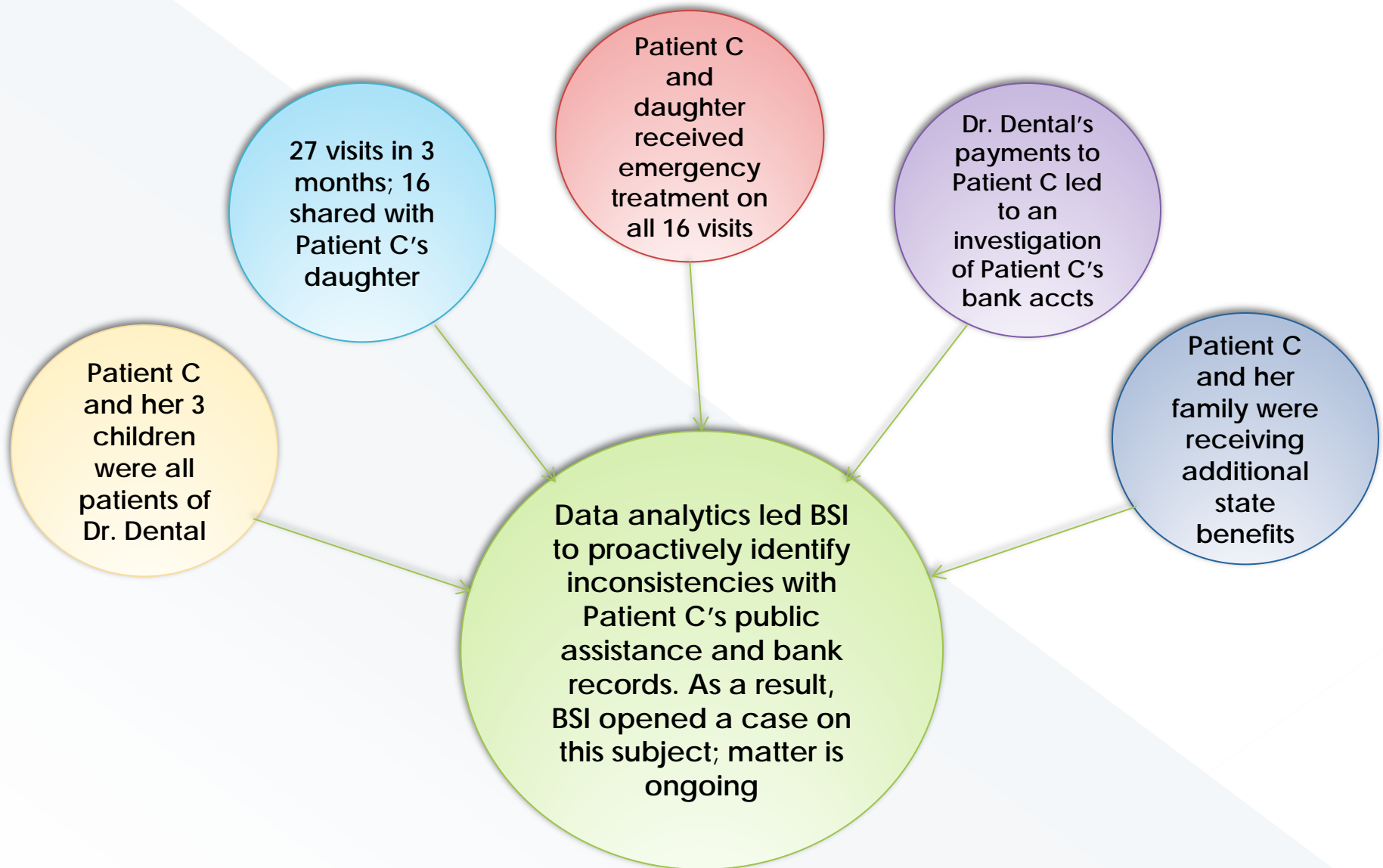
- Dr. Dental's bank records show transactions between Dr. Dental and her patients
- Analysis showed checks to 5 of her patients, Patient C received **\$3,743.38 in 3 years**

Date:	Check Number:	Amount:	Made Payable To:	Dr. Dental Claims Near Date:
12/7/2007	1056	\$ 141.75	Patient C	No Dr. Dental Claims Near Check Date
12/14/2007	1063	\$ 150.00	Patient C	No Dr. Dental Claims Near Check Date
12/21/2007	1066	\$ 140.40	Patient C	No Dr. Dental Claims Near Check Date
1/16/2008	1081	\$ 316.80	Patient C	No Dr. Dental Claims Near Check Date
2/15/2008	1092	\$ 105.00	Patient C	4 Claims on 2/19/2008, Paid Amount \$186.00
2/28/2008	1104	\$ 80.70	Patient C	4 Claims on 2/19/2008, Paid Amount \$186.00
3/12/2008	1111	\$ 351.43	Patient C	No Dr. Dental Claims Near Check Date
3/27/2008	1117	\$ 275.55	Patient C	No Dr. Dental Claims Near Check Date
4/11/2008	1137	\$ 243.90	Patient C	No Dr. Dental Claims Near Check Date
4/23/2008	1150	\$ 320.25	Patient C	No Dr. Dental Claims Near Check Date
5/8/2008	1155	\$ 137.40	Patient C	No Dr. Dental Claims Near Check Date
5/21/2008	1166	\$ 233.40	Patient C	1 Claim on 5/14/2008, Paid Amount \$132.00
6/5/2008	1169	\$ 248.85	Patient C	No Dr. Dental Claims Near Check Date
6/20/2008	1177	\$ 201.45	Patient C	No Dr. Dental Claims Near Check Date
9/18/2009	1404	\$ 75.00	Patient C	68 Claims between 9/10/2009 and 9/17/2009, Paid Amount \$6,996
11/5/2009	1427	\$ 136.80	Patient C	26 Claims between 11/2/2009 - 11/19/2009, Paid Amount \$2,018.58
11/16/2009	1428	\$ 273.60	Patient C	26 Claims between 11/2/2009 - 11/19/2009, Paid Amount \$2,018.58
				2 Claims on 11/16/2009 , Paid Amount \$93.00
1/27/2010	1550	\$ 274.95	Patient C	34 Claims between 1/18/2010 - 1/25/2010, Paid Amount \$7,863.00
2/21/2011	1597	\$ 36.45	Patient C	3 Claims on 2/21/2011 , Paid Amount \$114.00
	Total:	\$ 3,743.38		



Checks made payable to a patient from a dental provider

Analysis and Progression of Patient C

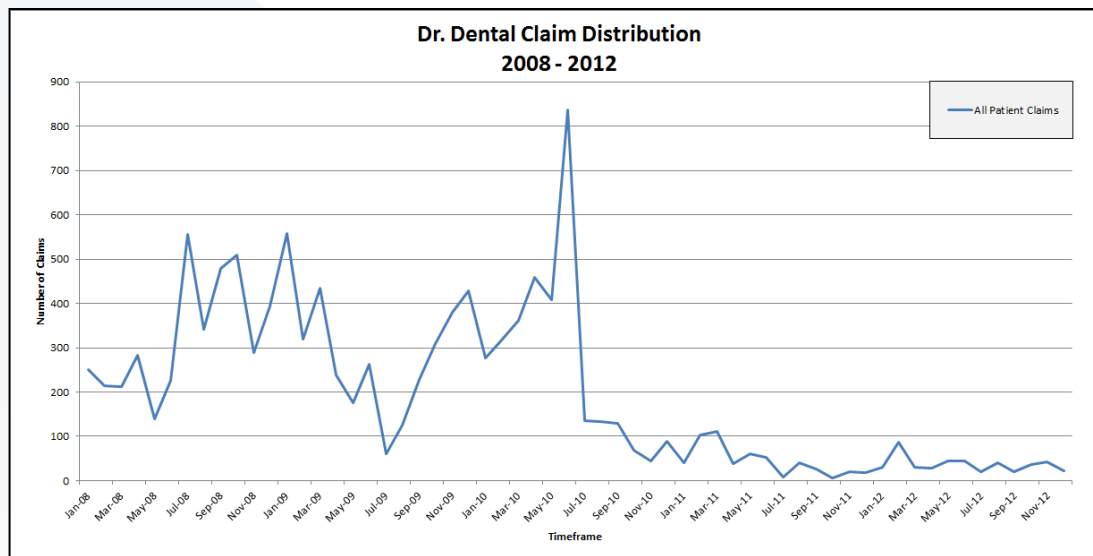


Select lines from Personal Income Tax Returns

	<u>2008</u>	<u>QC</u>	<u>2009</u>	<u>QC</u>	<u>2010</u>	<u>QC</u>	<u>2011</u>	<u>QC</u>
Wages	238,100.00	✓	443,850.00	✓	402,500.00	✓	293,926.00	✓
Total income	\$ 222,563.00		\$ 315,773.00		\$ 365,284.00		\$ 237,790.00	
Total taxable income	177,226.00		275,831.00		322,970.00		209,790.00	
<u>Break out of wages</u>								
Husband Wages Job #1	177,000.00		188,500.04		217,500.02		182,051.00	
Husband Wages Job #2			45,350.00		37,000.00		13,000.00	
Dr. Dental Wages	61,100.00		210,000.00		148,000.00		52,000.00	
							46,875.00	
<i>Subtotal</i>	<i>238,100.00</i>	✓	<i>443,850.04</i>	✓	<i>402,500.02</i>	✓	<i>293,926.00</i>	✓
Dependents	Mother		Mother		Mother		Mother	
	Father in law		Father in law		Father in law		Father in law	
	Mother in law		Mother in law		Mother in law		Mother in law	
	Son #1		Son #1		Son #1		Son #1	
			Son #2		Son #2		Son #2	
			Brother		Brother		Brother	
			Sister		Sister		Sister	
			Niece		Niece		Niece	

Take Aways from Tax Analysis

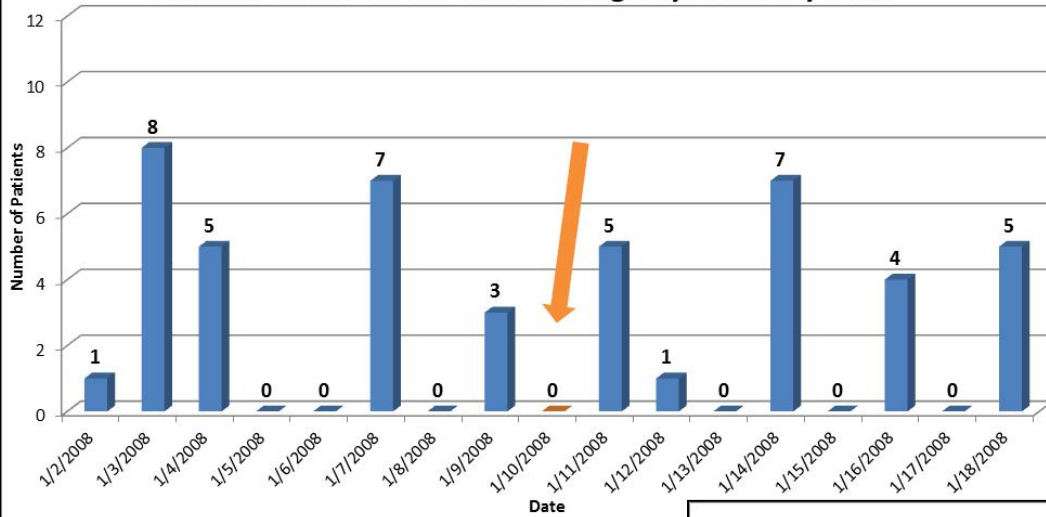
- Dr. Dental's practice suffered a significant income decrease from 2010 to 2011 (approx. 35%). This corresponds with provider's decrease in claims



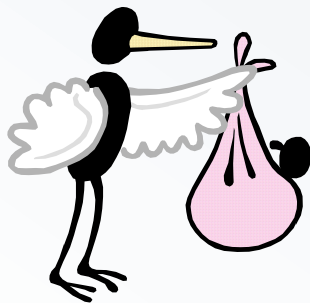
- Dr. Dental's husband was paid by her company (Husband's Job #2)
- Dr. Dental owns dental practice (reports income loss on corporate tax returns)
- Dr. Dental claimed family members as dependents, 2 of which were her sons

Childbirth and Treatment on Surrounding Days

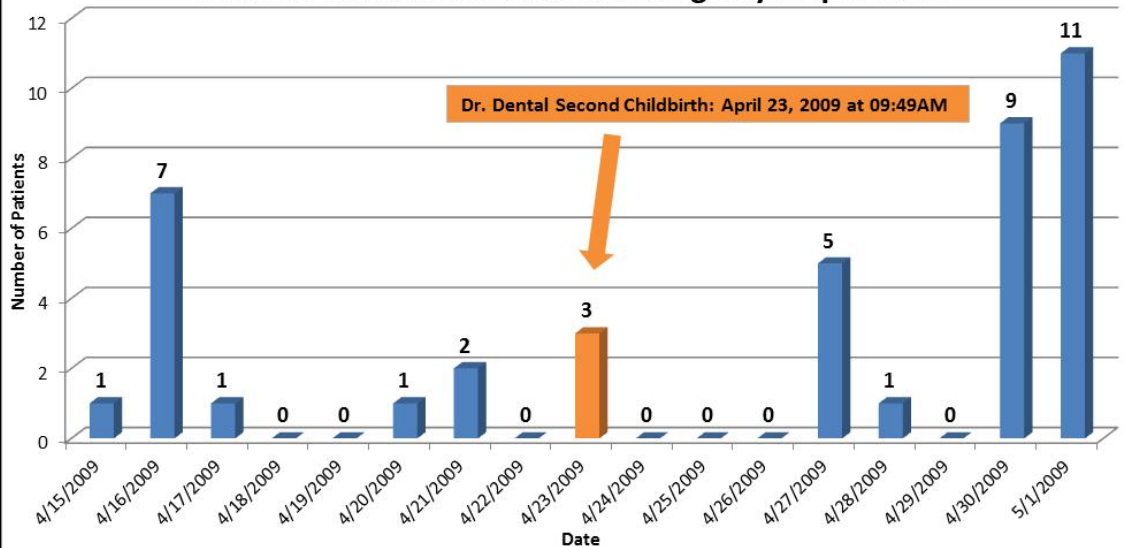
Dr. Dental First Childbirth and the Number of MassHealth Patients Treated in the Surrounding Days: January 2008



Claims data indicates treatment performed by Dr. Dental on the days surrounding childbirth



Dr. Dental Second Childbirth and the Number of MassHealth Patients Treated in the Surrounding Days: April 2009



Treatment Provided to People Not in the United States

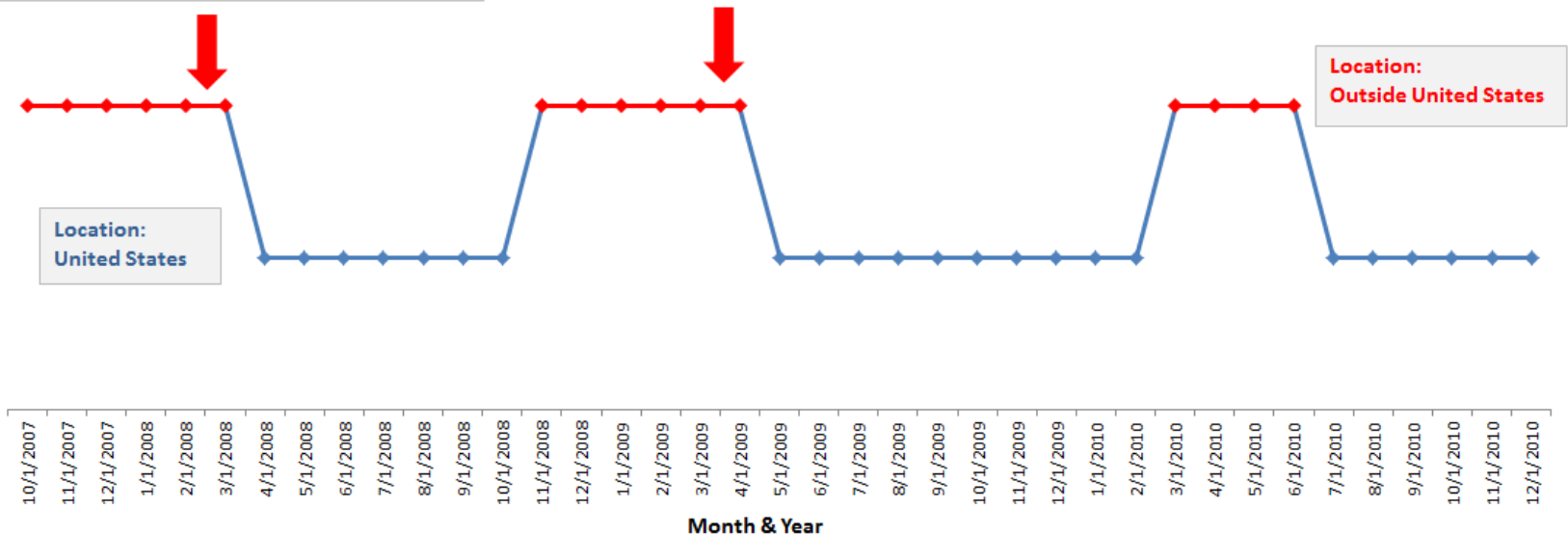
Immigration Status and Dental Treatment by Dr. Dental Patient B, October 2007 - December 2010 U.S Department of Homeland Security Verified

03/26/2008: Patient B treated by Dr. Dental.
Verified to be out of the United States

Procedure Code and Description	Paid Amount
D0120 - PERIODIC ORAL EXAMINATION	\$20.00
D0274 - BITEWINGS- FOUR FILMS	\$33.00
D1110 - PROPHYLAXIS - ADULT (OVER AGE 14)	\$49.00
D9110 - PALLIATIVE (EMERGENCY) TREATMENT	\$33.00

03/25/2009: Patient B treated by Dr. Dental.
Verified to be out of the United States

Procedure Code and Description	Paid Amount
D0160 - DETAILED EXTEN ORAL EVAL	\$60.00
D9110 - PALLIATIVE (EMERGENCY) TREATMENT	\$33.00



Immigration status verified with the Department of Homeland Security

Other Toothaches

- ⦿ Compared claims history to MassHealth death records.
- ⦿ Queried husband's patients vs. Dr. Dental's patients to identify possible overlap of patient population
- ⦿ Reviewed MassHealth pharmaceutical claims to identify the amount of Dr. Dental's narcotics prescriptions
- ⦿ Data analysis on denied claims to identify irregular billing practices

Deceased Patients Analysis

- ⦿ Compared Dr. Dental's patients to the MassHealth Death Records
 - › She treated 745 patients during 7 year period
 - › 6 of those patients died during that time
- ⦿ Dr. Dental did not submit claims for the six patients after they died.

Husband's Practice Analysis

- ◎ Dr. Dental had 745 patients
- ◎ Her husband had 1032 patients
- ◎ Only two patients were seen by both:
 - > \$203.88 in medical claims (husband).
 - > \$1717.00 in dental claims (Dr. Dental).
- ◎ Patient M and Patient W never received services at the same time from Dr. Dental and her husband.

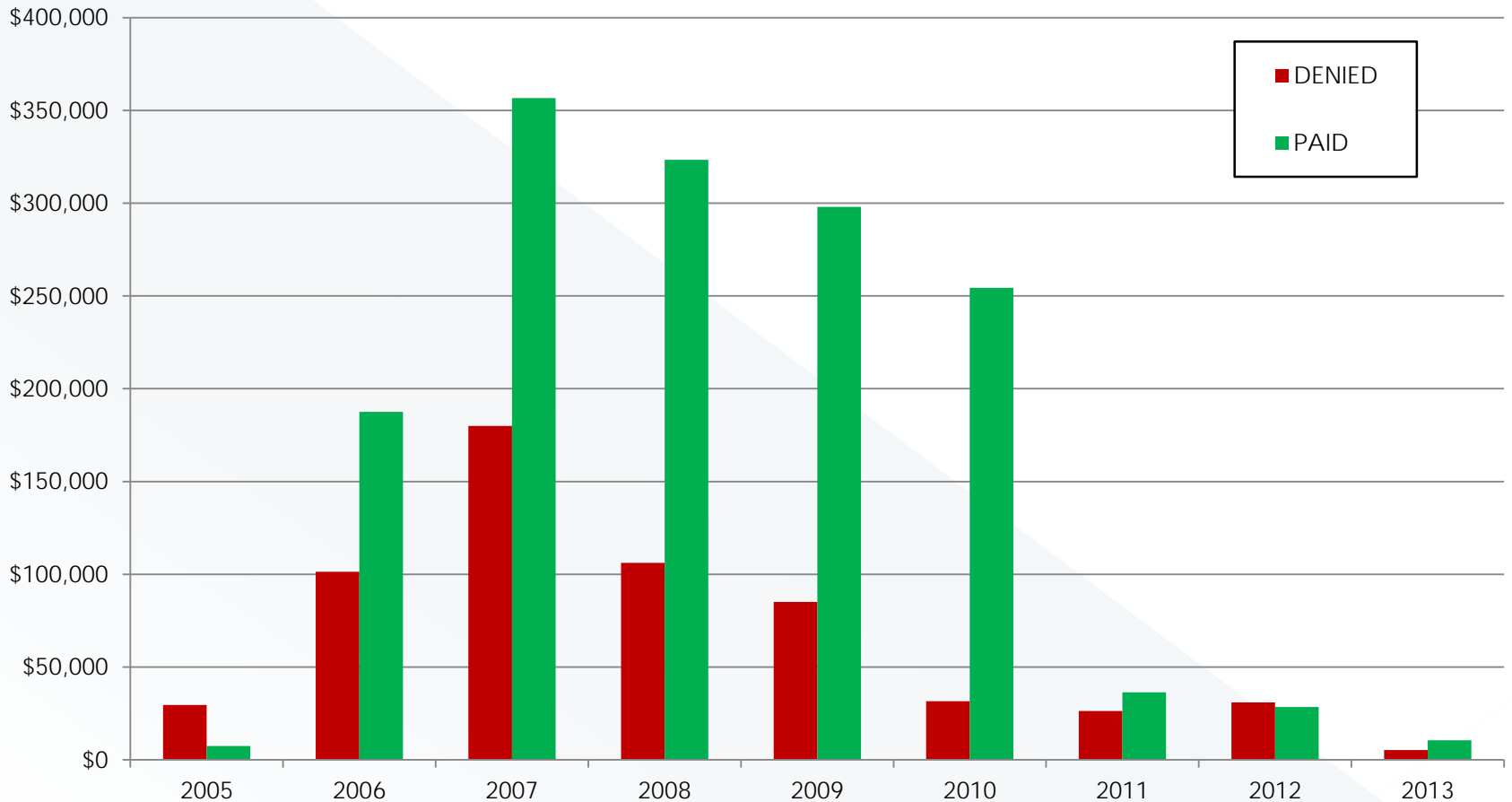


Prescription Narcotics Analysis

- Reviewed 5 years of narcotics prescriptions written by Dr. Dental.
 - › 15 claims
 - › 14 different MassHealth patients
 - › MassHealth paid \$51.03 total



Paid vs. Denied Claims Analysis



BSI Findings: Dr. Dental

213 out of 387 member patients (55%) received cancer screenings

Description	Amount
Fraudulent claim for Cancer Screenings (D0160) and Emergency Visits (D9110).	\$191,773
Dr. Dental provided 16 claims on or immediately after the birth of her children.	\$909
Six claims for family members when they were confirmed to be out of the country.	\$228
Unbundling of services, individual tooth replacement (D5520) vs. denture replacements(D5110/D55120).	\$18,144
Fluoride treatments provided, 45 to 1 patient in 15 months.	\$1,170
Total Value of Fraudulently Identified Claims:	\$212,224



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Paul McLaughlin, Director
Information Technology

Data Analytics at the OSA Present and Future

The Broad Toolset of Analytics

- ◉ Data analytics allows the OSA to employ a range of new and expanded strategies
- ◉ Paul and Allie discussed two very different strategies of using data analytics
- ◉ Telescopic and microscopic

Telescopic Use

- Paul focused the tools on the universe of dentists and identified those behaving in a suspicious manner. Then by adjusting and refining the queries narrowed the focus to a single provider.



Microscopic Use

- ◎ Allie's example took the tool and focused it on a single individual ,and with the use of analytic tools and additional data sources, expanded the case to include other behaviors, acts and people



Some Definitions

- ◎ Over time the OSA has developed specific meaning for some common terms, they are:
 - > Data Analytics Engine
 - > Analysis
 - > Analytics
 - > Clustering
 - > Fuzzy Logic
 - > Visualization

Data Analytics Engine

- ⦿ A collection of tools and equipment that collectively promote the use of statistical analysis, machine learning, data discovery techniques in databases, and feedback from Audit and BSI's interpretation of the data to produce analytics, visualizations and a risk score for the data

Analysis

- ⦿ Large blocks of data manipulated and presented in a manner that facilitates analysis by an auditor or investigator
- ⦿ Historically auditors have used applications like Excel, MS Access and ACL in their analysis
- ⦿ These are fine tools and still play a very important role in our data analysis

Analytics Process

- ◉ Using machine driven business rules and algorithms to analyze extremely large data sources
- ◉ Identify and group specific individuals, behaviors, or transactions within the data
- ◉ Apply additional tests, business rules, and algorithms to those clusters
- ◉ Identify sub-clusters which are deemed to represent the riskiest events or behaviors
- ◉ Provide this post-analytic data to the auditor or investigator for analysis

What is Clustering

- ⦿ Clustering is the process of identifying and placing relevant objects into a group.
- ⦿ Analytics allows relationships between variables, that are not immediately evident, to be identified, correlated and placed into the appropriate cluster.

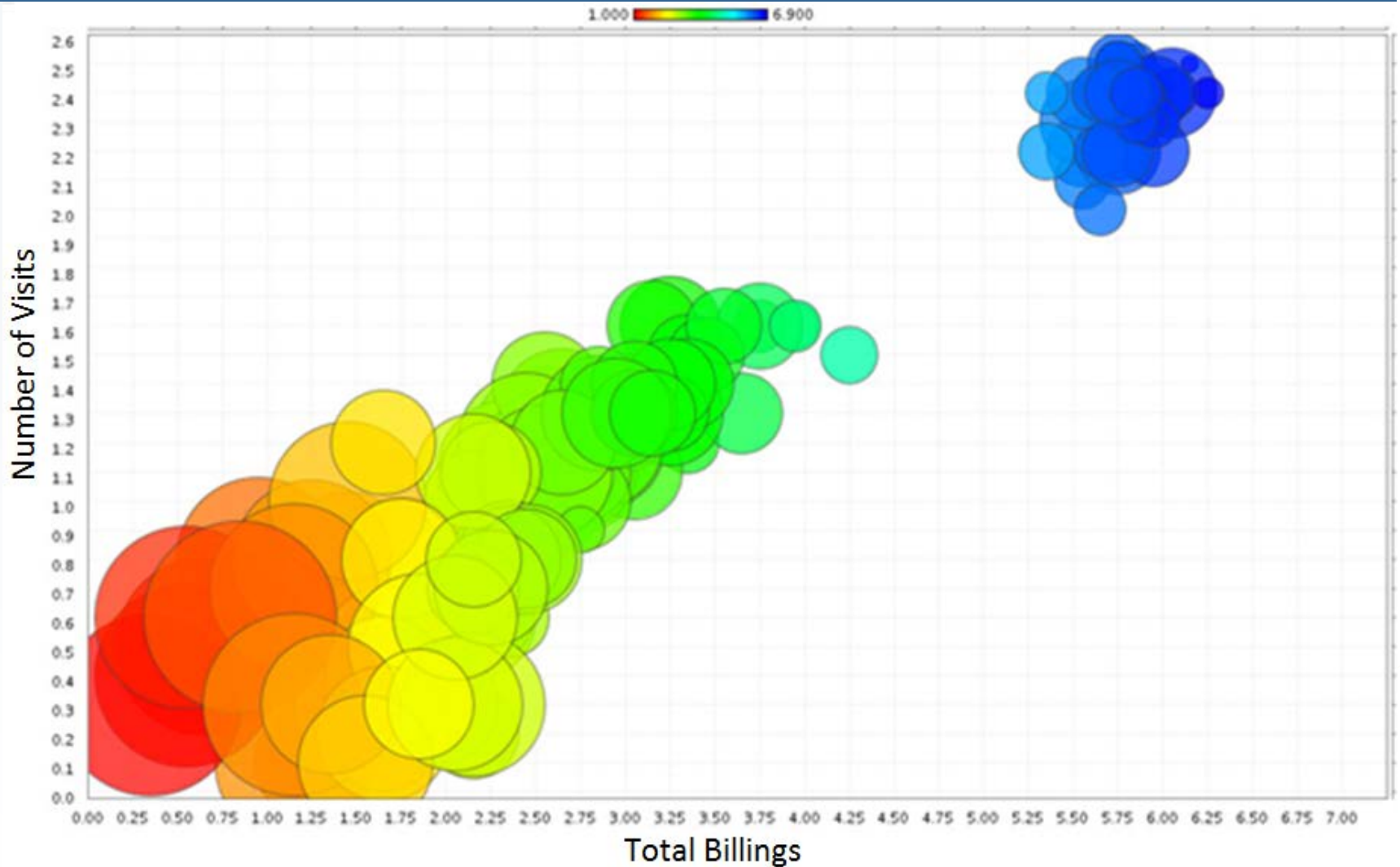
Fuzzy Logic

- ◎ Logic based on the concept of fuzzy (“close enough”) sets, in which membership is expressed in varying probabilities or degrees of truth, for example:
 - › McLaughlin, MacLoughlin, MacLaughlin
 - › XXX-83-XXXX, XXX-38-XXXX
 - › 45 Main St., 54 Main St.
 - › 12-13-1979, 12-13-1997, 12-31-1979, 12-31-1997

Visualization

- ◎ Visualization captures and displays clusters of
 - › Transactions
 - › Individuals
 - › Entities
 - › Metrics (e.g. distances from the mean)
- ◎ The combination of data identification, matching, and clustering presents information in a manner that enhances the identification of relationships between transactions, individuals and behaviors.

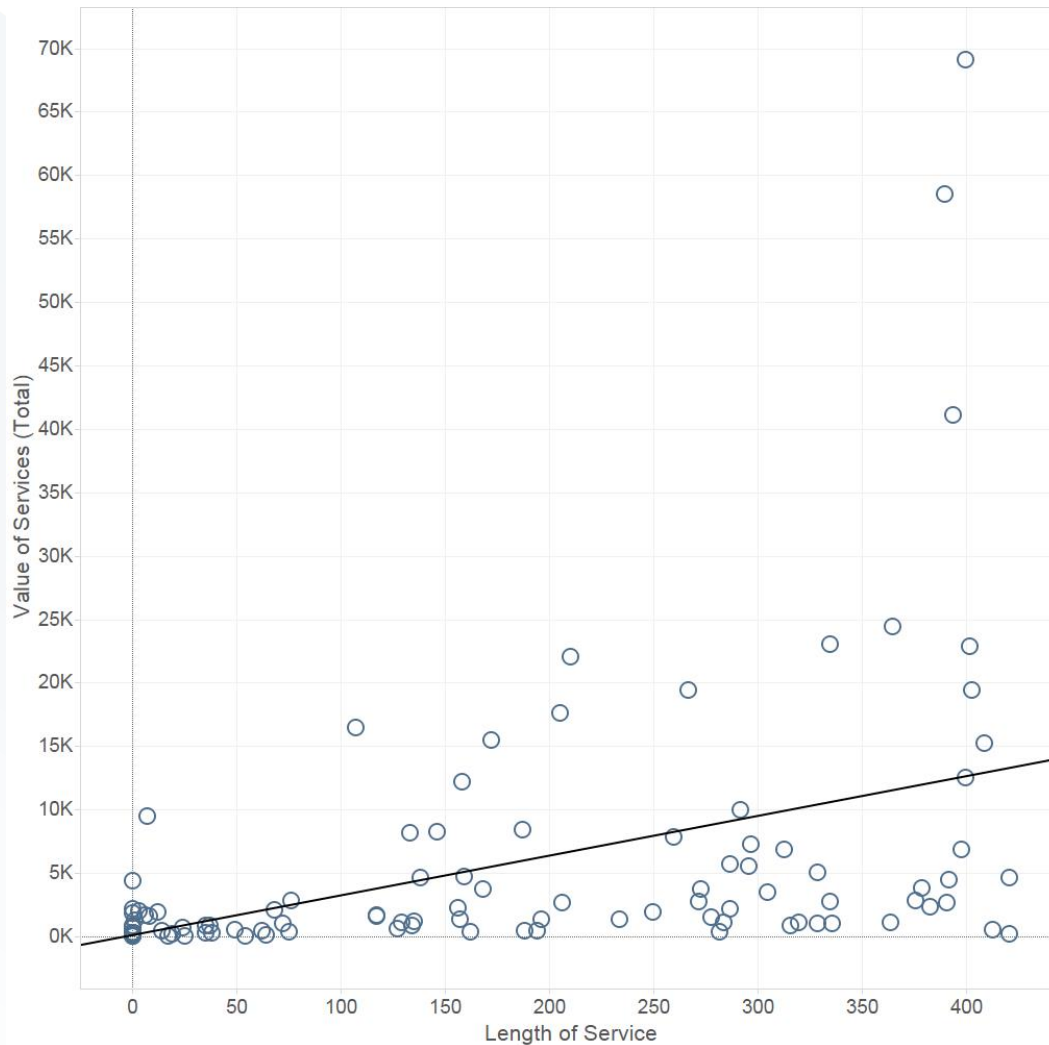
Sample Visualization of Groupings



Proof-of-Concept 1 Dataset

	A	B	C	D	E	F	G	H	I
1	ID	Member Name	State	RID	Received Services Y/N	Length of Service	Date of Service (First)	Date of Service (Last)	Value of Services (Total)
2	REDACTED	REDACTED	Missing	REDACTED	Y	400	6/1/06	7/6/07	\$69,127.83
3	REDACTED	REDACTED	NH	REDACTED	Y	390	6/1/06	6/26/07	\$58,466.98
4	REDACTED	REDACTED	NH	REDACTED	Y	394	6/13/06	7/12/07	\$41,094.75
5	REDACTED	REDACTED	FL	REDACTED	Y	365	6/1/06	6/1/07	\$24,395.60
6	REDACTED	REDACTED	CT	REDACTED	Y	335	6/14/06	5/15/07	\$23,006.86
7	REDACTED	REDACTED	Missing	REDACTED	Y	402	6/5/06	7/12/07	\$22,891.93
8	REDACTED	REDACTED	Missing	REDACTED	Y	210	12/21/06	7/19/07	\$22,068.67
9	REDACTED	REDACTED	VA	REDACTED	Y	267	9/1/06	5/26/07	\$19,450.93
10	REDACTED	REDACTED	Missing	REDACTED	Y	403	6/1/06	7/9/07	\$19,435.15
11	REDACTED	REDACTED	RI	REDACTED	Y	205	6/5/06	12/27/06	\$17,646.38
12	REDACTED	REDACTED	RI	REDACTED	Y	107	3/10/07	6/25/07	\$16,453.08
13	REDACTED	REDACTED	NC	REDACTED	Y	172	6/1/06	11/20/06	\$15,452.40
14	REDACTED	REDACTED	Missing	REDACTED	Y	409	6/6/06	7/20/07	\$15,251.35
15	REDACTED	REDACTED	Missing	REDACTED	Y	400	6/14/06	7/19/07	\$12,559.75
16	REDACTED	REDACTED	MI	REDACTED	Y	158	6/1/06	11/6/06	\$12,199.10
17	REDACTED	REDACTED	Missing	REDACTED	Y	292	9/18/06	7/7/07	\$9,952.94
18	REDACTED	REDACTED	TX	REDACTED	Y	7	5/15/07	5/22/07	\$9,477.27
19	REDACTED	REDACTED	NH	REDACTED	Y	187	6/1/06	12/5/06	\$8,374.90
20	REDACTED	REDACTED	RI	REDACTED	Y	146	6/3/06	10/27/06	\$8,282.25
21	REDACTED	REDACTED	FL	REDACTED	Y	133	6/7/06	10/18/06	\$8,191.35
22	REDACTED	REDACTED	IA	REDACTED	Y	260	6/15/06	3/2/07	\$7,805.84
23	REDACTED	REDACTED	PA	REDACTED	Y	297	7/4/06	4/27/07	\$7,290.11
24	REDACTED	REDACTED	NH	REDACTED	Y	398	6/14/06	7/17/07	\$6,887.26
25	REDACTED	REDACTED	NH	REDACTED	Y	313	6/8/06	4/17/07	\$6,855.74
26	REDACTED	REDACTED	NH	REDACTED	Y	287	6/14/06	3/28/07	\$5,686.38
27	REDACTED	REDACTED	NH	REDACTED	Y	296	6/7/06	3/30/07	\$5,507.09
28	REDACTED	REDACTED	NH	REDACTED	Y	329	6/15/06	5/10/07	\$5,037.50
29	REDACTED	REDACTED	FL	REDACTED	Y	159	9/23/06	3/1/07	\$4,707.56
30	REDACTED	REDACTED	GA	REDACTED	Y	138	7/29/06	12/14/06	\$4,662.08
31	REDACTED	REDACTED	FL	REDACTED	Y	421	6/5/06	7/31/07	\$4,638.46
32	REDACTED	REDACTED	SC	REDACTED	Y	392	6/16/06	7/13/07	\$4,513.47
33	REDACTED	REDACTED	NY	REDACTED	Y	0	9/20/06	9/20/06	\$4,407.42

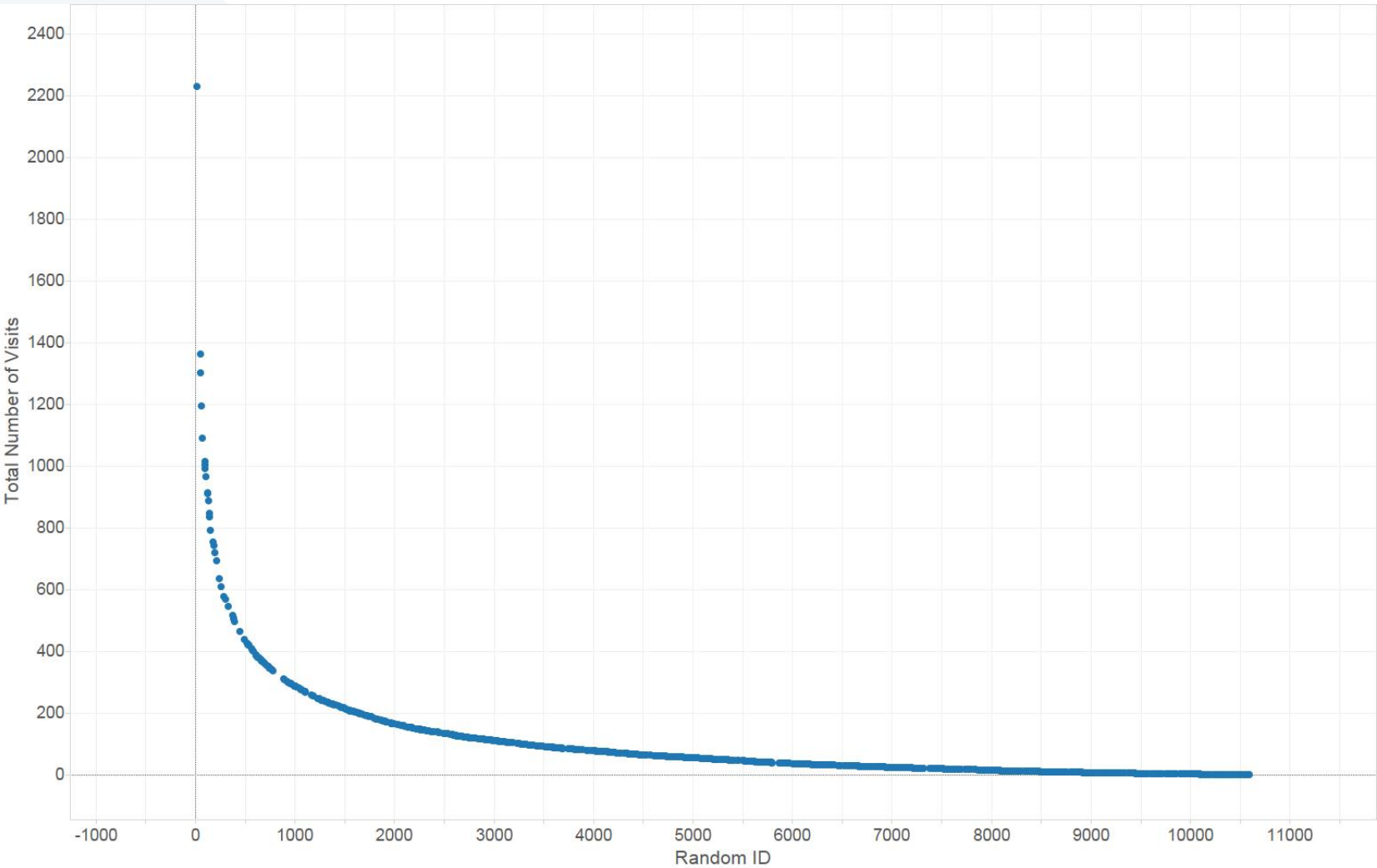
Out of State Recipients



Proof-of-Concept 2 Dataset

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Random ID	Provider ID	Provider Name	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Total Number of Visits
2	19	Redacted	Redacted	217	148	226	207	201	211	194	184	229	196	209	8	2230
3	51	Redacted	Redacted	120	140	116	106	125	131	133	136	139	119	91	8	1364
4	57	Redacted	Redacted	100	108	129	133	117	144	136	124	142	127	42	0	1302
5	65	Redacted	Redacted	73	127	131	128	97	115	130	121	125	111	36	0	1194
6	76	Redacted	Redacted	117	96	123	116	118	89	77	99	111	102	40	4	1092
7	98	Redacted	Redacted	96	68	94	80	101	95	106	86	128	83	66	12	1015
8	100	Redacted	Redacted	97	26	98	83	84	105	111	106	118	111	65	0	1004
9	104	Redacted	Redacted	99	98	117	96	91	121	13	90	114	77	65	10	991
10	110	Redacted	Redacted	61	53	86	109	96	106	102	97	121	50	76	10	967
11	126	Redacted	Redacted	78	67	77	81	65	80	86	73	102	106	99	0	914
12	127	Redacted	Redacted	93	90	102	72	97	57	97	84	63	71	64	20	910
13	134	Redacted	Redacted	86	103	76	83	68	67	92	61	92	87	63	10	888
14	147	Redacted	Redacted	79	83	88	74	58	73	69	74	94	66	72	17	847
15	149	Redacted	Redacted	61	53	56	84	75	60	78	90	71	85	96	26	835
16	157	Redacted	Redacted	42	94	84	87	90	66	70	32	95	76	55	0	791
17	179	Redacted	Redacted	50	30	52	53	65	82	89	101	103	61	68	0	754
18	186	Redacted	Redacted	59	66	74	72	60	63	65	51	94	61	68	9	742
19	197	Redacted	Redacted	66	92	71	61	72	64	60	68	78	38	49	1	720
20	213	Redacted	Redacted	64	26	66	72	69	85	94	93	102	22	0	0	693
21	244	Redacted	Redacted	37	33	34	72	62	56	81	74	73	56	53	4	635

Doctor's Visits



The OSA Pre-Data Analytics

- ◉ We used traditional tools to analyze data
- ◉ Relied on auditees to provide us with data
- ◉ We developed small groups of experts in analysis techniques using the available tools
- ◉ These experts were not necessarily known beyond their audit groups resulting in localized, rather than shared expertise across the enterprise

Embracing Big Data

- Understanding that the OSA's role and responsibilities allowed access a broad range of data
- Understanding that data used in concert with other data increases the value of all of the data
- Understanding that the ability to identify and cluster data and then further analyze that sub-set of transactions is a powerful tool
- Investing in the infrastructure and tools required to develop a big data strategy

Overview of the OSA's Strategy

- ◎ Data Analytics 1.0
 - › Prove the concept
 - › Build the team
 - › Access data sources
- ◎ Data Analytics 2.0
 - › Expand the team
 - › Complete the engine
 - › Expand data sources
- ◎ Data Analytics 3.0
 - › Deploy across the enterprise
 - › Expand the user group
 - › Expand data sources

Data Analytics 1.0

- ◎ The OSA is currently operating at a level of analytics use and deployment we refer to as data analytics 1.0
 - › Initial Analytics provided by a small group of very skilled individuals
 - › Blocks or sets of enhanced data are delivered to the audit team
 - › Feedback from the audit and investigative teams is collected for the purpose of improving algorithms
 - › Algorithms are stored in an algorithm library for reuse

Data Analytics 2.0

- The OSA is currently working towards Data Analytics 2.0
- Data Analytics engine will be fully developed
- There will be an expanded group of users trained to use the data analytics engine
- Packets of algorithms will be used in standard audit testing and investigative processes
- Several additional data sources will be added

Data Analytics 3.0

- ◎ Data Analytics 3.0 represents the project completion
 - › Engine is fully deployed across the OSA (visualization tools)
 - › Group of up to 30-40 power users trained and given access to the data analytics engine
 - › Additional data sources added
 - › Predictive analytics/trends and projections
 - › Optimization

What has the OSA learned

- ◉ Data Analytics is a process
- ◉ Business Partnerships are vital to success
- ◉ Analytic results must be verified by the business
- ◉ The Data Analytics process requires insight
- ◉ The analytic process itself must be analyzed

Data Analytics is a Process

- ⦿ ETL (Extraction, Transform, Load)
- ⦿ Analysis
- ⦿ Publish Results of the Initial Analysis to the Business User
- ⦿ Refine the Results
- ⦿ Develop New and Improved Algorithms Based on the Results
- ⦿ Run the Algorithms Again

Business/ Analyst Partnerships

- ⦿ Data analytics is not an intuitive process
- ⦿ It is the exercise of applying known rules to data
- ⦿ The rules are imbedded in the business processes
- ⦿ Subject area expertise is essential to the success of the project
- ⦿ The blend of subject area knowledge and analytic expertise is a powerful combination

Closing the Loop

- The results themselves need to be analyzed
- The analytic process has produced a valuable subset of data
- This subset may lead to new information, patterns, systemic issues that were unknown prior to the analysis
- The analysis of this data may result in improvements that truly add value



Results Need to be Verified

- ⦿ Data analytics results are not the end product they need to be verified through the normal audit or investigative processes
- ⦿ Feedback from the auditors is critical to the long-term data analytic process it provides information on the result's
 - › Relevancy
 - › Accuracy
 - › Provides information required for new and improved algorithms

Data Analytics Requires Insight

As remarkable as the data analytic tools are...it is the combination of information generated by the algorithms and the intelligence of the human mind that enhances the success of the process.

"...the task is not so much to see what no one else has seen, but to think what nobody else has thought about that which everyone sees." Schopenhauer

Summary

- Data analytics provides enhanced and or enriched data for auditors, investigations and other OSA users
- Audit and investigative results lead to better models, enhanced algorithms and more effective packages
- Improved models, algorithms and packages lead to more precise and more meaningful audits or investigations
- Velocity will increase:

Timeliness X Impact = Velocity



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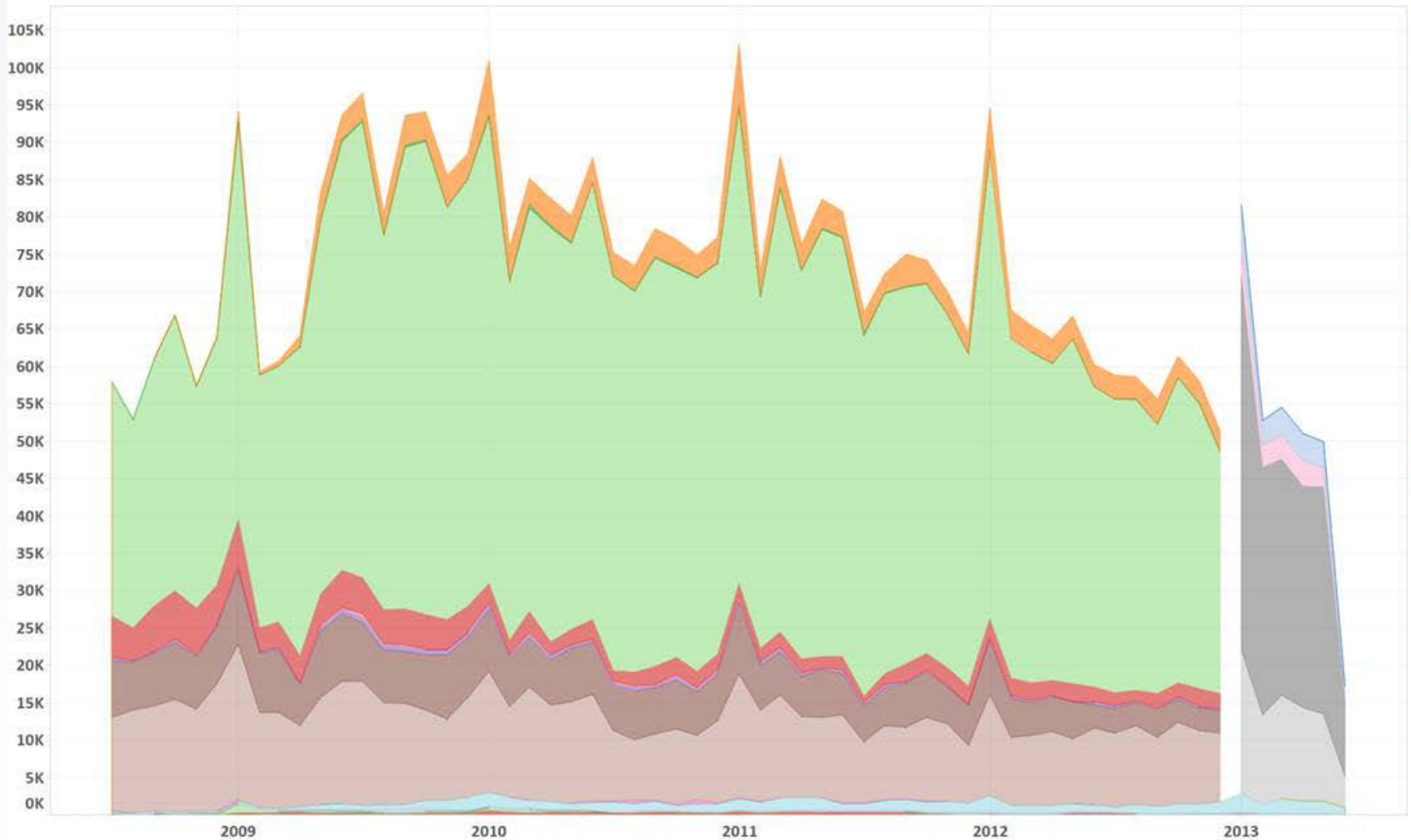
Laura Marlin, First Deputy Auditor

Wrap Up and Questions

Data Analytics:

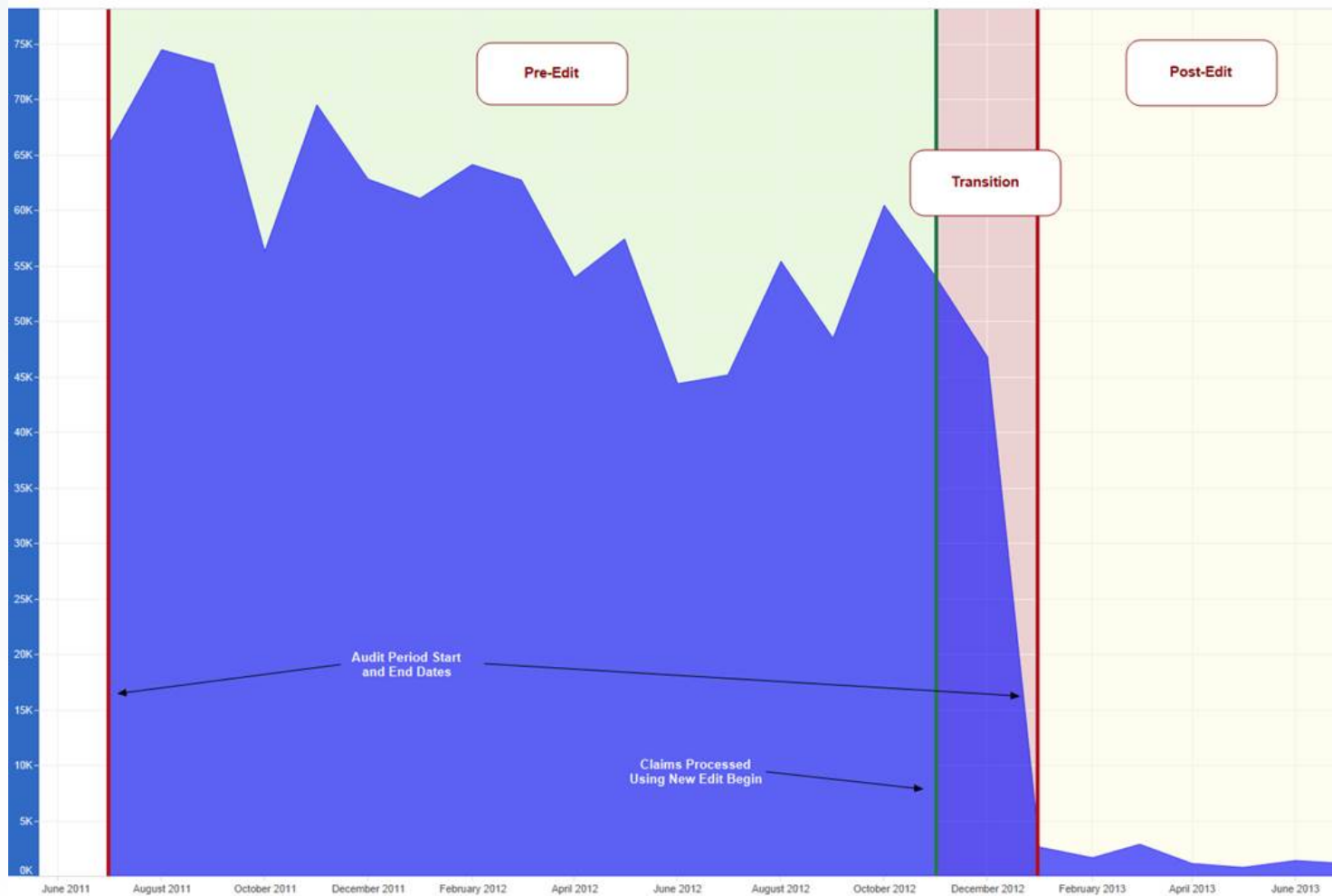
- ⦿ Allows us to take vast number of transactions and quickly highlight problem areas – telescopic analysis
- ⦿ Allows us to start with a problem and find other related problems – microscopic analysis
- ⦿ Significantly reduces the amount of time that we spend going down what might turn out to be the wrong path
- ⦿ **Also allows us to continuously monitor high-risk areas and to evaluate whether solutions that have been put into place are working**

Non-payable Services – providers shifted to other billing codes after edit



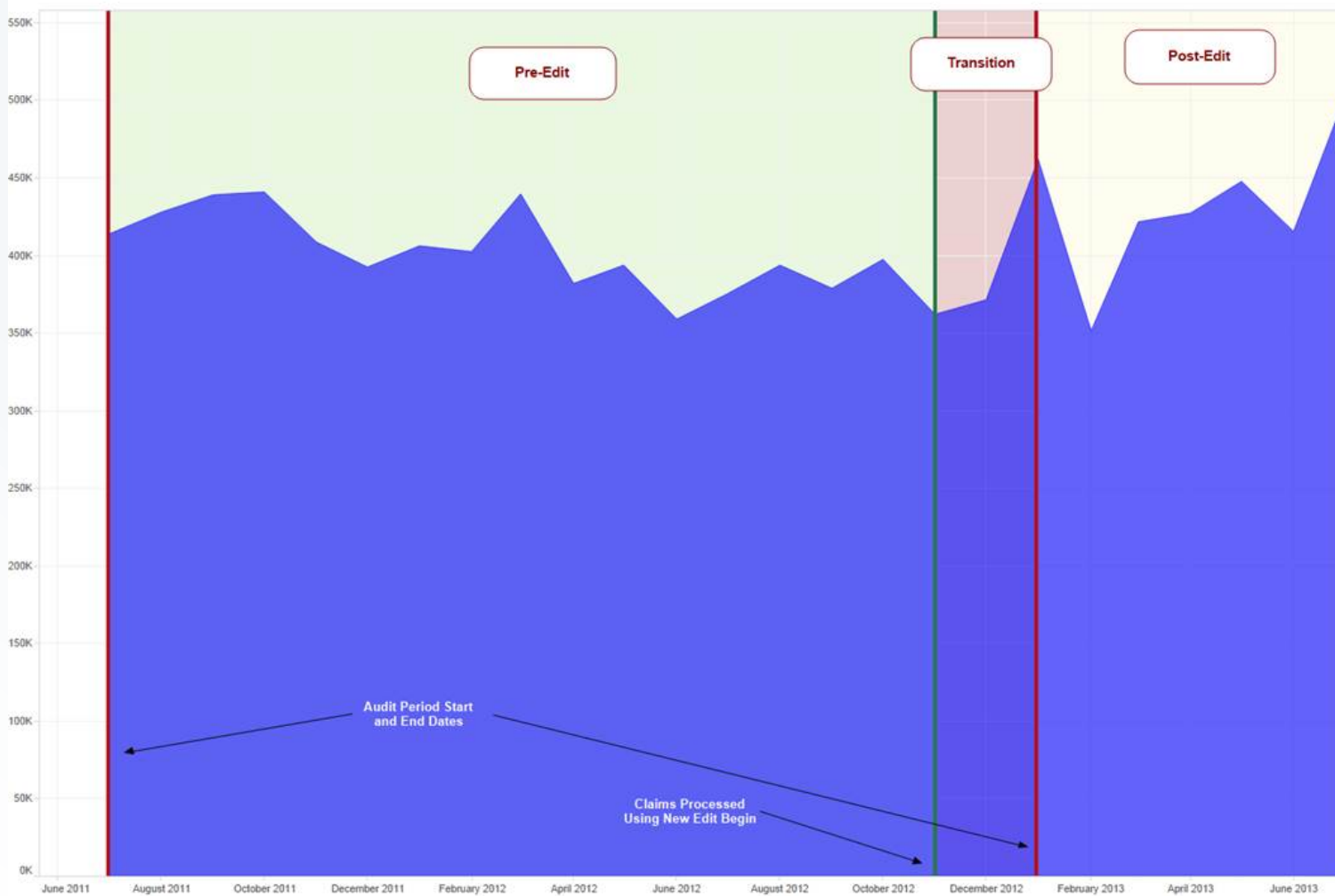
Suspect Behavioral Health Claims – edit appears successful in reducing claims

Suspect Behavioral Health Claims



Suspect ER, Clinic and Office Visits – edit appears unsuccessful in reducing claims

Suspect ER, Clinic and Office Visits



Data Analytics external benefits

- ◎ The expanded of data analytics use of will allow the OSA to make significant impact in a variety of areas –
 - › Public policy,
 - › systemic process changes,
 - › fraud reduction,
 - › dollar savings, and
 - › protecting the public
- ◎ And it provides more opportunities for collaboration between our audit and investigative units, which contributes to those impacts

Data Analytics internal benefits

- ⦿ Incorporating data analytics has ignited a new passion for some more experienced staff,
- ⦿ Has drawn in our younger and newer staff,
- ⦿ and is helping everyone really think about their work in new ways.

In short, the whole office is working smarter, more collaboratively and with greater passion for the work.



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Questions?

Recommended Articles

- ◎ **Detecting Fraud in the Real World**
 - > <http://cm.bell-labs.com/cm/ms/departments/sia/doc/hmds.pdf>
- ◎ **Statistical Fraud Detection: A Review**
 - > <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.92.9299&rep=rep1&type=pdf>
- ◎ **Application of Bayesian Methods in Detection of Healthcare Fraud**
 - > <http://business.gwu.edu/decisionsciences/i2sds/pdf/TR-2013-1.pdf>
- ◎ **Multiple Algorithms for Fraud Detection**
 - > <http://home.cc.gatech.edu/ccl/uploads/45/multiple-algorithms-for-fraud.pdf>
- ◎ **A Survey on Statistical Methods for Health Care Fraud Detection**
 - > http://www.public.asu.edu/~jli09/publications/HCMS2008_survey.pdf