

EHR Incentive program for Meaningful Use of EHR
Technology

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MS: INFORMATION SYSTEMS

5270: BUSINESS INTELLIGENCE

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URL's OF DATASET

Links for Data Set:

<https://catalog.data.gov/dataset/cms-medicare-and-medicaid-ehr-incentive-program-electronic-health-record-products-used-for-f4247>

<https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/DataAndReports.html>

<https://dashboard.healthit.gov/>

Data Set 1: MU Data consists of 20 columns.

1. NPI- Unique Provider Number
2. Provider type- Category has two types Eligible providers and Hospital
3. State- has 50 States
4. Latitude
5. Longitude
6. Specialty – Specialty Physicians
7. Hospital Type- Two Category: Critical Access, General
8. Program Type- Three Types: Medicaid, Medicare, Medicaid/Medicare
9. Program Year- 2011, 2012, 2013, 2014, 2015, 2016, 2017
10. Provider Stage- Two Stages: Stage 1, Stage 2
11. Payment Year- Since how many years providers are paid:1,2,3,4,5,6
12. Attestation Month- January-December (12 Months)
13. Attestation Year- 2011, 2012 ,2013 ,2014 ,2015 ,2016,2017
14. MU Definition 2014- 2013, 2014, not Scheduled
15. Stage 2 scheduled- Yes, No

16. EHR Product Name- Multiple Vendor Names
17. Product classification- Complete EHR, Modular EHR
18. Product Setting- Ambulatory, Inpatient
19. Product Certification- 2011,2014, 2015
20. Amount Received- total amount received by each provider

Data Set 2: Total Payments

Data Set Consists of 7 columns

State, Medicare NPI Providers, Medicare Payments, Medicaid NPI Providers, Medicaid Payments, Total NPI Providers, Total Payments

Data Set 3: Certified EHR

Data Set Consists of 6 columns

Developers, Providers certified with certified technology, Providers with 2015 certified technology, Providers with 2014 certified technology, Providers with 2011 certified technology.

DATA CLEANING:

Various Dta Cleaning methods were used. Five Types are Listed below.

1. Column Mismatch
2. Duplicate Values
3. Incomple Data
4. Data Irrelavency
5. Improper data format
6. **TYPE 1: Column Mismatch:**

Data in Speciality column belonged to Hospital Type and data in Hospital Type belonged to Speciality column.

Steps Taken: Interchanged the data

Before Data cleaning

A	B	C	D	E	F	G	H	I
NPI	Provider_Typ	Business_State_Ter	Latitude	Longitude	Specialty	Hospital_Type	Program_Typ	Program_Yea
1003007980	EP	Alabama	32.806671	-86.79113	General	Interventional Cardiology	Medicare	2012
1003007980	EP	Alabama	32.806671	-86.79113	General	Interventional Cardiology	Medicare	2013
1003007980	EP	Alabama	32.806671	-86.79113	General	Interventional Cardiology	Medicare	2014
1003007980	EP	Alabama	32.806671	-86.79113	General	Interventional Cardiology	Medicare	2016
1003011859	EP	Alabama	32.806671	-86.79113	General	Surgery	Medicare	2013
1003011859	EP	Alabama	32.806671	-86.79113	General	Surgery	Medicare	2014
1003011859	EP	Alabama	32.806671	-86.79113	General	Surgery	Medicare	2015
1003011859	EP	Alabama	32.806671	-86.79113	General	Surgery	Medicare	2016
1003014762	EP	Alabama	32.806671	-86.79113	General	Dermatology	Medicare	2012
1003014762	EP	Alabama	32.806671	-86.79113	General	Dermatology	Medicare	2013
1003014762	EP	Alabama	32.806671	-86.79113	General	Dermatology	Medicare	2015
1003014762	EP	Alabama	32.806671	-86.79113	General	Dermatology	Medicare	2016
1003024746	EP	Alabama	32.806671	-86.79113	General	Student in an Organized Health	Medicare	2012
1003024746	EP	Alabama	32.806671	-86.79113	General	Student in an Organized Health	Medicare	2013
1003024746	EP	Alabama	32.806671	-86.79113	General	Student in an Organized Health	Medicare	2015
1003029869	EP	Alabama	32.806671	-86.79113	General	Cardiovascular Disease	Medicare	2011
1003029869	EP	Alabama	32.806671	-86.79113	General	Cardiovascular Disease	Medicare	2012

After Data cleaning

A	B	C	D	E	F	G	H	I
NPI	Provider_Type	Business_State_Ter	Latitude	Longitude	Specialty	Hospital_Type	Program_Type	Program_Yea
1003007980	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2012
1003007980	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2013
1003007980	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2014
1003007980	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2016
1003011859	EP	Alabama	32.806671	-86.79113	Surgery	General	Medicare	2013
1003011859	EP	Alabama	32.806671	-86.79113	Surgery	General	Medicare	2014
1003011859	EP	Alabama	32.806671	-86.79113	Surgery	General	Medicare	2015
1003011859	EP	Alabama	32.806671	-86.79113	Surgery	General	Medicare	2016
1003014762	EP	Alabama	32.806671	-86.79113	Dermatology	General	Medicare	2012
1003014762	EP	Alabama	32.806671	-86.79113	Dermatology	General	Medicare	2013
1003014762	EP	Alabama	32.806671	-86.79113	Dermatology	General	Medicare	2015
1003014762	EP	Alabama	32.806671	-86.79113	Dermatology	General	Medicare	2016
1003024746	EP	Alabama	32.806671	-86.79113	Student in an Organized Heal	General	Medicare	2012
1003024746	EP	Alabama	32.806671	-86.79113	Student in an Organized Heal	General	Medicare	2013
1003024746	EP	Alabama	32.806671	-86.79113	Student in an Organized Heal	General	Medicare	2015
1003029869	EP	Alabama	32.806671	-86.79113	Cardiovascular Disease	General	Medicare	2011
1003029869	EP	Alabama	32.806671	-86.79113	Cardiovascular Disease	General	Medicare	2012

TYPE 2: Duplicate Values:

Before Data Cleaning: There were about 1025325 rows.

MU_REPORT (1) - Excel																		Sign in	
File Home Insert Page Layout Formulas Data Review View Tell me what you want to do																			
Get Data From Other Sources																			
Queries & Connections																			
Sort & Filter																			
Text to Columns Flash Fill Remove Duplicates Validation																			
Data Tools																			
Manage Data Model																			
What-If Analysis Forecast Sheet																			
Group Upposheet Subtotal																			
Show Detail Hide Detail																			
Outline																			
A																			
01																			
Stage_2_Scheduled_2014																			
A B C D E F G H I J K L M N O P Q R S																			
NPI CCN Provider_Business_ZIP Specialty Hospital_Program_Program_Provider_Payment Attestation_Month Attestation_Year MU_Definition_2014 Stage_2_Schedule EHR_Certification EHR_Product EHR_Vendor_Name EHR_Product_Nam EHR_Prod																			
1	1003000142	EP	Ohio	43623	Pain Medicine	Medicare	2015 Stage 1	1	January	2	2016	2014	0 A014E01NCEUEAF	CHP-022045	Epic Systems Corp	EpicCare Ambulat	Epic 2012		
3	1003000142	EP	Ohio	43623	Pain Medicine	Medicare	2015 Stage 1	2		2	2016	2016	0 A014E01NCEUEAF	CHP-022044	Epic Systems Corp	EpicCare Ambulat	Epic 2014		
4	1003000142	EP	Ohio	43623	Pain Medicine	Medicare	2016 Stage 2	3		2	2017	2016	0 A014E01NCEUEAF	CHP-022044	Epic Systems Corp	EpicCare Ambulat	Epic 2014		
5	1003000522	EP	Florida	32725	Adult Medicine	Medicare	2012 Stage 1	1		2	2013	2013	1 30000001SVGWEA	CHP-007425	NextGen Healthca	NextGen Ambulat	5.6 SP1		
6	1003000522	EP	Florida	32725	Adult Medicine	Medicare	2014 Stage 1	3	February	2	2015	2013	1 AOH1301NCEQVLA	CHP-018548	NextGen Healthca	NextGen Ambulat	5.8.0.77		
7	1003000522	EP	Florida	32725	Adult Medicine	Medicare	2015 Stage 2	4		2	2016	2013	1 AOH1301NCEQVLA	CHP-021999	NextGen Healthca	NextGen Ambulat	5.8.0.77		
8	1003000522	EP	Florida	32725	Adult Medicine	Medicare	2016 Stage 2	5		1	2017	2016	1 1314E01PHNUEAF	CHP-021369	NextGen Healthca	NextGen Ambulat	5.8.1		
9	1003000530	EP	Florida	32725	Adult Medicine	Medicare	2016 Stage 2	5		1	2017	2016	1 0014EWR4DRAGCC	14.07.07.2880.ATA	athenahealth, Inc.	athenaClinicals			
10	1003000530	EP	Pennsylvania	18951	Internal Medicine	Medicare	2012 Stage 1	1		11	2012	2014	1 30000004TQGMELA	CHP-008032	Allscripts	Allscripts Enterprise			
11	1003000530	EP	Pennsylvania	18951	Internal Medicine	Medicare	2013 Stage 1	2		3	2014	2014	1 30000004TQGMELA	CHP-008032	Allscripts	Allscripts Enterprise			
12	1003000530	EP	Pennsylvania	18951	Internal Medicine	Medicare	2014 Stage 1	3		2	2015	2014	1 A014E01SOFAMAEA	CHP-019270	Get Real Health	InstantPHR			
13	1003000530	EP	Pennsylvania	18951	Internal Medicine	Medicare	2014 Stage 1	3		2	2015	2014	1 A014E01SOFAMAEA	CHP-021796	Allscripts	InstantPHR/Version 11			
14	1003000530	EP	Pennsylvania	18951	Internal Medicine	Medicare	2015 Stage 2	4		2	2016	2016	1 1314E01PORTLEAF	CHP-019270	Get Real Health	InstantPHR			
15	1003000530	EP	Pennsylvania	18951	Internal Medicine	Medicare	2015 Stage 2	4		2	2016	2016	1 1314E01PORTLEAF	CHP-022044	Allscripts	Allscripts TouchW 11.4.1			
16	1003000597	EP	Oklahoma	74104	Urology	Medicare	2015 Stage 1	2		2	2016	2016	0 1314E01PHNUEAF	CHP-023369	NextGen Healthca	NextGen Ambulat	5.8.1		
17	1003000597	EP	Oklahoma	74104	Urology	Medicare	2016 Stage 1	1		1	2017	2017	0 1314E01PHNUEAF	CHP-023369	NextGen Healthca	NextGen Ambulat	5.8.1		
18	1003000621	EP	Virginia	23901	Chiropractor	Medicare	2012 Stage 1	1	September		2012	2012	1 3000000459VAAEAF	CHP-008186	MPN Software Syst	ECLIPSE			
19	1003000639	EP	California	90095	Surgery	Medicare	2015 Stage 1	2		2	2016	2016	0 1314E01PNHSEAF	CHP-024722	Epic Systems Corp	EpicCare Ambulat	Epic 2014 (
20	1003000639	EP	California	90095	Surgery	Medicare	2016 Stage 1	2		2	2017	2017	0 1314E01PNHSEAF	CHP-024722	Epic Systems Corp	EpicCare Ambulat	Epic 2014 (
21	1003000902	EP	Indiana	40212	Family Medicine	Medicare	2012 Stage 1	1		9	2012	2012	1 300000015W7HEAF	CHP-007428	GE Healthcare	Centricity Practice			
22	1003000902	EP	Indiana	40212	Family Medicine	Medicare	2013 Stage 1	2		3	2014	2014	1 A000001CJUEAF	CHP-009439	GE Healthcare	Centricity Practice	10.1.3		
23	1003000902	EP	Indiana	40212	Family Medicine	Medicare	2014 Stage 1	3		2	2015	2014	1 A014E01KHMOZEA	CHP-021419	GE Healthcare	Centricity Practice			
24	1003000902	EP	Indiana	40212	Family Medicine	Medicare	2015 Stage 2	4		2	2016	2016	1 1314E01PSDHEAF	CHP-028297	GE Healthcare	Centricity Practice	12.0 R3		
25	1003000936	EP	South Carolina	29203	Cardiovascular Disease	Medicare	2014 Stage 1	1		2	2015	2014	0 1314E01P3YNZAF	CHP-023137	Greenway Health	Greenway PrimeS 2014 (17.0			
26	1003000936	EP	South Carolina	29203	Cardiovascular Disease	Medicare	2015 Stage 1	2		3	2016	2016	0 1314E01P3YNZAF	CHP-023136	Greenway Health	Greenway PrimeS 2014 (17.0			
27	1003000936	EP	South Carolina	29203	Cardiovascular Disease	Medicare	2016 Stage 2	3		5	2017	2017	0 0014E01P3YNZAF	CHP-023136	Greenway Health	Greenway PrimeS 2014 (17.0			
28	1003000936	EP	South Carolina	29203	Cardiovascular Disease	Medicare	2016 Stage 2	3		5	2017	2017	0 0014E01P3YNZAF	CHP-023136	Greenway Health	Greenway PrimeS 2014 (17.0			
29	1003001256	EP	Colorado	80620	Family Medicine	Medicare	2013 Stage 1	2		12	2015	2014	0 300000015VWGEAF	CHP-007425	NextGen Healthca	NextGen Ambulat	5.6 SP1		
30	1003001256	EP	Colorado	80620	Family Medicine	Medicare	2014 Stage 1	3		2	2015	2014	0 A014E01NDHFMFA	CHP-022048	Epic Systems Corp	EpicCare Ambulat	Epic 2010 (
31	1003001256	EP	Colorado	80620	Family Medicine	Medicare	2015 Stage 2	4		1	2016	2016	0 1314E01PULSEAF	CHP-024722	Epic Systems Corp	EpicCare Ambulat	Epic 2014 (
32	1003001256	EP	Colorado	80620	Family Medicine	Medicare	2015 Stage 2	4		1	2016	2016	0 1314E01PULSEAF	CHP-024743	Epic Systems Corp	EpicCare Ambulat	Epic 2014 (
33	1003001256	EP	Colorado	80620	Family Medicine	Medicare	2016 Stage 2	5		2	2017	2017	0 1314E01RNCSEAF	CHP-024722	Epic Systems Corp	EpicCare Ambulat	Epic 2014 (
34	1003001256	EP	Colorado	80620	Family Medicine	Medicare	2016 Stage 2	5		2	2017	2017	0 1314E01RNCSEAF	CHP-027887	Epic Systems Corp	EpicCare Ambulat	Epic 2015		
35	1003001363	EP	California	92243	Pain Medicine	Medicare	2013 Stage 1	1		5	2013	2013	0 300000015VWGEAF	CHP-007490	Greenway Health	PrimeSuite	Epic 2015		
36	1003001462	EP	Georgia	30642	Radiation Oncology	Medicare	2015 Stage 1	1		3	2016	2016	0 1314E01P3YLAFAV	CHP-023026	Elekta - IMPAC Me	MOSAIQ			
37	1003001462	EP	Georgia	30642	Radiation Oncology	Medicare	2016 Stage 1	1		3	2017	2017	0 1314E01P3YLAFAV	CHP-023026	Elekta - IMPAC Me	MOSAIQ			
38	1003001645	EP	California	95815	Infectious Disease	Medicare	2013 Stage 1	1		8	2013	2013	0 AOH1301FVVLVEAF	CHP-019280	athenahealth, Inc.	athenaClinicals			

MU_REPORT (1)

Calculating (4 Processes): 3% Average: 0.65453868 Count: 102532 Sum: 671114

Type here to search

2:18:04

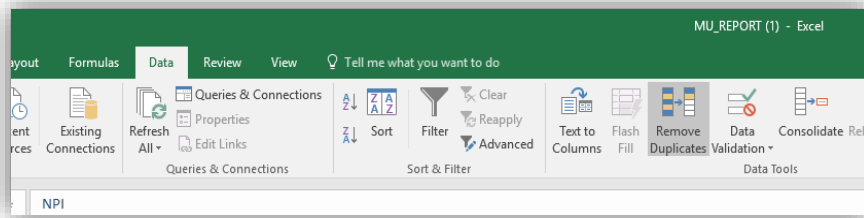
Summary
Average: 0.654538468 Count: 1025325 Sum: 671114

Steps Taken:

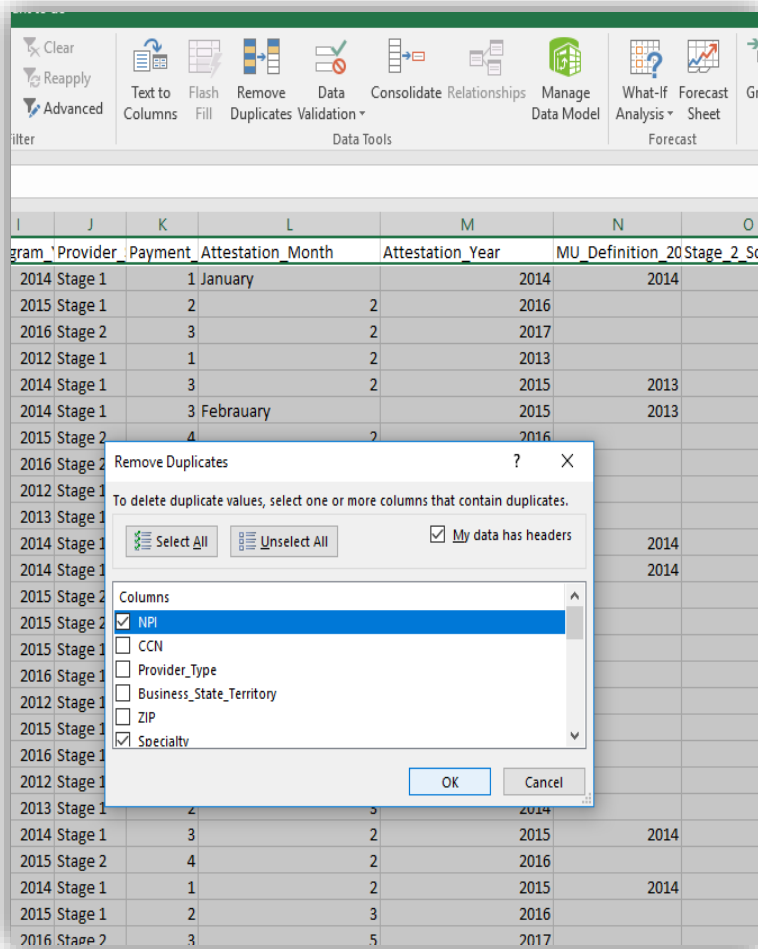
Based on the NPI number, Program Type, program Year, Stage multiple rows were duplicate and those were removed. Altogether 402122 rows were duplicate and were removed out of 1025325.

Used excel formula for removing duplicated values Under Data -> Remove Duplicate

Click on Data-> Remove Duplicate as shown below:

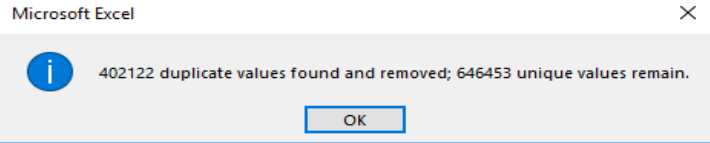


Select the proper columns -> Click OK



Duplicate Values will be deleted as shown below:

dicare	2013	Stage 2	4	2	2016		
dicare	2016	Stage 2	5	1	2017		
dicare	2012	Stage 1	1	11	2012		
dicare	2013	Stage 1	2	3	2014		
dicare	2014	Stage 1	3	2	2015	2014	
dicare	2015	Stage 2	4	2	2016		
dicare	2015	Stage					
dicare	2016	Stage					
dicare	2012	Stage					
dicare	2015	Stage					
dicare	2016	Stage					
dicare	2012	Stage					
dicare	2013	Stage 1	2	3	2014		
dicare	2014	Stage 1	3	2	2015	2014	
dicare	2015	Stage 2	4	2	2016		
dicare	2014	Stage 1	1	2	2015	2014	
dicare	2015	Stage 1	2	3	2016		
dicare	2016	Stage 2	3	5	2017		



Example Shown Below:

NPI number 1003932955 had multiple entries for year 2013.

105	1003932955	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2012
106	1003932955	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2013
107	1003932955	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2013
108	1003932955	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2013
109	1003932955	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2013
110	1003932955	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2014

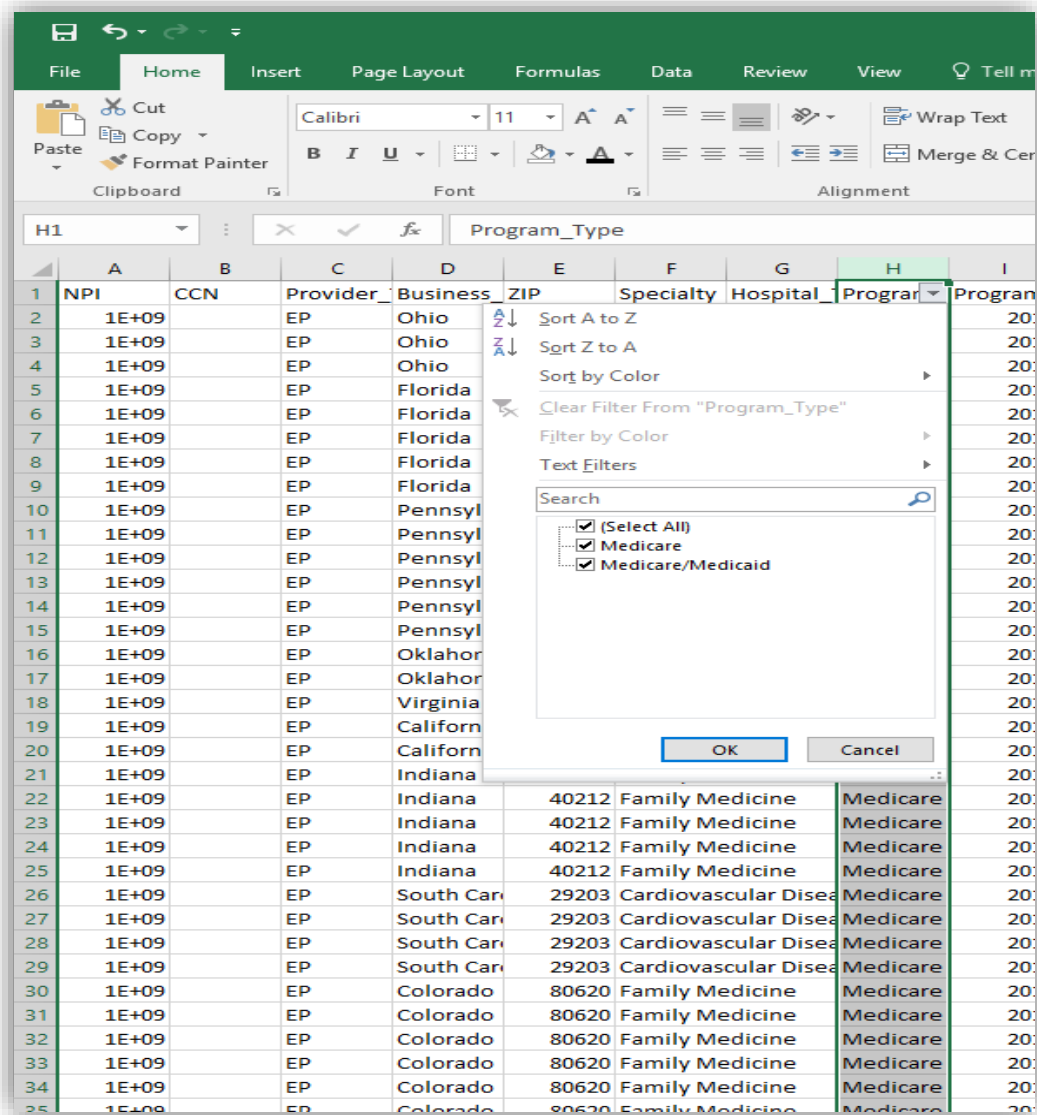
After Cleaning:

104	1003925207	EP	Alabama	32.806671	-86.79113	Internal Medicine	General	Medicare	2015
105	1003932955	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2012
106	1003932955	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2013
107	1003932955	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2014
108	1003932955	EP	Alabama	32.806671	-86.79113	Interventional Cardiology	General	Medicare	2015

TYPE 3: Incomplete Data:

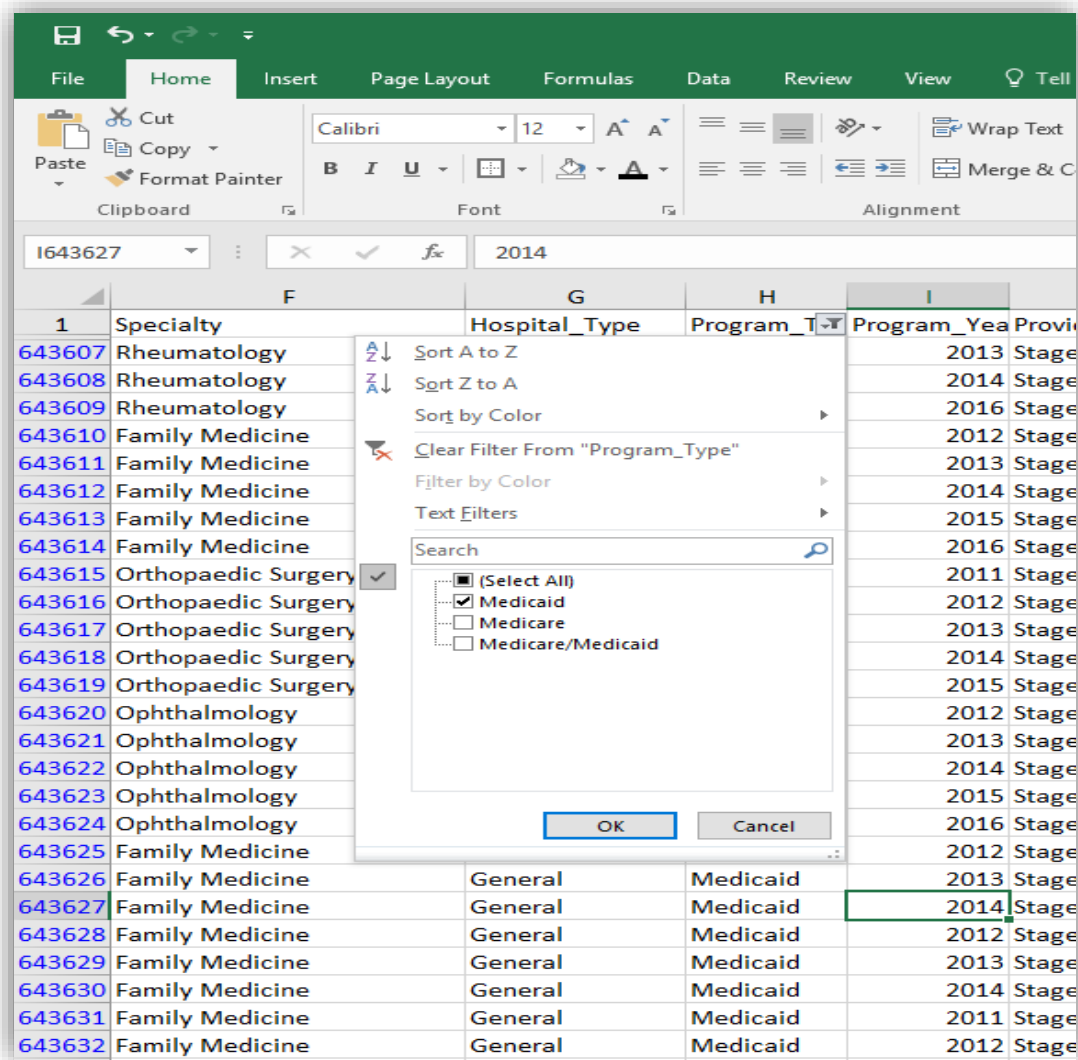
Category 1: Original Dataset Contained only two types of Program ie Medicare & Medicare/Medicaid. Medicare Program was missing. Merged Medicaid Program type to the datasheet.

Before Data Cleaning:



Step Taken: Added the medicaid Program Type with relevant data as per columns manually.

After Data Cleaning:



Example for Medicaid rows:

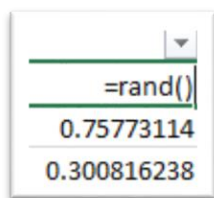
1	NPI	Provider_T	State	Latitude	Longitude	Specialty	Hospital_Type	Program_T
643607	1225115116	EP	Alabama	32.806671	-86.79113	Rheumatology	Critical Access	Medicaid
643608	1225138894	Hospital	Alabama	32.806671	-86.79113	Rheumatology	Critical Access	Medicaid
643609	1225138894	EP	Alaska	61.370716	-152.40442	Rheumatology	Critical Access	Medicaid

Category 2: Payment received column was added to make the dataset for meaningful and complete. Amount values were taken from different datasheet (mentioned in URL's).

Steps Taken: Amount were inserted with the formula:=rand() which gives the initial value. In the next coloum ie Amount received columns. Select the initial value cell ie =Initialvaluecell/sum(initialvaluecell:lastvaluecell)*total amount. This will insert the amounts in respective rows for particular selected field.

Example is shown below:

Inserting initial value and dragging down.



Inserting Amount:

	T	U
		Amount received
11	0.467964072	=T2/SUM(T2:T12)*12657
11	0.75773114	
11	0.300816238	
14	0.135759765	
11	0.46839659	
14	0.42022805	
14	0.073815606	
14	0.500973257	
11	0.00771054	
11	0.734541044	
14	0.728911603	

After insertion:

▼	Amount received	▼
0.536802263		6298.477112
0.75773114		23580.90378
0.300816238		9363.172071
0.135759765		4225.938257
0.46839659		14580.7374
0.42022805		13082.72016
0.073815606		2298.283505
0.500973257		15598.30469
0.00771054		240.1033432
0.734541044		22873.37497
0.728911603		22701.95038
0.901114652		28069.96861

TYPE 4: Data Irrelevancy

Removed irrelevant columns which were not needed for data visualization

Before Data Cleaning:

O	P	Q	R	S	T	U
Stage_2_Scheduled	EHR_Certification	EHR_Product_CHP	Vendor_Name	EHR_Product_Name	EHR_Product_Version	Product_Classification
0	A014E01NC9ZLEA1	CHP-022045	Epic Systems Corp	EpicCare Ambulate	Epic 2012 (June 2013 CC	Complete EHR
0	A014E01NCEULEA1	CHP-022044	Epic Systems Corp	EpicCare Ambulate	Epic 2014 (June 2013 CC	Complete EHR
0	1314E01QPVP1EAN	CHP-027887	Epic Systems Corp	EpicCare Ambulate	Epic 2015	Complete EHR
1	30000001SVGWEA	CHP-007425	NextGen Healthcare	NextGen Ambulate	5.6 SP1	Complete EHR
1	A0H1301NC8QYEA	CHP-018548	NextGen Healthcare	NextGen Ambulate	5.8	Complete EHR
1	A0H1301NC8QYEA	CHP-021999	NextGen Healthcare	NextGen Ambulate	5.8.0.77	Complete EHR
1	1314E01PHNJKEA5	CHP-023369	NextGen Healthcare	NextGen Ambulate	5.8.1	Complete EHR
1	0014EWR4DR4GCC	14.07.07.2880.ATA	athenahealth, Inc	athenaClinicals	16.11	Complete EHR
1	30000004TQGM EA	CHP-008032	Allscripts	Allscripts Enterprise	11.2	Complete EHR
1	30000004TQGM EA	CHP-008032	Allscripts	Allscripts Enterprise	11.2	Complete EHR
1	A014E01O5FAMEA	CHP-019270	Get Real Health	InstantPHR	3	Modular EHR
1	A014E01O5FAMEA	CHP-021796	Allscripts	Allscripts Enterprise	Version 11.4.1 (CQM P	Modular EHR
1	1314E01PDRTLEAR	CHP-019270	Get Real Health	InstantPHR	3	Modular EHR
1	1314E01PDRTLEAR	CHP-022204	Allscripts	Allscripts TouchWor	11.4.1	Modular EHR
0	1314E01PHNJKEA5	CHP-023369	NextGen Healthcare	NextGen Ambulate	5.8.1	Complete EHR
0	1314E01PHNJKEA5	CHP-023369	NextGen Healthcare	NextGen Ambulate	5.8.1	Complete EHR
1	30000004S9VAEA0	CHP-008186	MPN Software Sys	ECLIPSE	2011	Complete EHR
0	1314E01PNI95EAB	CHP-024722	Epic Systems Corp	EpicCare Ambulate	Epic2014 (June 2013 CC	Complete EHR
0	1314E01PNI95EAB	CHP-024722	Epic Systems Corp	EpicCare Ambulate	Epic2014 (June 2013 CC	Complete EHR
1	30000001SW7XEA5	CHP-007428	GE Healthcare	Centricity Practice	9.5	Complete EHR
1	A0000001CJJK1EAN	CHP-009439	GE Healthcare	Centricity Practice	10.1.3	Complete EHR

After Data Cleaning:

All the irrelevant columns were deleted to make the dataset more simplified and less crowded.

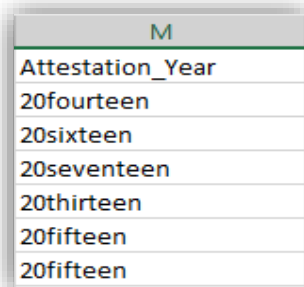
O	P	Q	R	S
Stage_2_Scheduled	EHR_Product_N	Product_Classific	Product_Setti	Product_Certification_Edition_Yr
1	Centricity Pract	Complete EHR	Ambulatory	2011
1	Centricity Pract	Complete EHR	Ambulatory	2011
1	Centricity Pract	Complete EHR	Ambulatory	2011
1	ezAccess Patien	Modular EHR	Ambulatory	2014
0	Powerchart and	Modular EHR	Ambulatory	2011
0	FairWarningÆ I	Modular EHR	Ambulatory	2014
0	FairWarningÆ I	Modular EHR	Ambulatory	2014
0	HealthLife and	Modular EHR	Ambulatory	2014
1	Allscripts Profe	Complete EHR	Ambulatory	2011
1	Allscripts Profe	Complete EHR	Ambulatory	2011
1	Allscripts Profe	Complete EHR	Ambulatory	2014
1	Allscripts Profe	Modular EHR	Ambulatory	2014
1	Powerchart and	Modular EHR	Ambulatory	2011
1	Powerchart and	Modular EHR	Ambulatory	2011
1	FairWarningÆ I	Modular EHR	Ambulatory	2014
1	Centricity EMR	Complete EHR	Ambulatory	2011
1	Centricity EMR	Complete EHR	Ambulatory	2011
1	Centricity EMR	Complete EHR	Ambulatory	2011
1	Centricity Pract	Modular EHR	Ambulatory	2011
1	ezAccess Patien	Modular EHR	Ambulatory	2014
1	ezAccess Patien	Modular EHR	Ambulatory	2014
0	EpicCare Ambu	Complete EHR	Ambulatory	2011
0	PrimeSuite	Complete EHR	Ambulatory	2011

TYPE 5: Improper Data Format:

Category 1: Incorrect Year format

Year mentioned was in combination of string and numbers

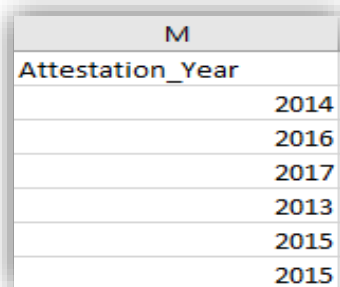
Before Data Cleaning:



A screenshot of a data table with a grey header bar containing the letter 'M'. The table has a column titled 'Attestation_Year'. The data rows contain the following values: '20fourteen', '20sixteen', '20seventeen', '20thirteen', '20fifteen', and '20fifteen'.

Attestation_Year
20fourteen
20sixteen
20seventeen
20thirteen
20fifteen
20fifteen

After Data Cleaning: Year was visible in number format



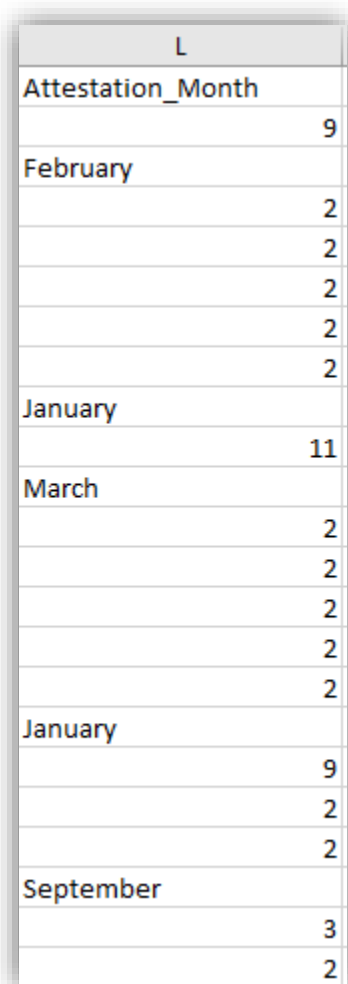
A screenshot of a data table with a grey header bar containing the letter 'M'. The table has a column titled 'Attestation_Year'. The data rows contain the following values: '2014', '2016', '2017', '2013', '2015', and '2015'.

Attestation_Year
2014
2016
2017
2013
2015
2015

Category 2: Inconsistency within the column

Months are in the string as well as numerical format

Before Data Cleaning



L
Attestation_Month
9
February
2
2
2
2
2
January
11
March
2
2
2
2
2
January
9
2
2
September
3
2

Steps Taken:

Changed the month cloumns into numerical formal. Used Replace option

Select the particular coloumn ->CtrlF -> Replace -> Find and Replace -> Replace All

K	L	M	N	
Payment	Attestation_Month	Attestation_Year	MU_Definition_20	Stage
1	January	2014	2014	
2	2	2016		
3	2	2017		
1	2	2013		
3	2	2015	2013	
3	February	2015	2013	
1	September	2012		
	2	2016		
	2	2017		
1	9	2012		
2	3	2014		
3	2	2015	2014	
4	2	2016		
5	1	2017		
1	2	2015	2014	

Find and Replace

Find Replace

Find what: January

Replace with: 1

Options >>

Replace All Replace Find All Find Next Close

After Data Cleaning:

Strings were changed to Numerical format.

L	
Attestation_Month	
	9
	2
	2
	2
	2
	2
	2
	2
	1
	11
	3
	2
	2
	2
	2
	2
	2
	1
	9

DATA VISUALIZATION:

Research Questions:

Q.1. Show participation of maximum number of providers in meaningful use incentive program and total payments received accordingly?

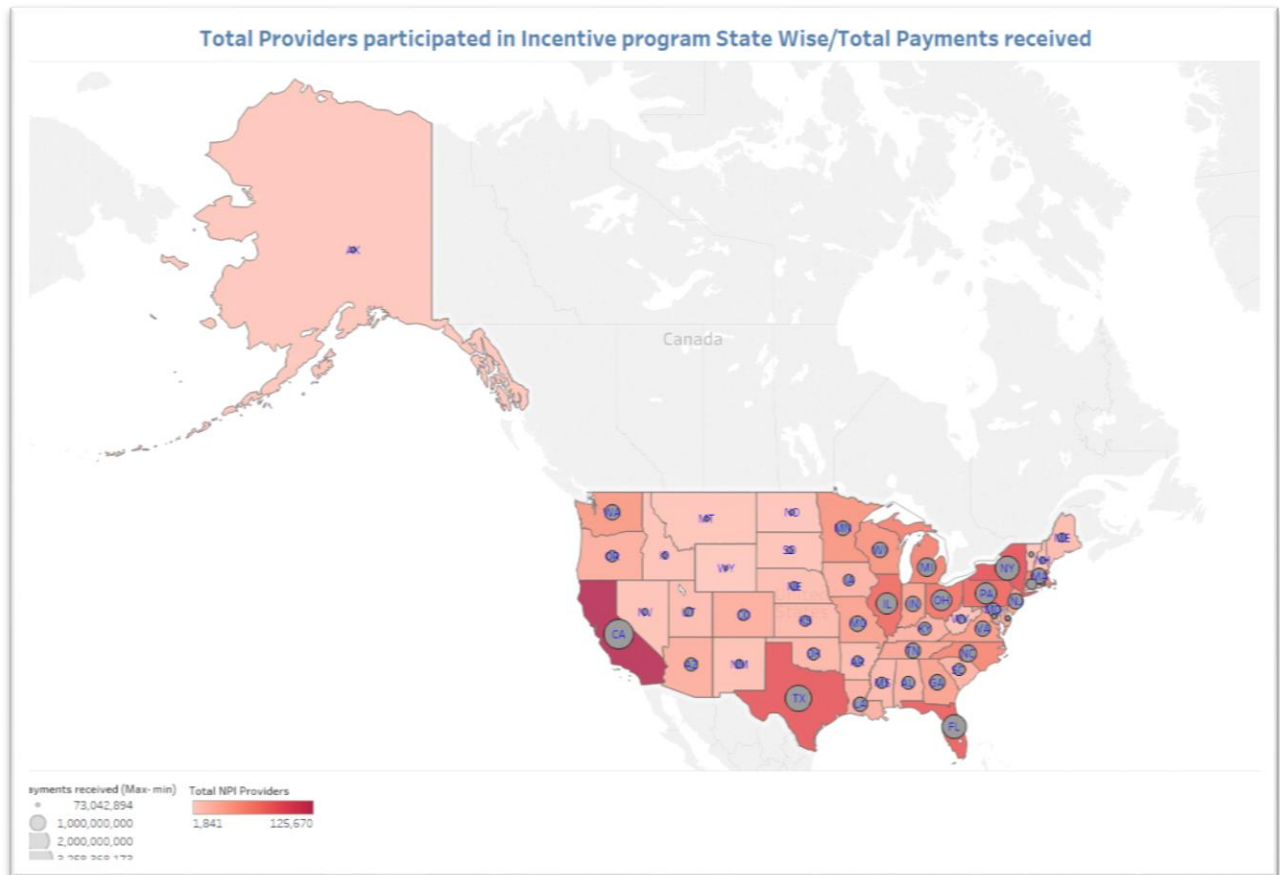


Tableau Features used:

Geographic Maps, Dual Axis, Marks Card, Filter

Marks Card- Color shows sum of total providers participated in program, Labels show State name and count of total providers.

By using dual Axis: Marks Card Size (grey circle) show total amount received for each state.

Graph shows the number of providers participated in meaningful use incentive program to improve the health facility in USA. As shown in graph, state of California, Florida, Illinois hold maximum number of participation. California has 125670 providers, Florida has 80417 providers, Illinois has 71901, Massachusetts has 58048. State of Wyoming holds 1841 participation of providers which is the lowest participation in United states of America. California has received the maximum total amount worth \$3,258,168,173. Wyoming has received lowest amount worth \$73042894. State with maximum providers and payments, interpret how effectively EHR technology providers are adopting by meeting requirements in order to qualify for the incentive plan.

Q.2. Show Total Medicare/Medicaid Amount received by each state?

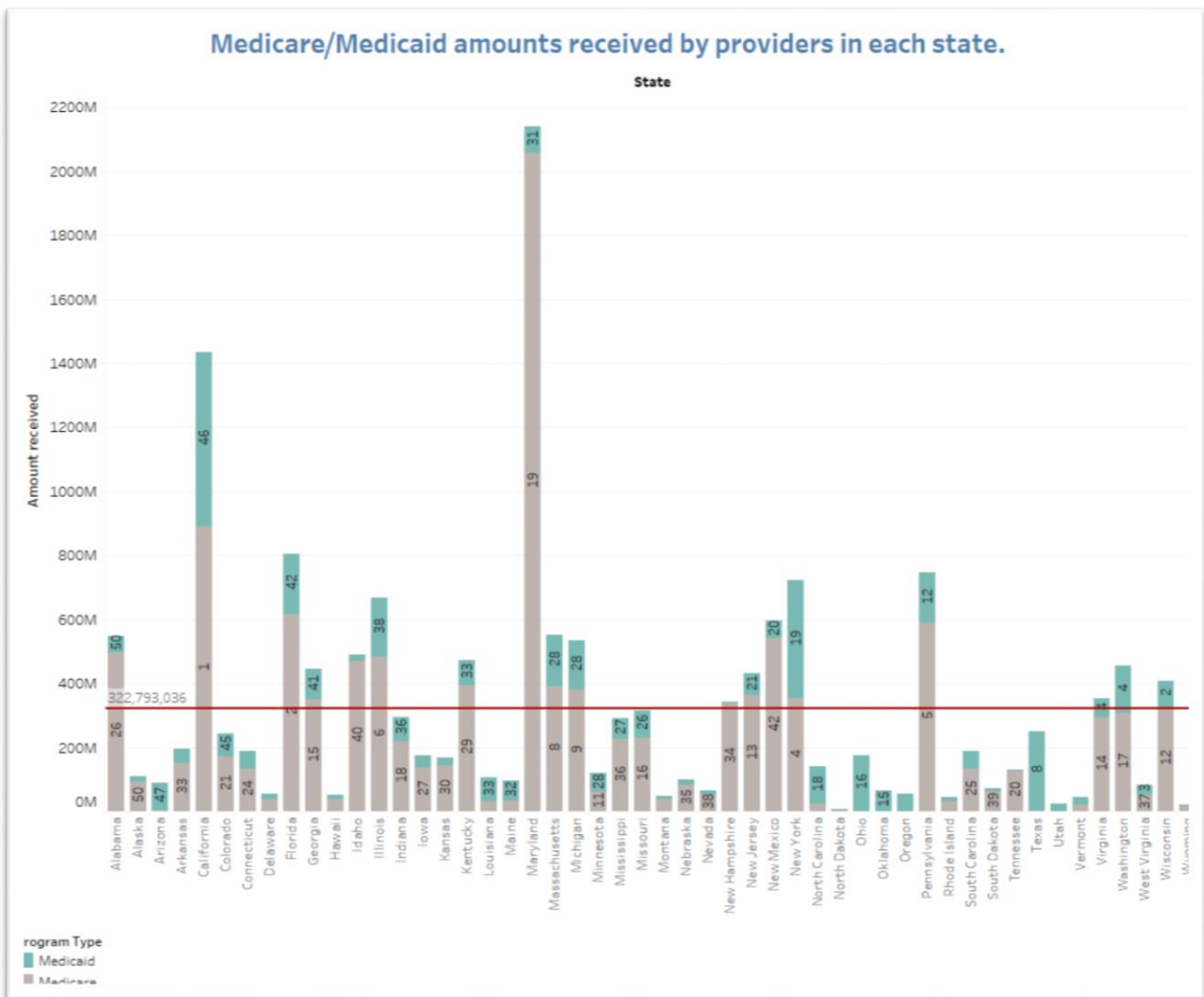


Tableau Features: Stacked Bar, Reference Line, Rank

Marks Card- Bar(Automatic), Filters, Color shows details about the Program types

The above visualization shows Medicare and Medicaid Programs amount received by each state. State of California has highest combined payment received and North Dakota have lowest combined payment received. Amount received ranges from \$9455 to \$2,056,777,658. Green shade shows the Medicaid Program amounts and Grey Shade shows the Medicare Program amount. As

per the Reference line the average amount of payments received by each state is \$322,793,035. Highest Medicare amount received is in state of California and highest Medicaid amount received is in state of Maryland. Rank reflects the rank of state as per program and amount received. As per the statistics it is evident that amount received for Medicare program is higher than the Medicaid Program in United States.

Q.3. Number of Providers who adopted EHR technology since 2011 and forecast for 2017?

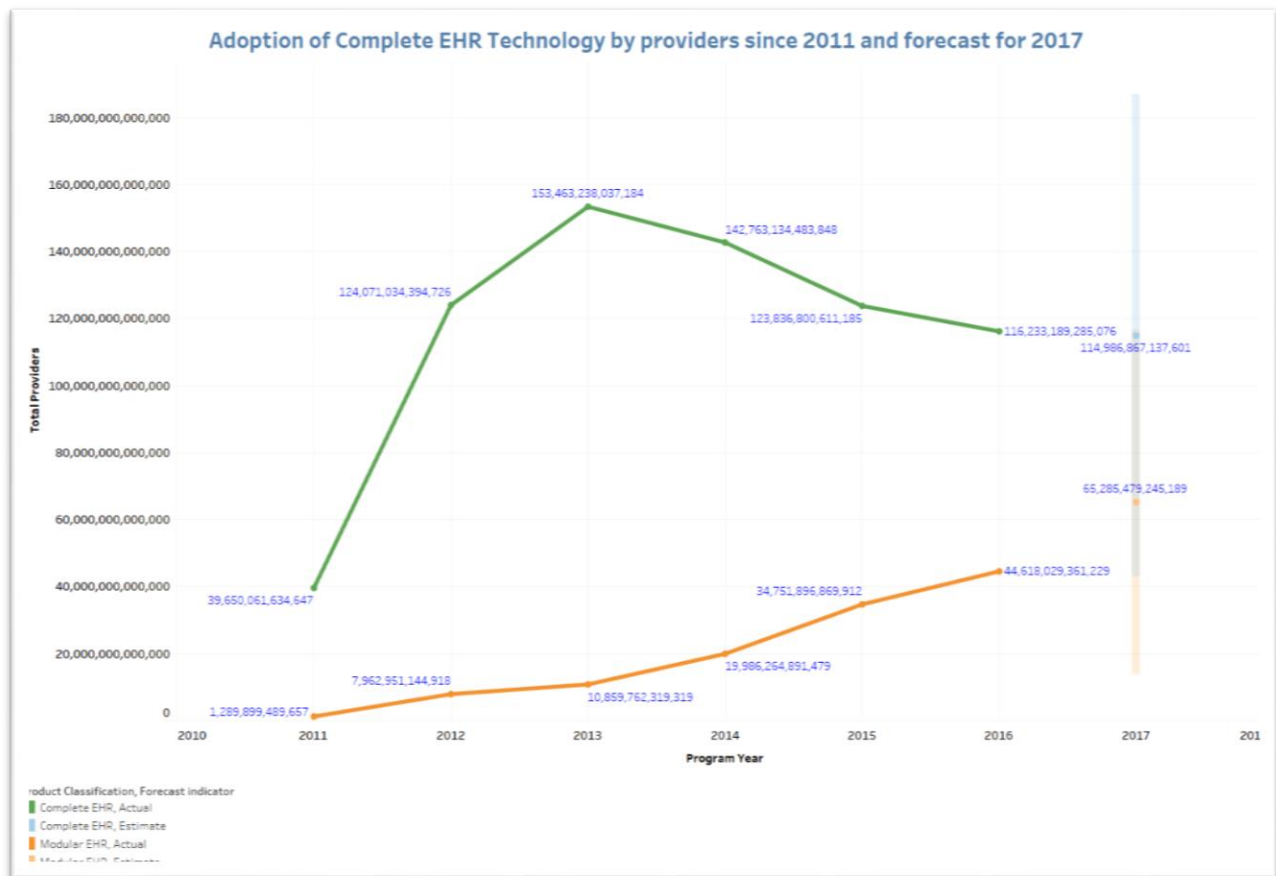


Tableau Features: Line chart, Forecast Trend Line

Marks Card- Line Chart, Forecast Trend, Colors, Label, Size

Products are classified as Complete and Modular EHR Products. Complete EHR product is the highly advanced product. As per the visualization, as of 2016 adoption of Complete EHR product from Modular EHR product has drastically increased from 44618029361229 providers to 116233189258076 providers. In 2010 there were only Basic EHR available. In 2011 39650061634647 providers switched to Complete EHR product in order to meet meaningful use criterias and effective use of patient safety, security, quality of healthcare provided. As per the

previous years statistics, 2017 adoption is predicted which will be calculated after stage 2 attestation scheduled in May 2018. Around 114986867137601 providers must have adopted Complete EHR technology.

Q.4. Top Speciality providers who are scheduled for Stage 2 meaningful use attestation?

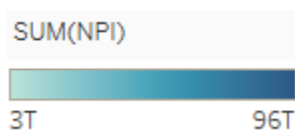
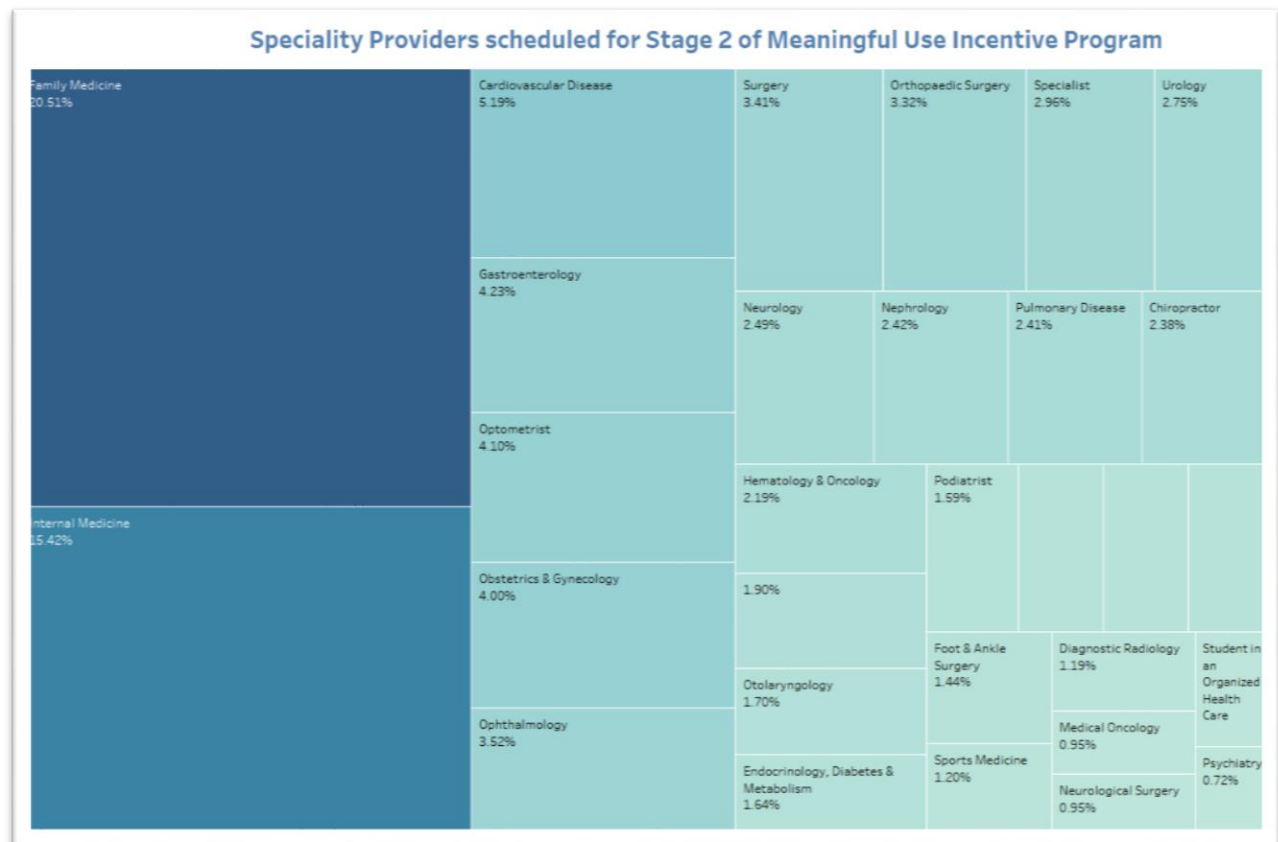


Tableau Features: Tree Map

Marks Card- Colors, Label, Filters

As per the tree map, it shows the percentage of providers from the Specialty Hospitals who are scheduled for Stage 2 Attestation. Family Medicine has highest percentage of Providers who are scheduled for Stage 2 Program of Meaningful use Incentive program. Stage 2 is the second criteria program in order to be eligible for Incentive Payment by government. If the providers fail to

achieve mentioned criteria during the attestation period, they might be charged depending upon the measures missed or won't be eligible for the respective stage. Psychiatry Specialty have least percentage of providers scheduled for the stage 2.

Q.5. Top IT Providers who used 2011, 2014, 2015 certified EHR?

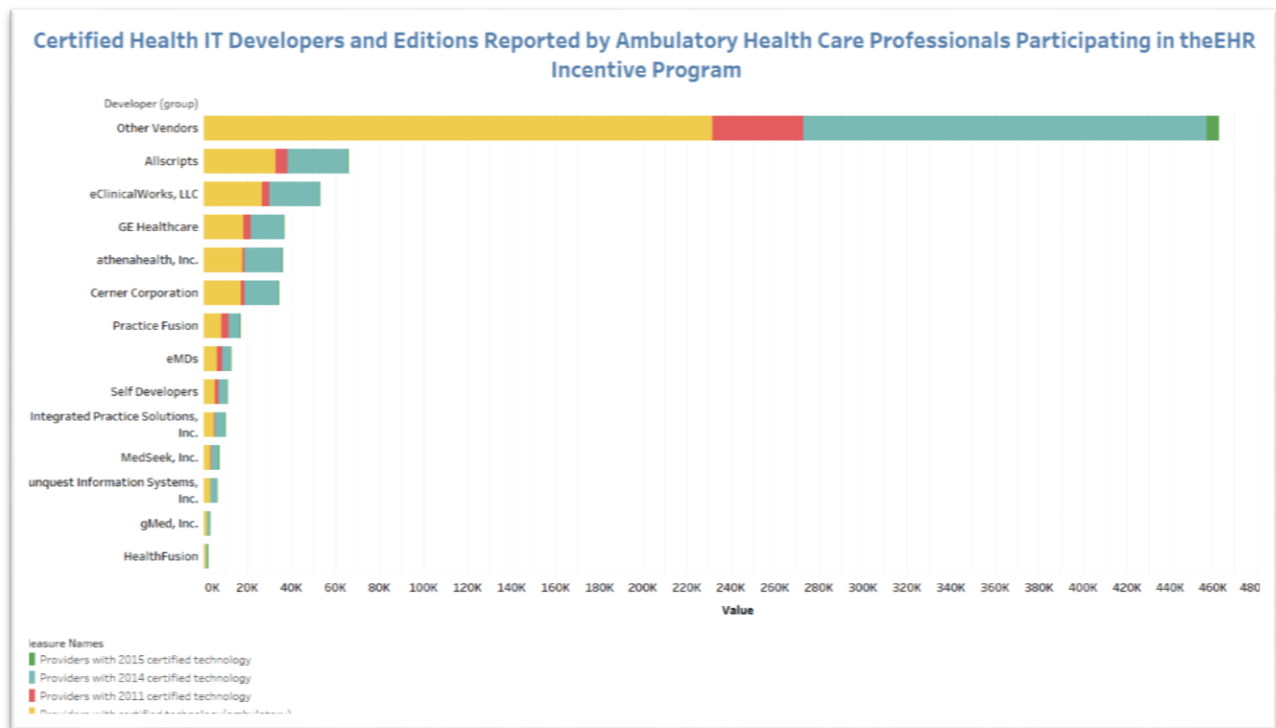


Tableau features: Stacked Bar, Groups, Sorting

Mark Card- Filter, Label, Color

The above Stacked bar, shows the top vendors/IT developers held the providers with Certified Products of 2011,2014,2015. Other vendor group consists of all common vendors. Almost 231606 providers of other vendors use Certified EHR technology. Only 5,875 vendors out of the total vendors use the latest 2015 edition EHR. Big Private firms like Sunquest Information Systems and gMed have not adopted 2015 edition HER product. As per the visualization, although vendors have certified her product. It is equally important to adopt the latest 2015 edition product in order to achieve all the measures and effectively use the technology in healthcare field to improve the healthcare quality given to patients.

Q.6. Number of Providers attested monthly w.r.t year 2016?

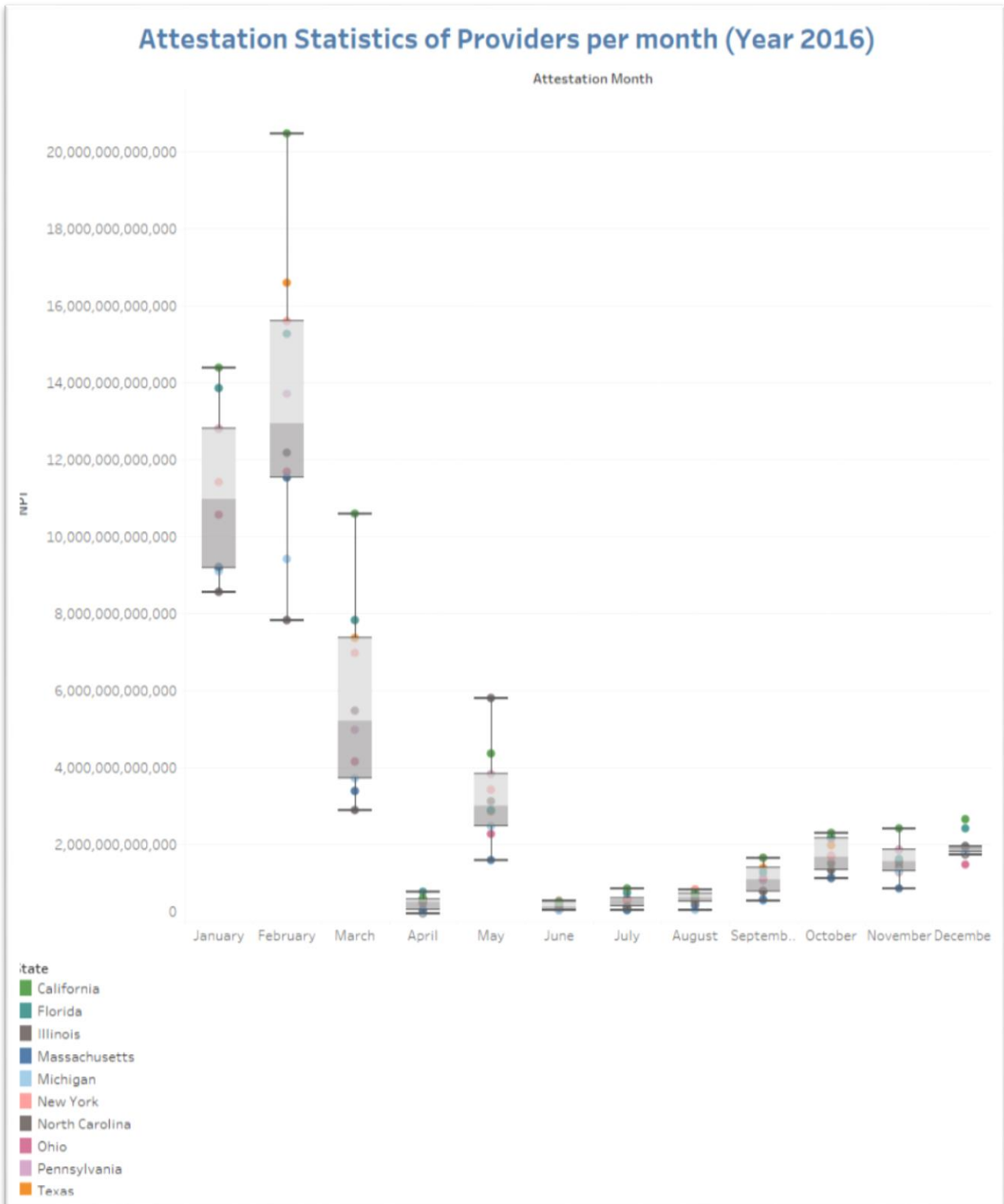
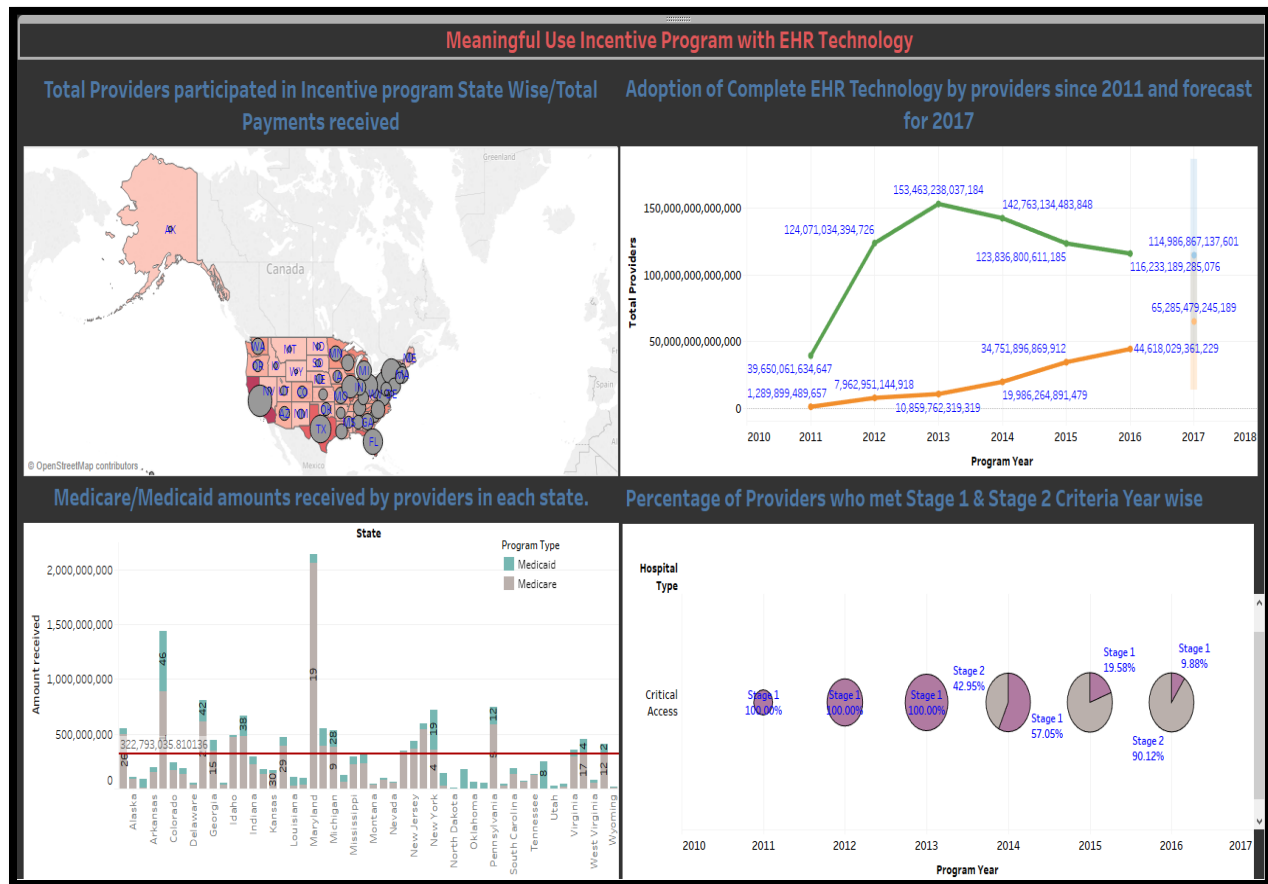


Tableau Features: Box & Whisker Plot, Parameters-Program Type which shoes Medicare and Medicaid Types

As per the statistic shown above, California as least which is at the outlier every month. Majority of providers have attestations in month of February from states of Pennsylvania, Florida.

December and June have least scheduled attestations. As per statistics we could interpret that maximum attestations are scheduled during the first four months. The reason for this can be because providers have to follow the after process of attestation so they try to do the attestations earlier. Around maximum of 16,000,000,000,000, average of 11,000,000,000,000 and minimum of 9,000,000,000,000 providers participated in Attestations.

DASHBOARD:



Dashboard shows the statistics of Meaningful Use Incentive program with EHR Technology. It shows how many providers have participated in respective program as per the state. It also shows the payment received with respect to Medicare and Medicaid programs. Adoption of EHR technology since last three years has been shown. In order to be eligible for the incentive program Stage 1 and Stage 2 requirements should be fulfilled by the providers. Percentage of providers who met Stage 1 & Stage 2 graphs shows the percent of providers who met the criteria since Year 2011.

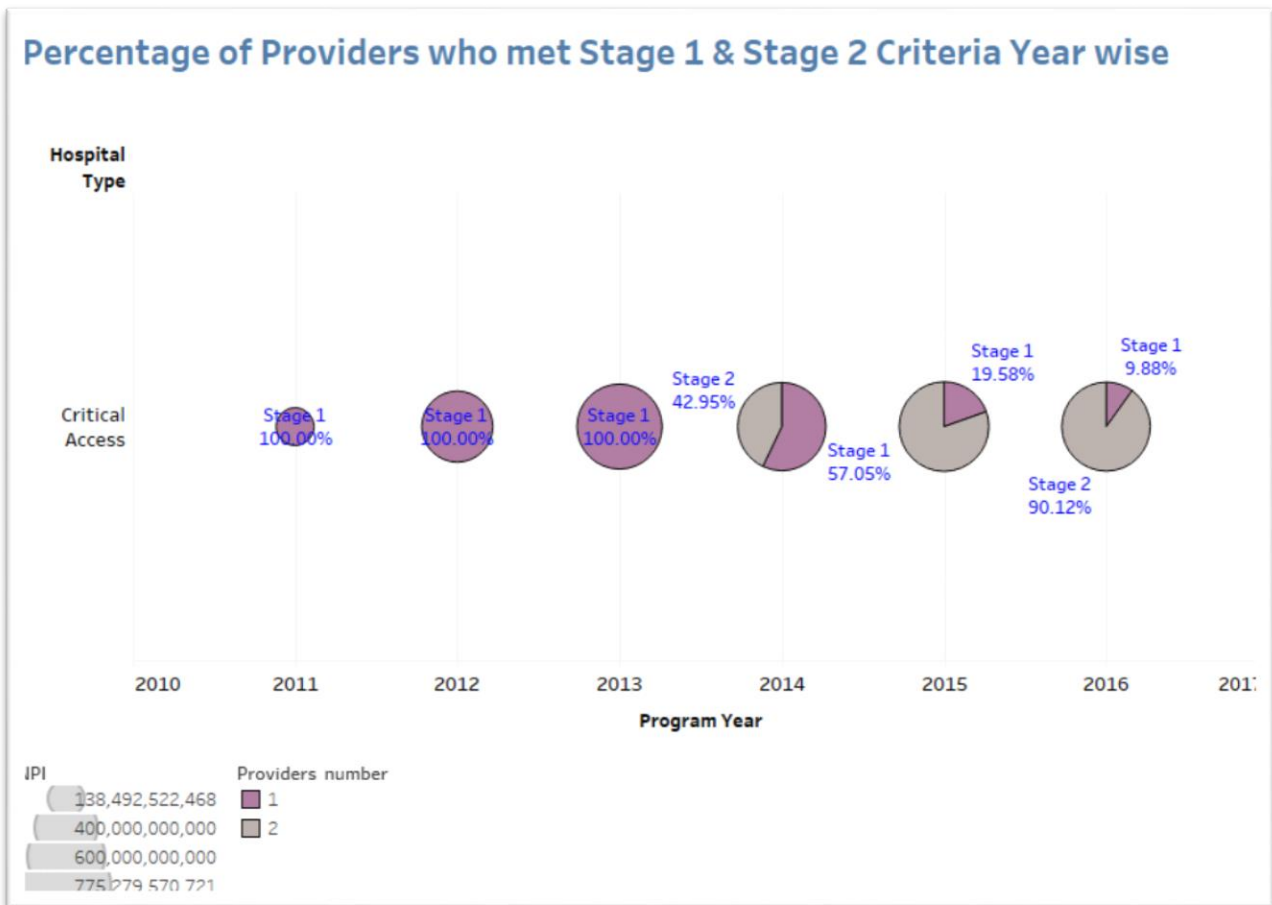


Tableau Features: Pie chart, Parameter- Program Type

Above visualization shows the Percentage of Providers who were in Stage 1 & Stage 2 since 2011. Stage 2 was introduced in Year 2014. Lot of providers met the Stage 2 requirements in Year 2016 i.e. about 90.12 %. It can be clearly interpreted that the providers are adopting the EHR for better healthcare quality by meeting the requirements mentioned in the stages. The reason for maximum percentage of Stage 2 requirement participation in 2016 was because Providers had already met the Stage 1 requirements in large number.

STORYTELLING:

State wise Total Providers participated in Incentive program	Percentage of Providers in Stage 1 & Stage 2 since 201	State Breakdown of Medicare/Medicaid Pavments providers	Adoption of EHR technology by providers since 2010	Number of IT developers using certifies EHR Product
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Beginning from the year 2011, Medicare and Medicaid Incentive program were developed to encourage eligible professions and providers to adopt and implement the meaningful use of certified EHR technology. Meaningful Use Program was introduced to adopt electronic health record system with a goal to improve health quality, safety, provider efficiency and efficiency for patient care. It was introduced as part of 2009 Health Information Technology for Economic & Clinic Health (HITECH) Act to encourage health care providers to show how meaningfully they make use of Certified Electronic Health Record (CEHR).

Criteria Eligibility:

As per CMS (Centre for Medicare & Medicaid services) EHR incentive program, Eligible professionals (EP's) & Hospitals need to successfully meet criteria of meaningful use of EHR to qualify for incentive program. In order to achieve criteria, Eligible Provider's & Hospital's should adopt CEHR technology and achieve objectives and measures specified for meaningful use as per their stages. Stages are divided into Stage 1 and Stage 2.

Participation:

Almost every provider in entire United States is now participating in the Meaning Use incentive program. State wise, California has maximum participation as well as received maximum payment on the other side Wyoming has the lowest participation.

Fulfilling the criteria as per stages:

Stage 1 requirements involves use of EHR functions which include electronic prescribing, maintaining drug list, medication, allergy list etc. Providers should meet 15 core measures and 5 additional specified measures. Stage 2 requirements focusses on patient care improvement. Providers must meet 16 core and 3 additional measures. As per statistics in year 2011 and 2012 100 % of providers fulfilled the stage 1 requirements. Stage 2 was introduced in year 2013 and 43% of providers fulfilled the criteria. Attestation as per months were also calculated which showed that although many providers are meeting the criteria and attestation, rest should also speed up with the adoption so that they won't have to pay the penalty for rest of the upcoming year. If the providers do not attest or meet the criteria of the mentioned stages they have to pay the penalty.

Article **“Early Results of Meaningful Use Program for Electronic Health Record”** written by Doctors in Boston and Texas show the similar Statistics and interpretation. They calculated the attestation rates according to state, specialty, EHR Vendor and Month between April 2011 and May 2012. They also considered the count of providers who have not attested or participated in Meaningful Use program. As per May 2012 they figured around 62226 eligible providers attested to meaningful use under Medicare Program including specialty and primary care providers. Family practitioners has higher attestation rates and also providers adopted EHR from 310 vendors. They concluded that even though adoption of EHR and attestations are increasing rapidly there are bulk of providers yet to participate and they may have to pay penalty. They also express that downstream effect of meaningful use on Healthcare EHR Technology are yet unknown.

Medicare/Medicaid Payments:

As per statistics it shows that, in general Medicaid Payments are less in entire United States compared to Medicare Payments. As per the Article Medicare and Medicaid Payments Rates for Doctor by State written by Greg Kelly shows Percentage of Medicare Medicaid patients as per

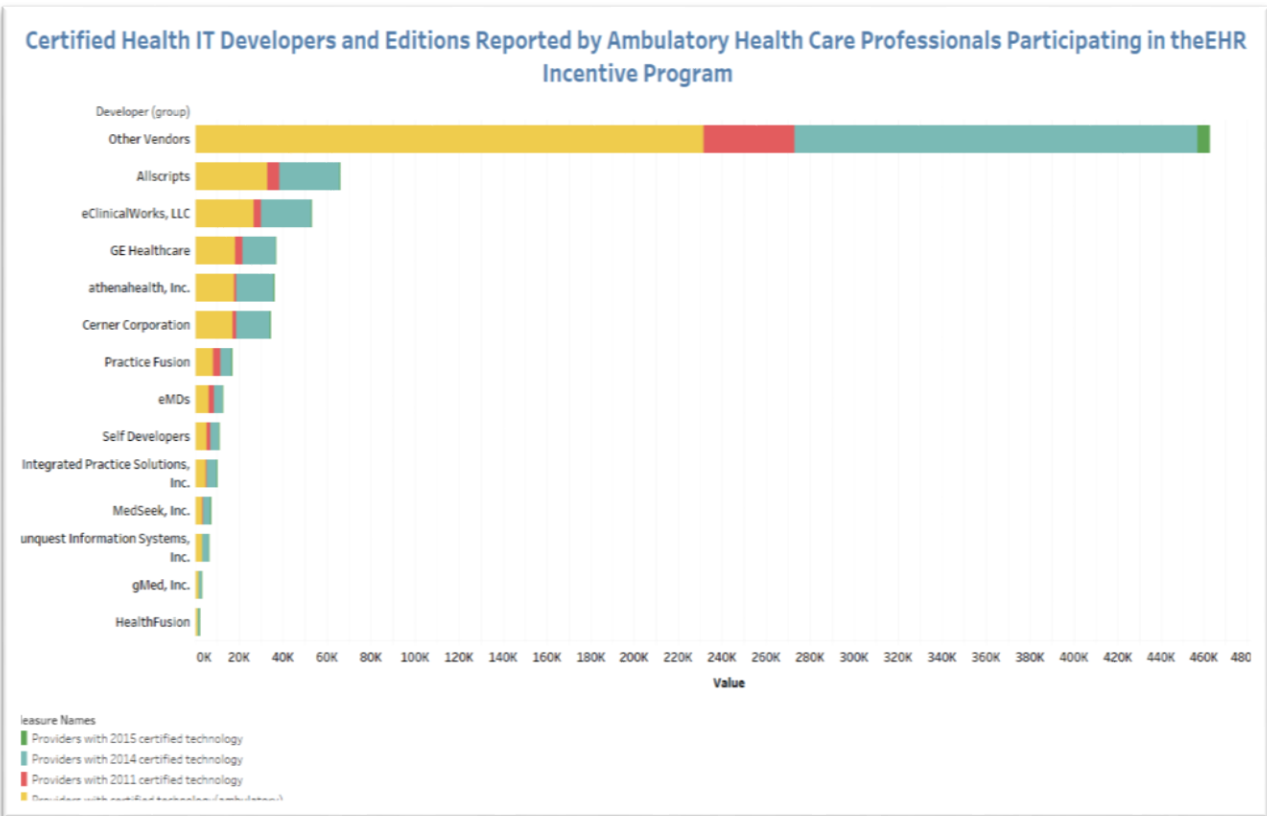
State. He suggests the possible reasons behind the low amount received for Medicaid program and high amount received for Medicare Program. Article shows the below statistics:

Percentage of Physicians who say they do not see the Medicare patients

Top 5		Bottom 5	
Nevada	22.50%	South Dakota	2.90%
Virginia	22.20%	Maine	5.00%
New Jersey	18.90%	North Dakota	5.60%
Arkansas	18.50%	Montana	5.70%
Texas	18.40%	Iowa	8.00%

Another article by David Stone in **Health Services Research** expresses the comparison between Medicaid and Medicare payments. He states that, the stages and requirements to fulfil for Medicaid program is complex. Also, the majority of Inpatient category falls under Medicaid which makes it more difficult.

Using Certified EHR Technology:



Today, there are various EHR technology products available in market with different versions. The ever-changing landscape of technology dramatically changes software and allied products. The more recent versions have more updated features and functionalities. There are modular and complete EHR products available in the market. For the efficient use of healthcare, patient safety providers are adopting the updated and certified versions rapidly. To avoid the payment adjustment and fulfil all the measures in incentive plan, providers must use the certified EHR products. Certified EHR products have high capability, technology and functionality to fulfil the criteria specified in stages involved in order to receive payment. Modular EHR do not have all the functionalities which might be problematic to fulfilling all the measures. Hence providers are shifting towards recent editions since Year 2011. Recent editions come with patient security, safety

and healthcare quality. However, it has been observed that many providers are yet to switch to 2015 edition. Though they have adopted the EHR technology it is equally important to use the latest edition which gives all the functionalities, and our IT developers are still working towards it to make it more efficient

In the article “Expert Advice on how to improve Health IT Use and its Interoperability”, Kate Monika suggests that even though meaningful use program has made lot of difference in health care industry in United states and adoption by physician is highly commendable, there are lot of things yet to be worked. It highly failed to encourage the providers to adopt the certified version which covers all the measures. Its main focus is now on increasing the interoperability and improving healthcare technology so that providers can efficiently work with the measures. As per Health IT Quick Stats Report, 684 IT developers supply certified health IT products to 354394 ambulatory providers. Around 82% have 2014 certified technology including eClinical Works, Epic Systems, Athena Health. Epic System alone provides 2014 certified technology to around 30% of total providers.

Adoption of EHR technology and its effects:

Entire focus of implementing this program was to Improve the Healthcare, patient safety, security, quality. Health Research centers took the survey to see how efficiently the use of EHR technology has benefited the physicians. Over 79% physicians who have not met MU criteria and 88% who meets MU criteria say that adoption of EHR technology has proved beneficial to their practice. Over 75 % of physicians say that their practice functions efficiently. Over 72% Physicians say that it produces financial benefits to the practice.

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