Grant Thornton

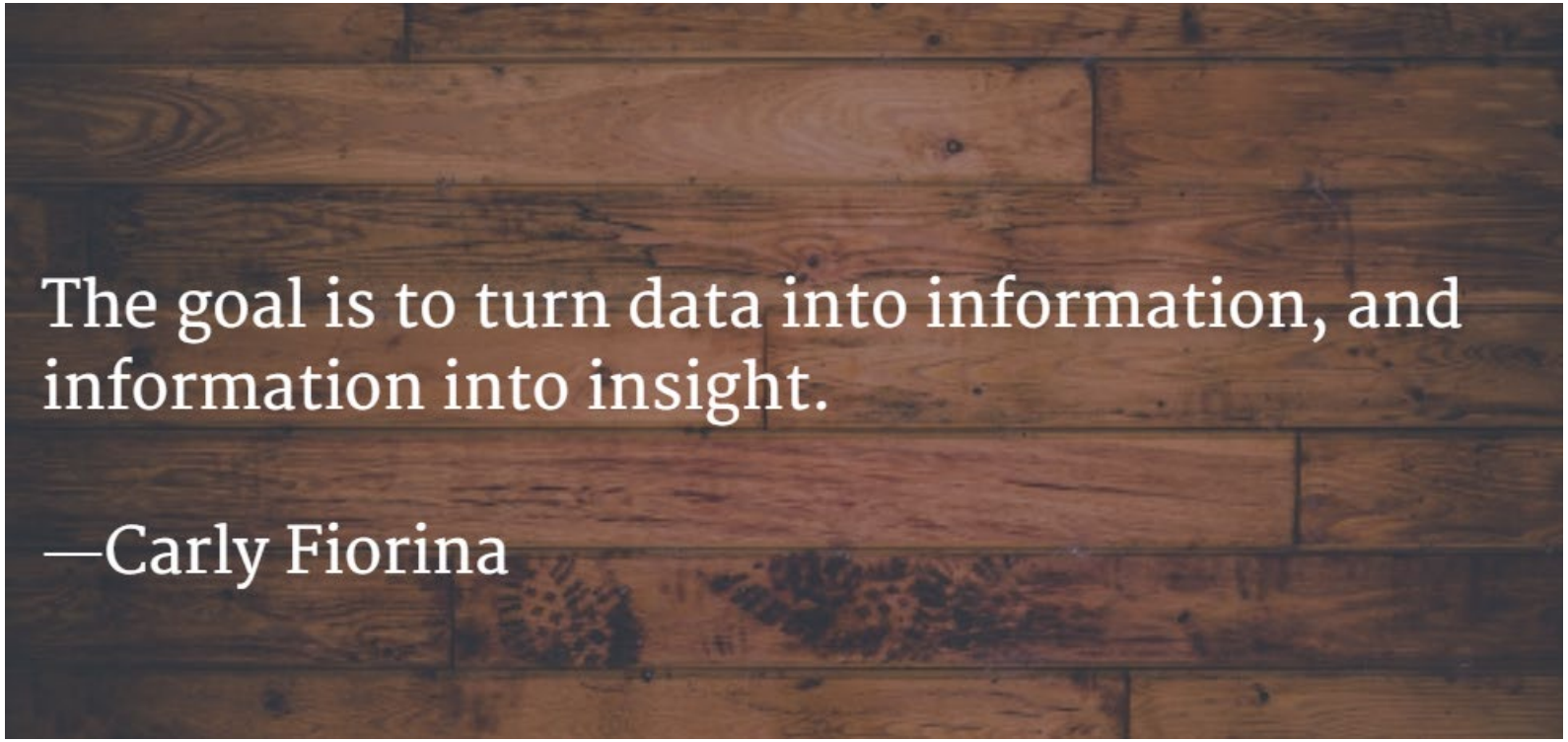
Visualizing Fraud in Your Data

NY/NJ Intergovernmental Audit Forum

Thursday, September 26th, 2019

Today's Topics

- Introduction to Data Visualization
- Benefits of Data Visualization
- Choosing the Right Tool
- Best Practices
- Detecting and Preventing Fraud Through Data Visualization


The goal is to turn data into information, and information into insight.
—Carly Fiorina

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Introduction to Data Visualization

FRAUD RISK ASSESSMENT

Rule-Based Analytics	Anomaly Detection Analytics	Predictive Analytics	Network / Link Analytics	Text Analytics
Known Patterns	Unknown Patterns	Complex Patterns	Linked Patterns	Text Patterns

Common Fraud | Criminal Fraud | Organized Fraud

Introduction to Data Visualization

- Data visualization is the graphical representation of data.
- By using visual elements like charts, graphs, and maps, data visualization tools provide an accessible way to quickly understand trends, outliers, and patterns in data—especially for busy decision-makers.

Introduction to Data Visualization

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Can You Spot the Outliers?

A1 | Cardholder Name

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	
1	Cardho	Cardho	Cardho	EMPLO	Acct La	CARD_I	LIMIT_(	TRX_LI	Transac	Transac	Post Da	Transac	Expendi	Day of	Purchas	Debit A	AMOUN	Credit A	Discour	Tax	TAX_FN	Transac	Mercha	M
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3	Cardholde	Administra	Administra	6204	9472	10104	20000	3500	1.36E+08	########	########	7:13:09	########	Wednesda	Unknown	0.53	0.53	0	1	5.30E-02	0	Fees	CONVENIE	Te
4	Cardholde	Administra	Operation	23957	6768	10022	20000	3500	1.36E+08	########	########	11:05:34	########	Sunday	Unknown	0.61	0.61	0	1		0	Fees	INTERNAT	Nc
5	Cardholde	Administra	Administra	11632	2198				1.37E+08	########	########	16:04:31	########	Monday	Unknown	26.78		0	0			Purchase	DEBIT TO	PU
6	Cardholde	Administra	Administra	23165	2198				1.37E+08	########	########	15:29:17	########	Monday	Unknown	10.99		0	0			Purchase	DEBIT TO	PU
7	Cardholde	Administra	Administra	23608	2198				1.37E+08	########	########	21:58:01	########	Monday	Unknown	11.64		0	0			Purchase	DEBIT TO	PU
8	Cardholde	Administra	Administra	8320	2198				1.37E+08	########	########	15:57:44	########	Monday	Unknown	3988.89		0	0	398.889		Purchase	DEBIT TO I	W
9	Cardholde	Administra	Administra	21666	2198				1.37E+08	########	########	2:35:43	########	Monday	Unknown	1168.18		0	0	116.818		Purchase	DEBIT TO I	W
10	Cardholde	Administra	Administra	5789	2198				1.37E+08	########	########	22:28:57	########	Monday	Unknown	238.78		0	0	23.878		Purchase	DEBIT TO I	Ha
11	Cardholde	Administra	Administra	13036	2198				1.37E+08	########	########	3:26:12	########	Monday	Unknown	2561.71		0	0	256.171		Purchase	DEBIT TO I	Al
12	Cardholde	Administra	Administra	5208	2198				1.37E+08	########	########	15:34:55	########	Monday	Unknown	16.72		0	0	1.672		Purchase	DEBIT TO I	Ar
13	Cardholde	Administra	Administra	12164	2198				1.37E+08	########	########	15:35:02	########	Monday	Unknown	3.84		0	0	0.384		Purchase	DEBIT TO I	Ar
14	Cardholde	Administra	Administra	3324	2198				1.37E+08	########	########	7:55:31	########	Monday	Unknown	205.08		0	0	20.508		Purchase	DEBIT TO I	Ca
15	Cardholde	Administra	Operation	8259	6768	10022	20000	3500	1.37E+08	########	########	11:56:01	########	Monday	Unknown	11.2	11.2	0	0	1.12	0	Fees	INTERNAT	Co
16	Cardholde	Administra	Program S	21662	4150	10091	20000	3500	1.37E+08	########	########	13:46:08	########	Monday	Unknown	2.32	2.32	0	0	0.232	0	Fees	INTERNAT	Co
17	Cardholde	Administra	Operation	13344	6768	10022	20000	3500	1.37E+08	########	########	16:08:30	########	Thursday	Unknown	8.66	8.66	0	0	0.866	0	Fees	INTERNAT	Di
18	Cardholde	Administra	Program S	23068	4150	10091	20000	3500	1.37E+08	########	########	23:06:58	########	Tuesday	Unknown	1.91	1.91	0	0	0.191	0	Fees	INTERNAT	De
19	Cardholde	Administra	Administra	19943	2198				1.38E+08	########	########	20:35:11	########	Wednesda	Unknown	94		0	0	9.4		Purchase	DEBIT TO I	Fl
20	Cardholde	Administra	Administra	8747	2198				1.38E+08	########	########	12:46:14	########	Thursday	Unknown	584.5		0	0	58.45		Purchase	DEBIT TO I	Ge
21	Cardholde	Administra	Administra	6734	2198				1.38E+08	########	########	18:08:58	########	Thursday	Unknown	54.03		0	0	5.403		Purchase	DEBIT TO I	Ha
22	Cardholde	Administra	Administra	5421	2198				1.38E+08	########	########	0:59:19	########	Monday	Unknown	72.98		0	0	7.298		Purchase	DEBIT TO I	Io
23	Cardholde	Administra	Administra	17751	2198				1.38E+08	########	########	21:17:18	########	Wednesda	Unknown	216.2		0	0	21.62		Purchase	DEBIT TO I	Id
24	Cardholde	Administra	Administra	10888	2198				1.38E+08	########	########	22:15:28	########	Friday	Unknown	14.19		0	0	1.419		Purchase	DEBIT TO I	Illi
25	Cardholde	Administra	Administra	10672	2198				1.38E+08	########	########	11:07:06	########	Tuesday	Unknown	30		0	0	3		Purchase	DEBIT TO I	In
26	Cardholde	Administra	Administra	1350	2198				1.38E+08	########	########	2:09:10	########	Wednesda	Unknown	40.93		0	0	4.093		Purchase	DEBIT TO I	Ka
27	Cardholde	Administra	Administra	19253	2198				1.39E+08	########	########	8:56:26	########	Friday	Unknown	157.8		0	0	15.78		Purchase	DEBIT TO I	Ke
28	Cardholde	Office of L	Administra	5949	2198				1.39E+08	########	########	2:07:24	########	Monday	Unknown	363		0	1	36.3		Purchase	DEBIT TO I	Lo
29	Cardholde	Office of L	Administra	24334	2198				1.39E+08	########	########	3:34:31	########	Wednesda	Unknown	36.6		0	1	3.66		Purchase	DEBIT TO I	M
30	Cardholde	Office of L	Administra	8020	2198				1.39E+08	########	########	17:17:05	########	Monday	Unknown	59.5		0	1	5.95		Purchase	DEBIT TO I	M

Purchase Card Output

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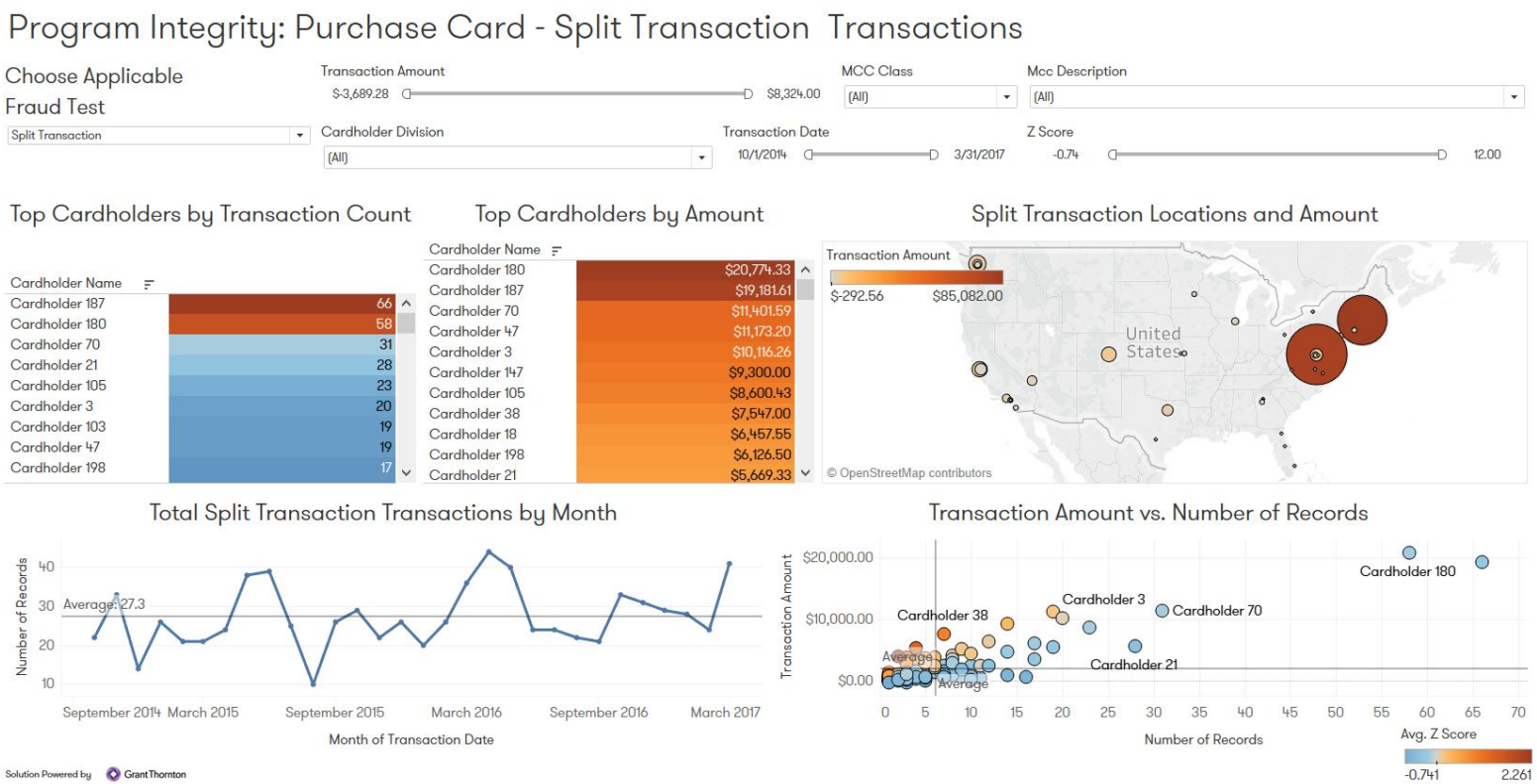
How About Now?



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- Introduction to Data Visualization
- **Benefits of Data Visualization**
- Choosing the Right Tool
- Best Practices
- Detecting and Preventing Fraud Through Data Visualization

Benefits of Data Visualization

Leveraging data visualization can empower an organization to take advantage of the numerous benefits; a few are outlined below.

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- **Choosing the Right Tool**
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Choosing the Right Tool

When choosing a tool to visualize your data as part of your anti-fraud efforts, you should consider several factors that can help optimize performance and provide the highest return on investment (ROI) for the fraud problem or problems at hand.

- Data Size & Complexity
- Data Sources
- Data Transformation
- Real-Time Access
- The Scope Triangle

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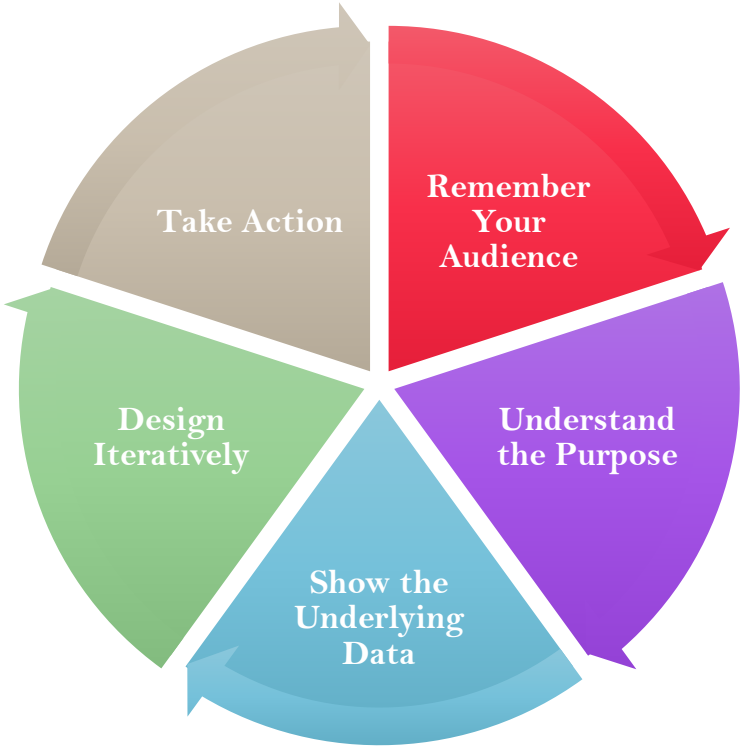
Best Practices for Data Visualization

There are such things as good and bad data visualizations.

To the right are **five best practices** to keep in mind so that your data visualization is useful and clear—and to ensure that you are effectively telling your fraud story.



Common Mistakes

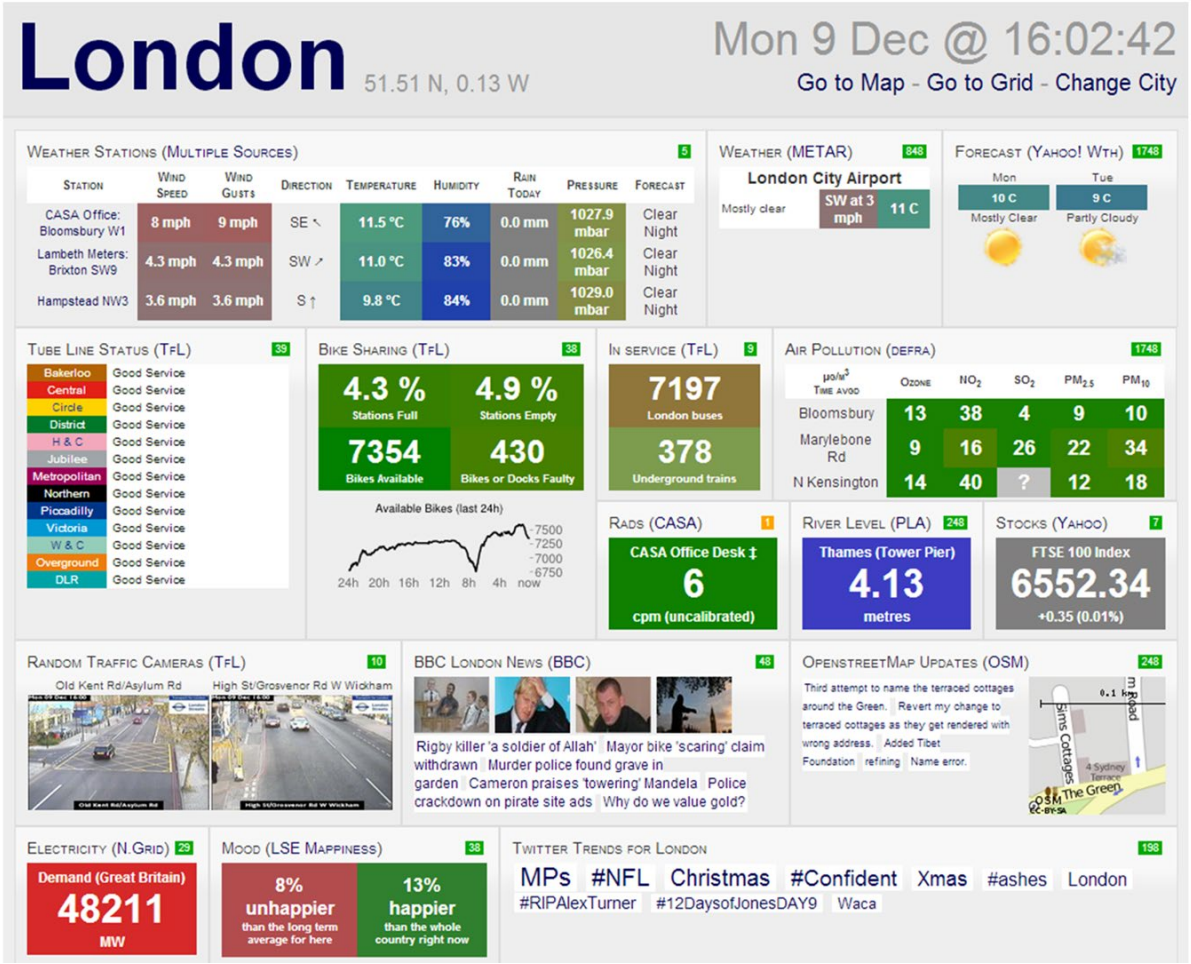
Visualization mistakes can be grouped into two main categories:

Design Mistakes

- Arranging information poorly
- Exceeding a single screen
- Misusing or overusing color
- Cluttering the display with visual effects
- Designing an unattractive display

Information Mistakes

- Inadequate context for the data
- Displaying excessive detail or precision
- Expressing measures indirectly
- Misreading your audience



Mistakes in This Visualization

- Wasted space on top
- Too much information at once
- Extremely cluttered
- May not be correctly considering audience
- Large use of unrelated color, no clear indication of meaning
- Repetitive information
- Poor choice of visualizations

Program Integrity: Vendor - All Records Transactions

Choose Applicable Fraud Test:

All Records

BOC Roll Up Name: (All)

Org-Roll Up: (All)

Expense: ($15,423) — $15,016,090

Transaction Date: 1/2/2015 — 12/25/2018

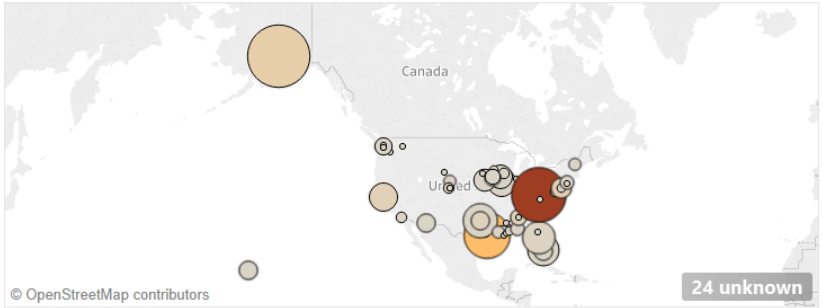
Top Vendors by Amount

Vendor	
Vendor 184	$32,883,728
Vendor 161	$10,493,262
Vendor 186	$4,863,751
Vendor 115	$3,814,741
Vendor 154	$2,007,532
Vendor 98	$1,657,517
Vendor 53	$1,609,559
Vendor 18	$1,303,694
Vendor 36	$1,210,670
Vendor 84	$797,999
Vendor 163	$769,245

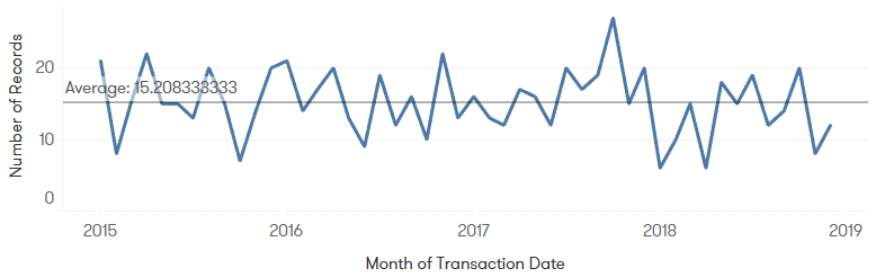
Top Vendors by Number of Records

Vendor	
Vendor 53	103
Vendor 31	31
Vendor 115	29
Vendor 57	22
Vendor 136	21
Vendor 186	19
Vendor 163	18
Vendor 18	18
Vendor 44	16
Vendor 107	15
Vendor 108	15

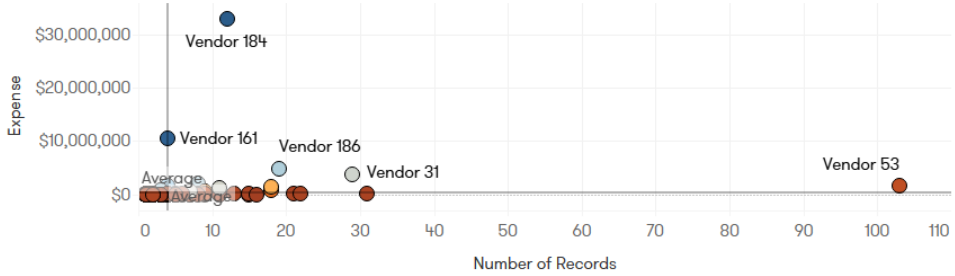
All Records Locations and Amount



Total Vendor Transactions by Month



Expense vs. Number of Records



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Visualization Types

Strategic

- Provide quick overview to monitor health and opportunities
- Focus on high-level performance measures

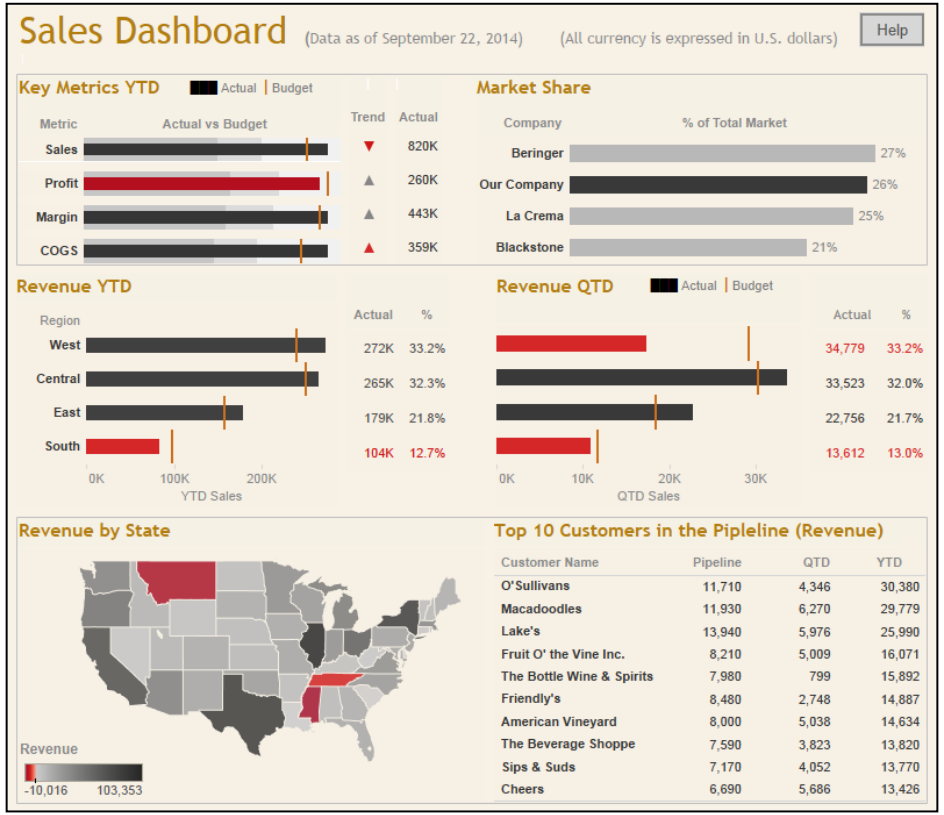
Operational

- Used mainly for monitoring operations
- Dynamic and immediate in nature

Analytical

- Require additional context (comparison, history, evaluations)
- Highly interactive

Visualization Types



Strategic

- Most important information only
- Color used sparingly
- No clutter

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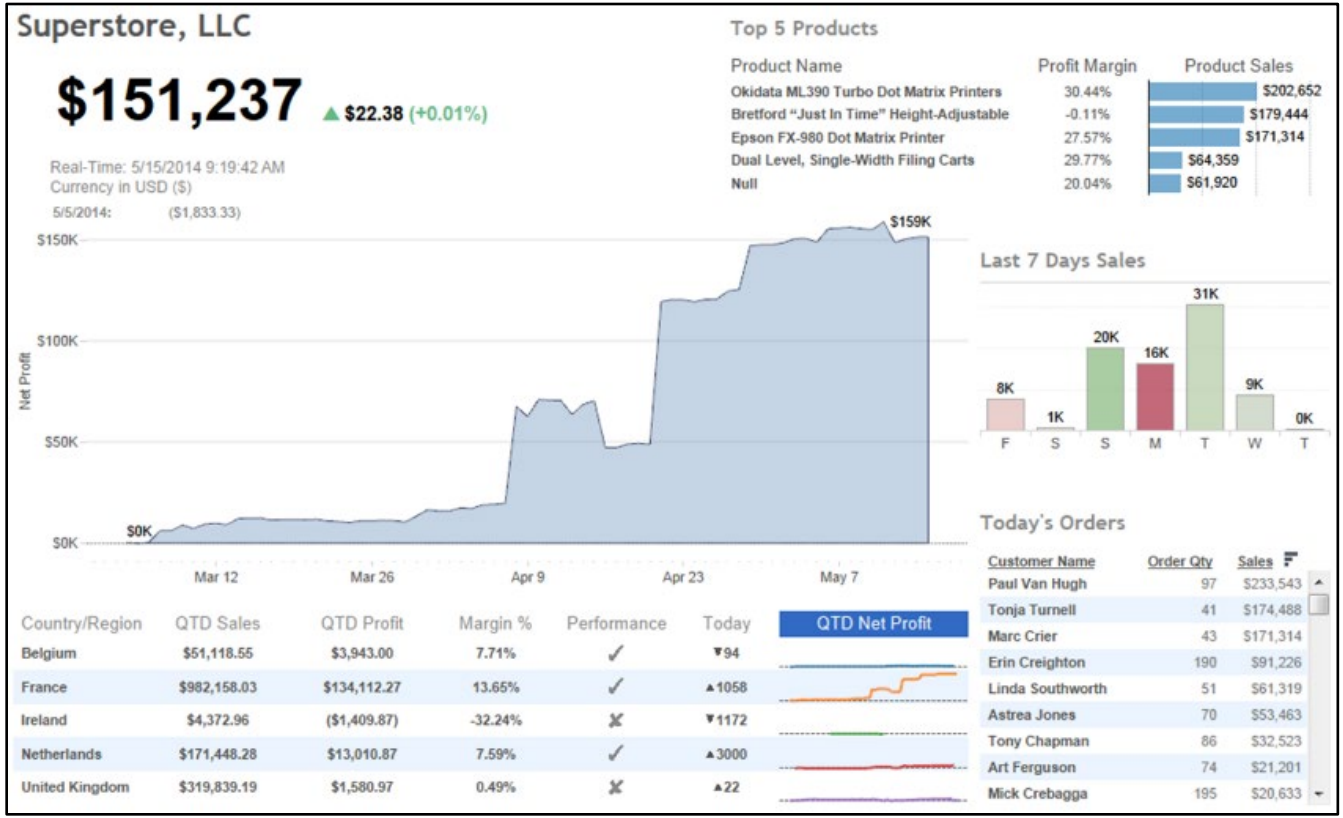
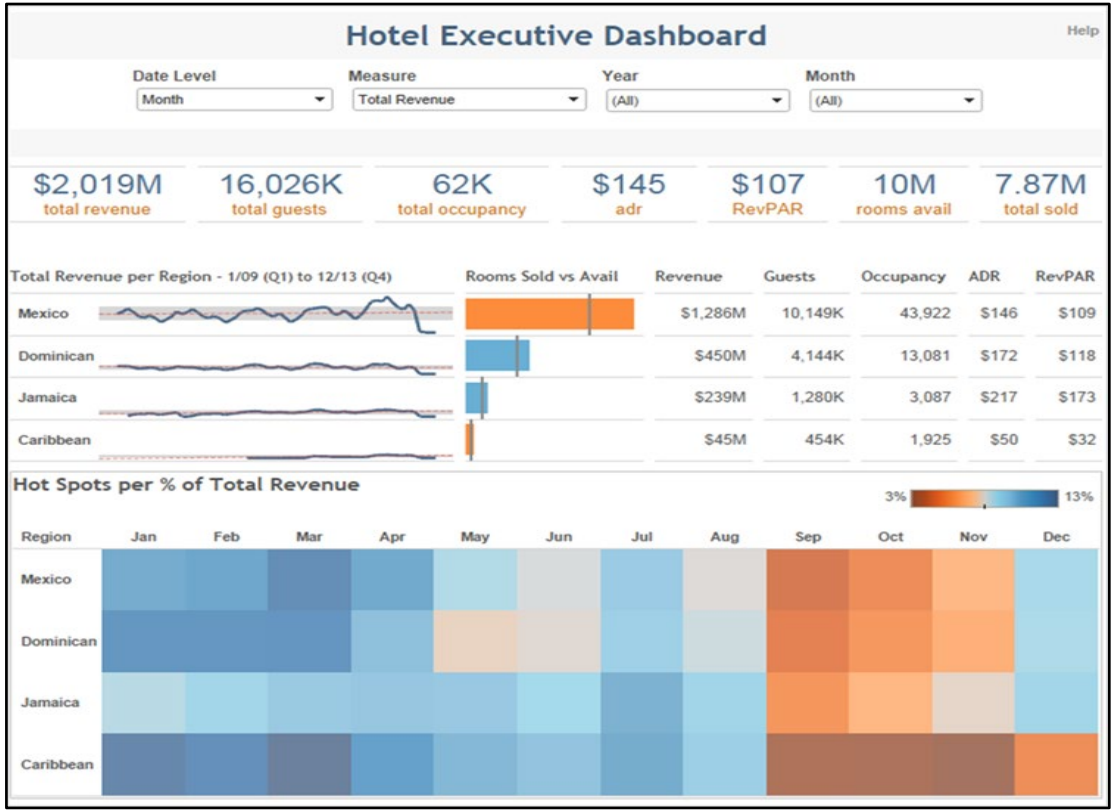
Visualization Types



Operational

- Frequent information updates
- Immediately monitor information

Visualization Types



Analytical

- Identify seasonality and opportunities
- Light borders, logical groupings
- Use of heat maps

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- Best Practices
- **Detecting and Preventing Fraud Through Data Visualization**

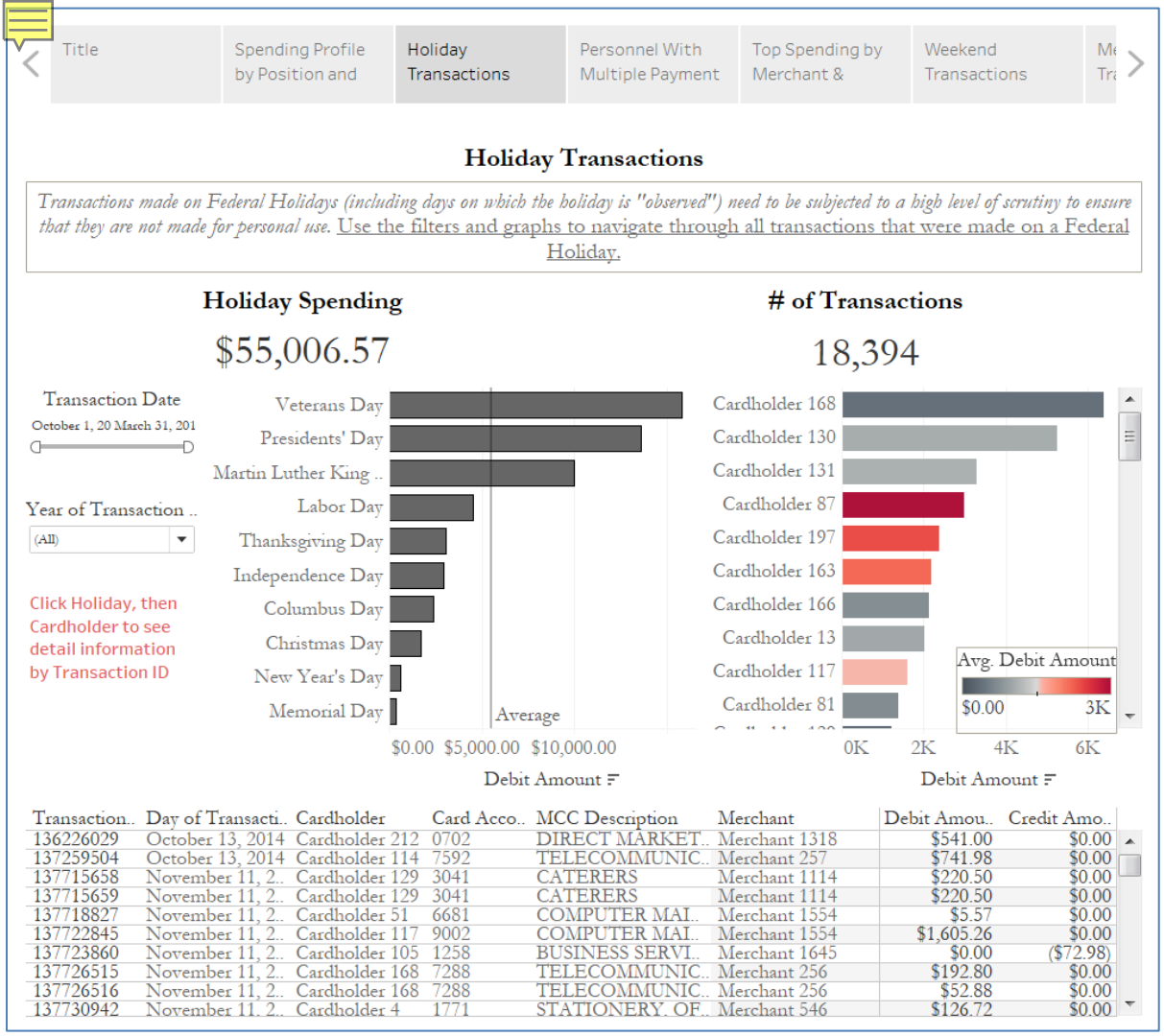
Detecting and Preventing Fraud
Case Study 1

What?

- **Do you know whether fraud is being committed with your organization's company credit cards or purchase/travel cards?**
- Grant Thornton performed a fraud risk assessment for an organization related to its card purchases; this assessment was paired with an effort to leverage analytical tools and methodologies to help mitigate risk within this area.
- **Metrics Available:** Holiday and weekend transactions, personnel holding multiple cards, tax charged.

How?

- Data related to cardholders and financial records were blended in order to evaluate questionable transactions that should be pulled for additional research; this practice effectively lowered the organization's fraud risk related to improper card usage.
- The Grant Thornton team used Alteryx, a multi-purpose, self-service analytics platform, for data cleansing, blending, and preparation.
- The team also leveraged Tableau for the development of the visual analytics storyline, using its interactive dashboard capabilities to identify suspicious transactions.



Benefits Achieved

- The dashboards created allow for more effective research into questionable card transactions, replacing a process that had been performed manually.
- The solution provides a set of formalized investigative procedures that standardize the tests and checks used at all levels.

Detecting and Preventing Fraud
Case Study 2

What?

- **Do you work with third parties, such as medical providers or vendors? Do you know if they are committing fraud against your organization?**
- We performed a fraud risk assessment for an organization related to payments to medical providers; this assessment was paired with an effort to leverage analytical tools to help detect suspicious providers.
- **High-Risk Medical Services Selected:** Chiropractic, sleep study, acupuncture, physical therapy, drug testing, radiation oncology
- Data was aggregated by provider, aligned to specific fraud schemes, and then tests were developed to identify suspicious providers.
- The Grant Thornton team leveraged Tableau for the development of the visual analytics storyline, using its interactive dashboard capabilities to identify suspicious providers.

Detecting and Preventing Fraud
Case Study 2

Medical Service	Fraud Scheme	Test
• Acupuncture • Chiropractic • Physical Therapy	• Billing timed codes that amount to over 24 hours per day	• Avg. # of minutes billed per day • Avg. # of visits billed per day • % of days billing over 6 hours
• Drug Test	• Redundant or excessive testing	• Avg. # of drug test procedures per patient • Single visits with more than one drug test
• Sleep Study • Chiropractic	• Submitting multiple claims for one visit	• % of visits with more than one claim per visit • % of duplicate billing without required modifier

Detecting and Preventing Fraud
Case Study 2

425 Providers

182k Claims

20k Patients

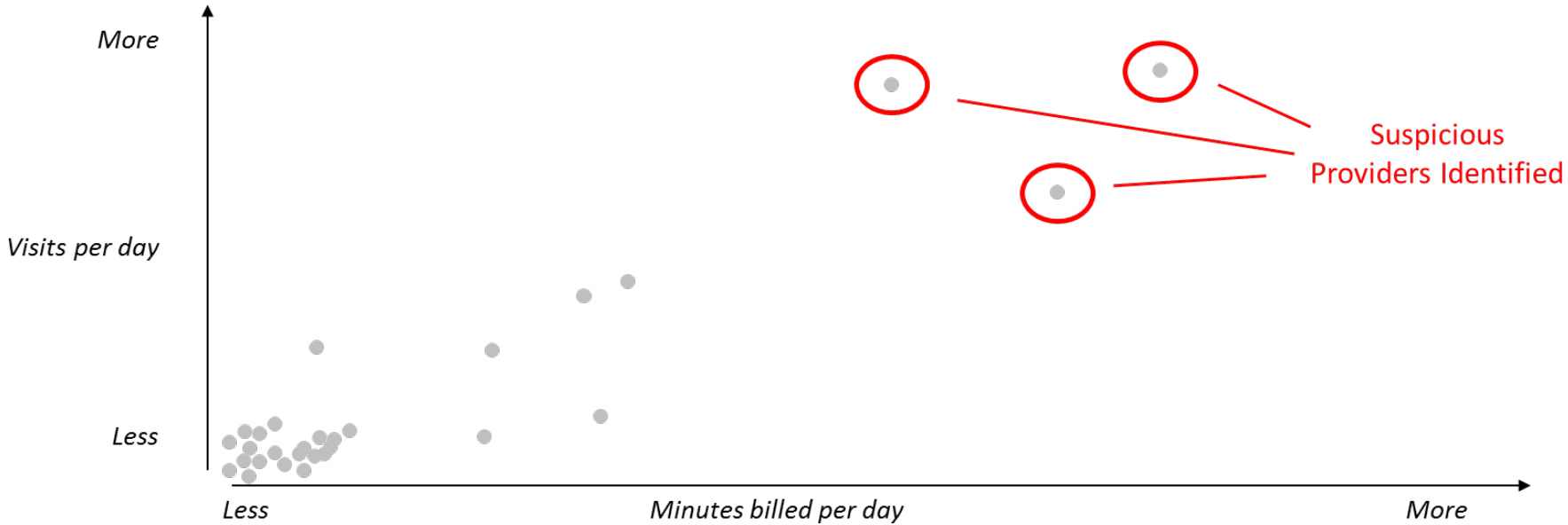
$69M Dollars

Model	Model (# of Tests)	Total # Providers Reviewed	Total # Providers Flagged	Total $ Paid to Flagged Providers
Acupuncture	55	389	59	$9,933,009
Chiropractor	78	565	48	$5,220,429
Drug Testing	52	323	30	$7,055,697
Radiation Oncology	53	1,080	240	$40,863,485
Physical Therapy	78	4,723	102	$16,805,660
Sleep	54	210	20	$2,297,172

*Totals are inclusive of duplicate patients across models due to overlapping procedures.

Detecting and Preventing Fraud
Case Study 2

Sleep Study Model: "Billing Anomalies"
Fraud Scheme: Provider bills for services not rendered by consistently billing for more services per visit than were received by patient.



CPT Code

All

Show Acupuncture

Yes

No

Show Chiropractic

Yes

No

Show Drug Testing

Yes

No

Of Claims

1.00 1265.00

Total $ Paid

$0.00 $1,638,000.0

Claim Type

All

Show PT/OT/Rehab

Yes

No

Show Radiation Onc...

Yes

No

Show Sleep Studies

Yes

No

# of Vets

1.00 1265.00

Max $ Paid

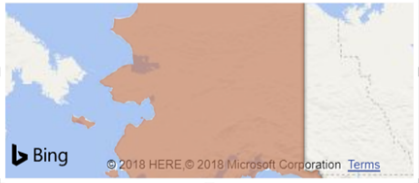
$0.00 $1,638,000.0

Amount per Claim by Provider State

Map Color Key

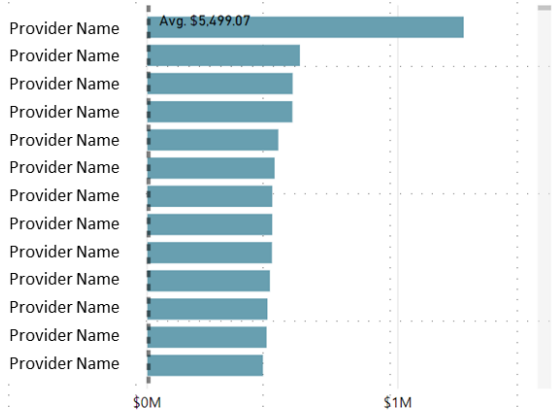
Low High

Amount per Claim - Alaska

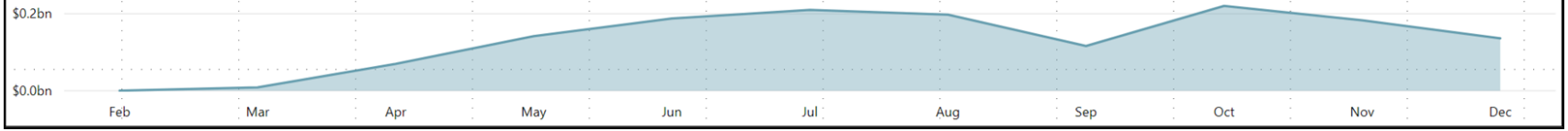


Amount per Claim - Hawaii

Amount per Claim by Provider



Total Amount Paid per Month



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Detecting and Preventing Fraud
Case Study 3

Challenge

A worker's compensation office required insights into whether there were any indications of FWA by employee claimants, medical providers and law firms.

While the client maintained data sets across a variety of source systems, they required the application of analytics to better understand potential FWA in order to identify fraud prevention and detection processes.

At the time of engagement, the client was not leveraging data visualizations or the application of robust analytics to review / monitor their data to glean insights into potentially fraudulent activities.

Detecting and Preventing Fraud
Case Study 3

Solution

Developed visualizations leveraging Tableau to identify anomalies within the data that merit further review. In addition, they helped to serve as a guide for further analysis, tracking and monitoring of claims payments.

Through the application of simple visualization capabilities within Tableau (such as bar charts, scatter plots, geospatial maps), we could identify insights, many of which were not identifiable without the visualizations

The visualizations provided immediate insights into areas of potential FWA, that can be prioritized for immediate action versus those to begin performing continuous monitoring moving forward.

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Detecting and Preventing Fraud
Case Study 3

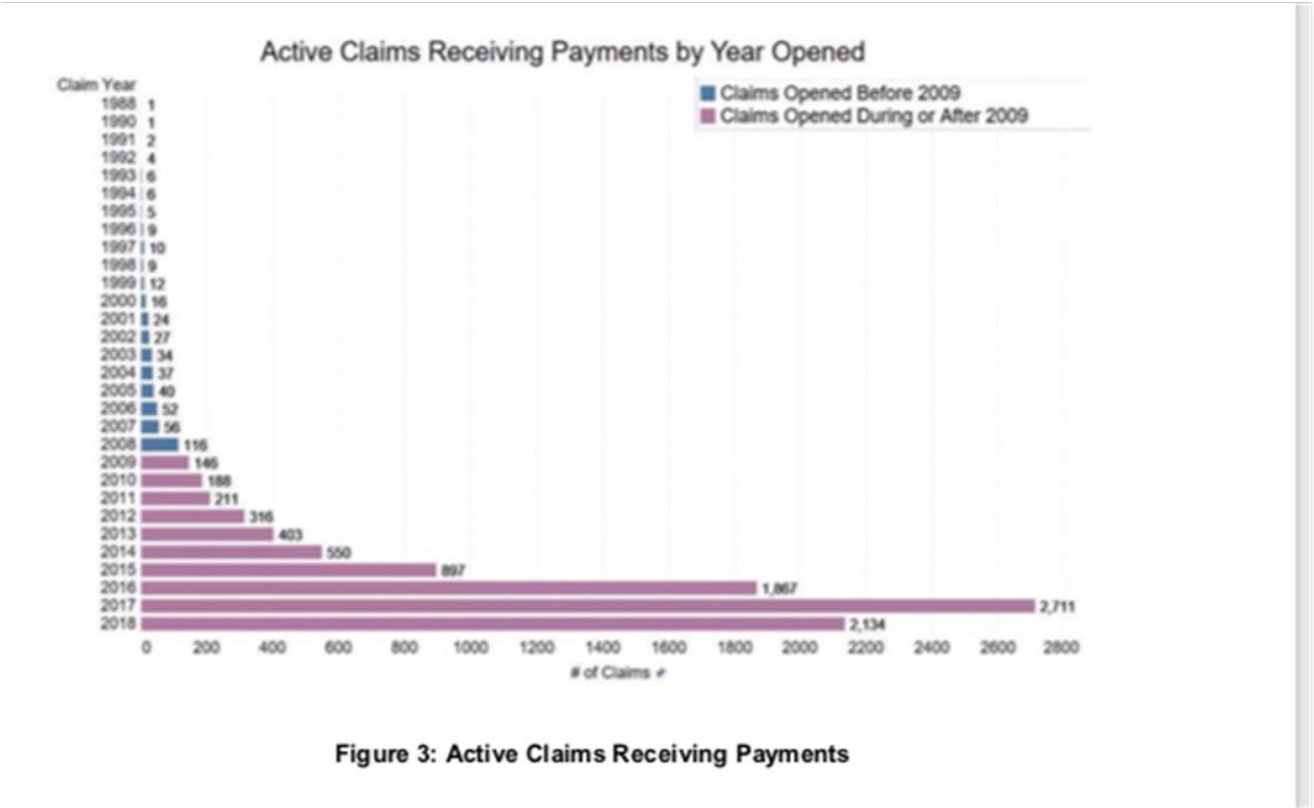

Figure 3: Active Claims Receiving Payments

Contact Information

Linda Miller, Principal
(571) 444 1990
Linda.Miller2@us.gt.com

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