INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

- Team Name: Echo
- Team Number: 5
- Team Members: Amey Bhivshet (001383083)

  Harikrishnan Shajil Kandampully (001473490)

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

❖ Objective:

Our objective is to Provide a high-level view on Opioid Prescriber Summary, Medicare Provider Utilization and Drug Abuse Deaths among states in the United States. The module allows us to integrate Medicare data into an Enterprise Data Warehouse (EDW) and provide Business Intelligence insights on the trends in Opioid Prescription Rate, Medicare Spending when it comes to Opioid, the total cost associated with the drug, the states with most opioid prescriptions and their relationship with the opioid abuse deaths for the years 2013 – 2017. The datasets used are the following:

- *Medicare Part D Opioid Prescriber Summary File (2013-2017)*

https://data.cms.gov/Medicare-Part-D/Medicare-Part-D-Opioid-Prescriber-Summary-File-201/e4ka-3ncx/data

Medicare Part D Opioid Prescriber Summary File, which presents information on the individual opioid prescribing rates of health providers that participate in Medicare Part D program.

- *Medicare Provider Utilization and Payment Data (2013-2017)*

https://data.cms.gov/Medicare-Part-D/Medicare-Provider-Utilization-and-Payment-Data-201/yvpj-pmj2/data

Dataset provides payment and utilization information on drugs prescribed by individual physicians and other health care providers under the Medicare Part D Prescription Drug Program.

- *Drug overdose deaths by state (2015-2017)*

https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm

Dataset provides the number of deaths related to the opioid use at the state level.

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

❖ Data Description:

- *Medicare Part D Opioid Prescriber Summary File (2013-2017)*

  There are 5 files each representing the following years respectively 2013 – 2017. After combing these files, the final dataset will contain 5.5M rows and 11 columns. The data set provides data on the number and percentage of prescription claims (includes new prescriptions and refills) for opioid drugs, and contains information on each provider's name, specialty, state, and ZIP code. Some columns have nulls, preprocessing and cleaning needs to be done.

- *Medicare Provider Utilization and Payment Data (2013-2017)*

  There are 5 files each representing the following years respectively 2013 – 2017. After combing these files, the final dataset will contain 122.4M rows and 21 columns. The dataset identifies providers by their National Provider Identifier (NPI) and the specific prescriptions that were dispensed at their direction, listed by brand name (if applicable) and generic name. For each prescriber and drug, the dataset includes the total number of prescriptions that were dispensed, which include original prescriptions and any refills, and the total drug cost. The total drug cost includes the ingredient cost of the medication, dispensing fees, sales tax, and any applicable administration fees and is based on the amount paid by the Part D plan, Medicare beneficiary, government subsidies, and any other third-party payers. Utilization data can be linked to Opioid Prescriber data by State/NPI/Specialty Description.

- *Drug overdose deaths by state (2015-2017)*

  Dataset contains 200 rows and 5 columns. Columns such as State, No. of deaths and Year could provide important details to the fact tables. No. of deaths can be linked to Opioid Prescriber data by State.

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

❖ Requirements:

♦ Technical Requirements:

TABLE 1

Tools	Functions
Talend	*Profiling data*
ER Studio	*Building the dimensional model*
SSIS	*Extracting, transforming and loading data*
SSAS	*Building OLAP cubes and data marts*
Tableau	*Visualizations*

♦ Data Requirements:

Profiling was done using Talend and Excel. Following are the observations and actions taken:

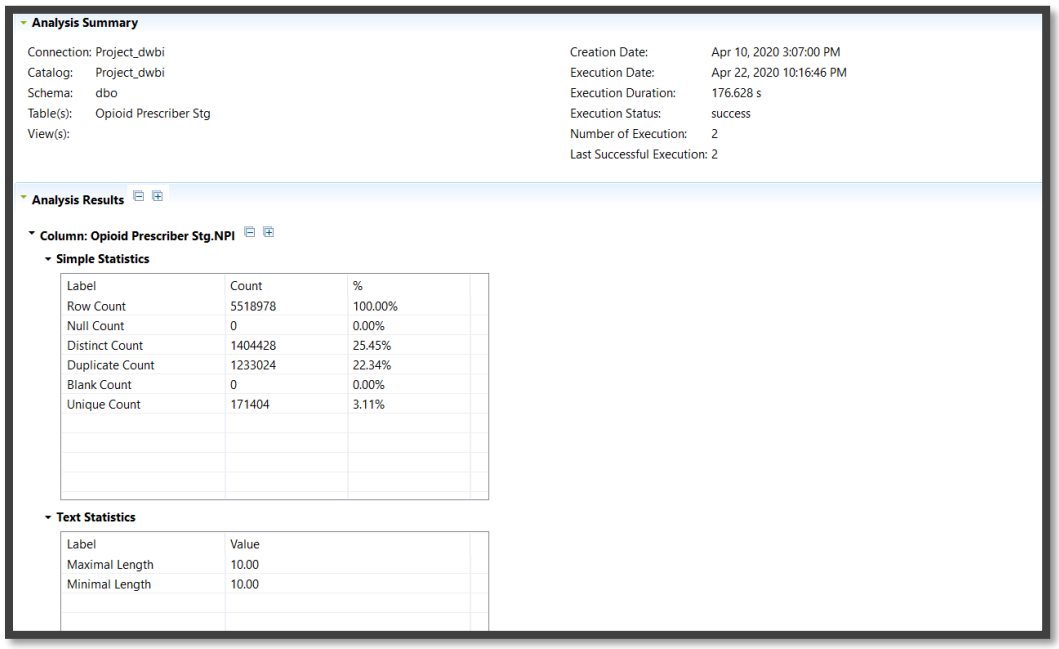
- *Opioid Prescriber:* Columns Long Acting Opioid Claim Count and Long Acting Opioid Prescribing Rate were dropped due to frequent null values. Column NPPES_Provider_State has 61 unique values.

- *Provider Utilization & Payments:* Columns for patients aged 65+ contains frequent null and junk values, these columns were dropped as they wouldn't contribute significantly to analysis.

- *Drug Abuse Deaths:* Columns State, Year, Month, Indicator and Data value were retained. Rest of the columns were dropped as there is no contribution. Months were filtered for January only as the data indicates a 12-month period and Indicator were filtered for Opioids (T40.0-T40.4, T40.6) as our primary analysis is around Opioid Prescriptions.

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo



Analysis Summary

Connection: Project_dwbi
Catalog: Project_dwbi
Schema: dbo
Table(s): Opioid Prescriber Stg
View(s):

Creation Date: Apr 10, 2020 3:07:00 PM
Execution Date: Apr 22, 2020 10:16:46 PM
Execution Duration: 176.628 s
Execution Status: success
Number of Execution: 2
Last Successful Execution: 2

Analysis Results

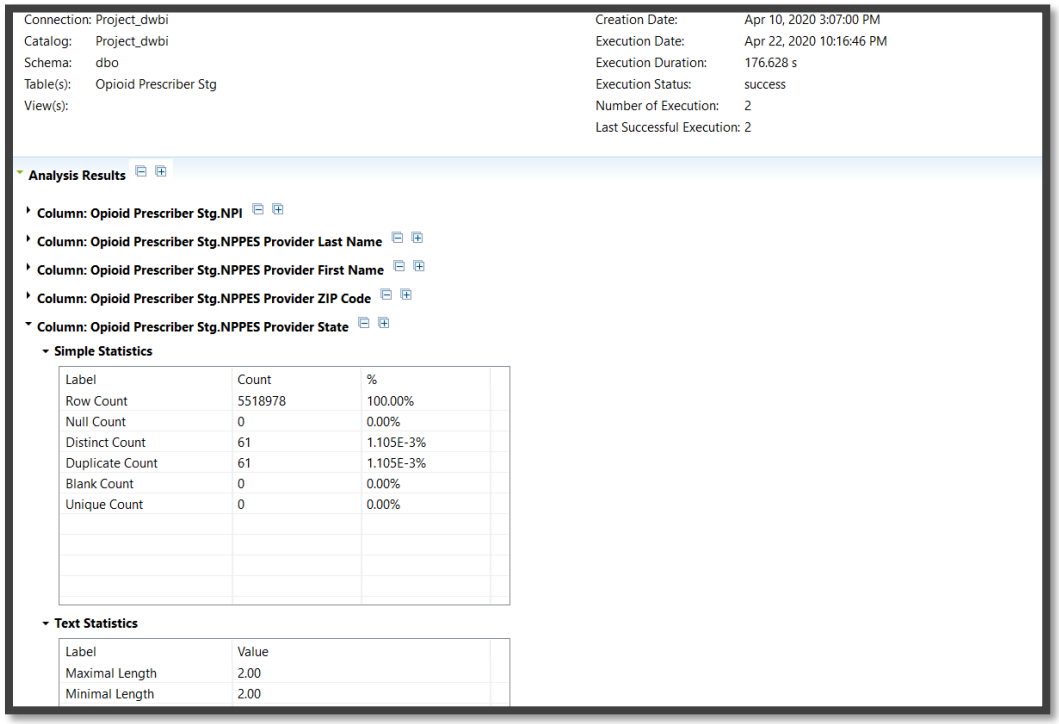
Column: Opioid Prescriber Stg.NPI

Simple Statistics

Label	Count	%
Row Count	5518978	100.00%
Null Count	0	0.00%
Distinct Count	1404428	25.45%
Duplicate Count	1233024	22.34%
Blank Count	0	0.00%
Unique Count	171404	3.11%

Text Statistics

Label	Value
Maximal Length	10.00
Minimal Length	10.00



Connection: Project_dwbi
Catalog: Project_dwbi
Schema: dbo
Table(s): Opioid Prescriber Stg
View(s):

Creation Date: Apr 10, 2020 3:07:00 PM
Execution Date: Apr 22, 2020 10:16:46 PM
Execution Duration: 176.628 s
Execution Status: success
Number of Execution: 2
Last Successful Execution: 2

Analysis Results

Column: Opioid Prescriber Stg.NPI

Column: Opioid Prescriber Stg.NPPES Provider Last Name

Column: Opioid Prescriber Stg.NPPES Provider First Name

Column: Opioid Prescriber Stg.NPPES Provider ZIP Code

Column: Opioid Prescriber Stg.NPPES Provider State

Simple Statistics

Label	Count	%
Row Count	5518978	100.00%
Null Count	0	0.00%
Distinct Count	61	1.105E-3%
Duplicate Count	61	1.105E-3%
Blank Count	0	0.00%
Unique Count	0	0.00%

Text Statistics

Label	Value
Maximal Length	2.00
Minimal Length	2.00

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

♦ Integration Requirements:

Pipeline was created using SSIS for Extracting, Transforming & Loading data to the data warehouse.

- *Staging*

  A stage table is a loosely created table with character data types which allow all the records from the source files to be recorded. The source files were loaded into the staging area using a for each loop container. A new column was created to store the year of the corresponding source file. The year was extracted from the file name itself using a Execute SQL Task.

- *Archive Tables*

  Archive tables are similar to stage tables in terms of their design and data types with the addition of a date-time stamp. A date-time stamp allows us to keep a track of when the records were loaded into the pipeline. Data was transferred from stage to archive table using a data flow task and an Execute SQL Task to assign the date-time stamp to the column LoadDate.

- *Target Tables*

  Target tables has a similar structure as staging table but holds the correct data types and error free records. These tables are created just before loading into the star schema. To transfer the data from the stage table to the destination table a data flow task was created which consisted of the lookup tables and a data conversion task which converted the records from the staging table to the appropriate data types. Lookup Tables were created for error handling.

  For instance, while transferring data from the provider utilization and opioid prescriber stage tables to the target tables Lookup_NPI and Lookup_State were used for transferring only valid records. Lookup_NPI was created using the unique values of NPI from the stage table and Lookup_state was created using an additional data source which consisted of the list of valid state in the US.

  In the process of transferring valid records to the destination table, invalid records from the lookup are sent to the reject tables (OpioidPrescriber_Error, ProviderUtilization_Error).

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

- *Star Schema*

The Star Schema which follows the third normal form holds all the dimension and fact tables forming the Enterprise Data Warehouse (EDW). Dimension tables are the ones that hold information about a particular entity and Fact tables contain measures and counts. The fact tables have a non-identifying mandatory relationship to the dimension tables.

The design of the dimension and fact tables were modelled using ER Studio and deployed using SQL Server.

For instance, DIM_Provider was loaded using a data flow task with the source being Opioid Prescriber and passed through a number of lookups State, Speciality Description, etc and a sort task to remove the duplicates. DIM_Provider contains information about the providers.

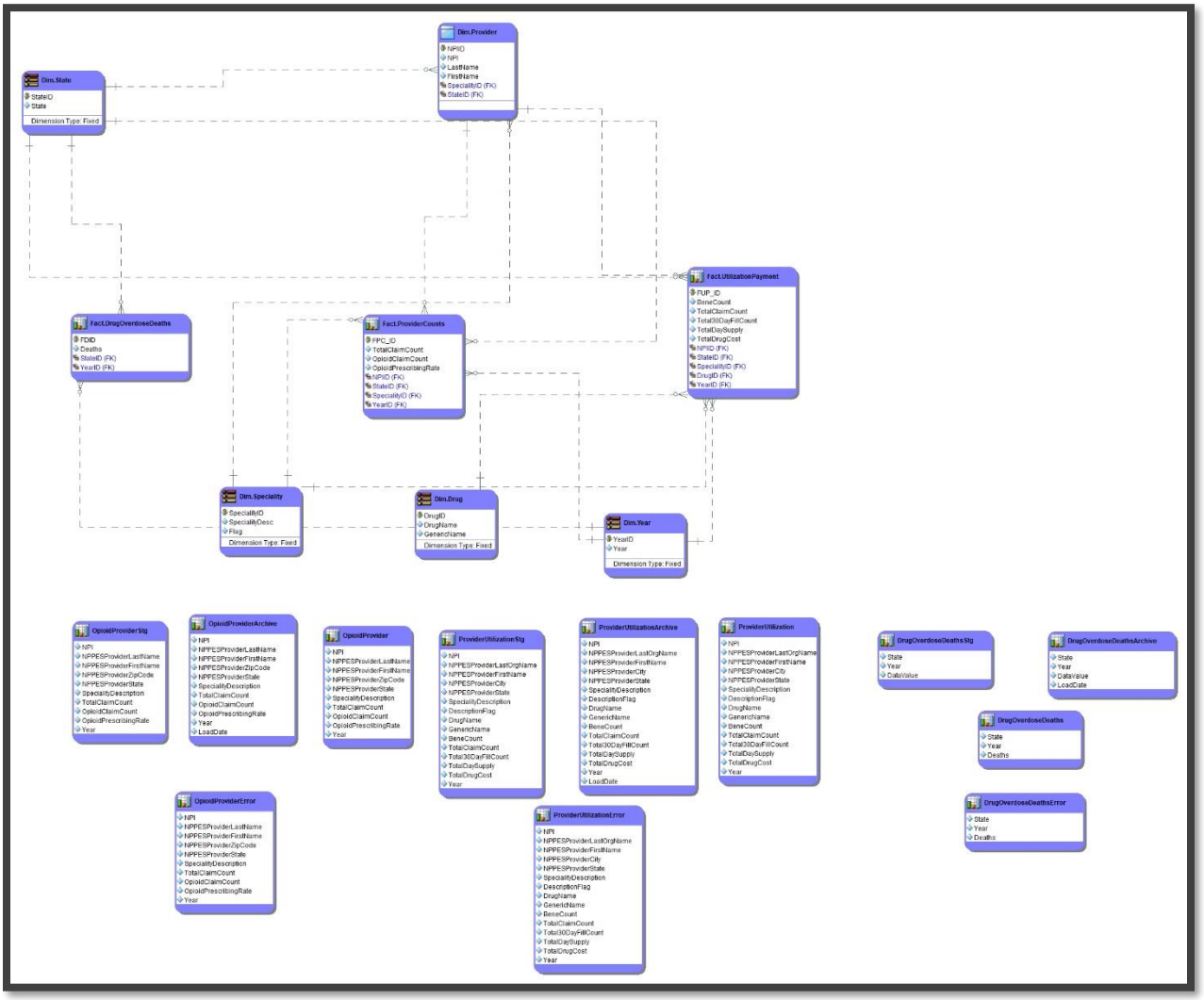
Fact_Opioid Provider was loaded using a data flow task with the source being Opioid Prescriber and passed through a number of lookups NPI, State, Speciality Description, etc. The idea of using lookups was to come up with a table which consisted of ID'S such as NPI_id, State_id for a particular provider along with their Opioid Prescribing rates.

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

❖ Dimensional Architecture

The star schema model was built using ER Studio to conform to the 3NF rules. It consists of 3 Facts and 6 Dimensions. The facts provide measures such as claim counts, prescribing rates, drug costs etc. whereas the dimensions provide information relating to that particular entity such as provider's NPI, Last Name, First Name, Specialty etc.



INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

The design structure for the facts and dimensions are as follows:

- Fact.ProviderCounts is a fact table which provides counts of opioid claims and prescription rate of each Medicare Provider. FPCID is the primary key which uniquely identifies each row in the fact table. FPCID was generated using IDENTITY (1,1) in SQL server. It is joined by NPIID, GeogprahyID, StateID, YearID, SpecialityID as non-identifying mandatory relationship.

TABLE 2

Attribute	Data Type
FPCID (PK)	*int*
Total Claim Count	*int*
Opioid Claim Count	*int*
Opioid Prescribing Rate	*int*
NPIID (FK)	*int*
YearID (FK)	*int*
SpecialityID (FK)	*int*
StateID (FK)	*int*

- Fact.UtilizationPayment is a fact table which provides total claims, beneficiary claims, total fills, total supply and drug costs for each drug prescribed by the Medicare Provider. FUPID is the primary key to uniquely identify each row in the table and was generated using IDENTITY (1,1) in SQL server. It is joined by NPIID, GeogprahyID, StateID, YearID, SpecialityID, DrugID as non-identifying mandatory relationship.

TABLE 3

Attribute	Data Type
FUPID (PK)	*int*
Bene Count	*int*
Total Claim Count	*int*
Total 30-Day Fill Count	*float*
Total Day Supply	*int*
Total Drug Cost	*float*
NPIID (FK)	*int*
YearID (FK)	*int*
SpecialityID (FK)	*int*
StateID (FK)	*int*

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

- Fact.DrugOverdoseDeaths is a fact table which provides the deaths counts in a particular state for a whole year starting from the month of January. FDID is the primary key for uniquely identifying each record in the table and is generated using IDENTITY (1,1) in SQL server. It is joined by StateID, YearID as non-identifying mandatory relationship.

TABLE 4

Attribute	Data Type
FDID (PK)	*int*
Deaths	*int*
StateID (FK)	*int*
YearID (FK)	*int*

- Dim.Provider is a dimension table which provides information about the Medicare Provider such as his/her unique identification number NPI, last name, first name and geography information. NPIID is the primary key which uniquely identifies each providers record. NPIID was generated using the window function (row_number ()) over the NPIs. It is joined by GeographyID, StateID and SpecialityID by non-identifying mandotry relationship.

TABLE 5

Attribute	Data Type
NPIID (PK)	*int*
NPI	*int*
Last Name	*char*
First Name	*char*
SpecialityID (FK)	*int*
StateID (FK)	*int*

- Dim.Year is a dimension for years. There are 5 years (2013-2017) which are uniquely identified by YearID. YearID was generated using window function over years in SQL server.

TABLE 6

Attribute	Data Type
YearID (PK)	*int*
Year	*int*

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

- Dim.State is a dimension table providing information about all the valid states in the US. It is identified by the primary key StateID which was generated using window function over states in SQL server.

TABLE 7

Attribute	Data Type
StateID (PK)	*int*
State	*char*

- Dim.Speciality is a dimension table providing Medicare Provider's specialty description and flag. It is identified by the primary key SpecialtyID which was generated using window function over specialties and flags in SQL server.

TABLE 8

Attribute	Data Type
SpecialityID (PK)	*int*
SpecialityDesc	*char*
Flag	*char*

- Dim.Drug is a dimension table to identify unique drugs prescribed along with their generic name. It is identified by the primary key DrugID which was generated using window function over drug and its generic names in SQL server.

TABLE 9

Attribute	Data Type
DrugID (PK)	*int*
Drug Name	*char*
Generic Name	*char*

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

❖ Data Integration Model:

ETL was done using SSIS in MS Visual Studio Developer Tools. Each .csv file of the three datasets i.e. (Opioid Prescriber, Provider Utilization & Payments and Drug Overdose Deaths) is loaded using four separate sequence containers. The four containers are used for the following data flow tasks: .csv source to staging area, staging to archive table, staging to final target table and final target table to the star schema or the EDW (Enterprise Data Warehouse).

The pipeline starts with a foreach loop container to load the raw data to staging area. It reads each of the 5 .csv files from its respective folder and loads them into the staging area. The foreach loop containers also allow to parse in the file name for assigning the date. Date is extracted and stored as column using execute SQL task.

For the archive table, a different container is used to load data from the staging table to the archive table. It consists of a derived column function used to assign a load date to the records inserted.

After this sequence is complete, the next container transforms the staging data to valid data using lookup tables and the data conversion function to transform columns to appropriate datatypes and sizes. Invalid data from the lookups are sent to a reject table.

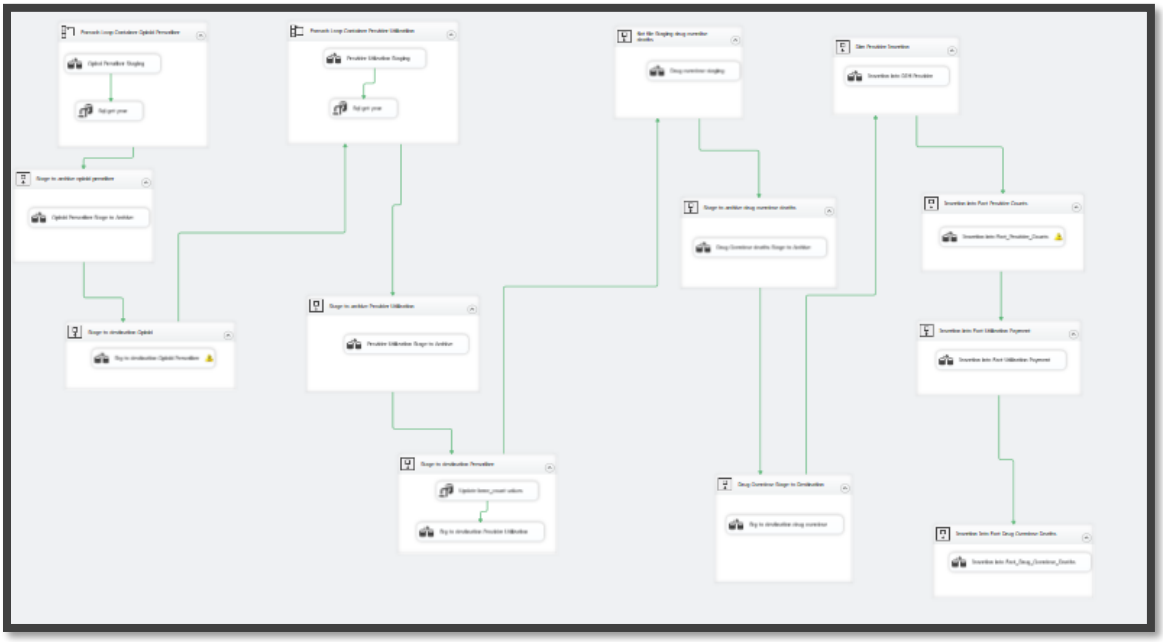
The final container loads the valid data from the final target tables to the star schema. Dim_Provider is loaded using a series of lookups (Dim_NPI, Dim_Speciality, Dim_State, etc.) and a sort function to remove duplicates and keep unique provider records.

These lookups help in maintaining referential integrity. The fact tables (Fact_OpioidPresriber, Fact_ProviderUtilizationPayments & Fact_DrugOverdoseDeaths) are also loaded using a series of lookups (Dim_Provider, Dim_State, Dim_Year, etc.).

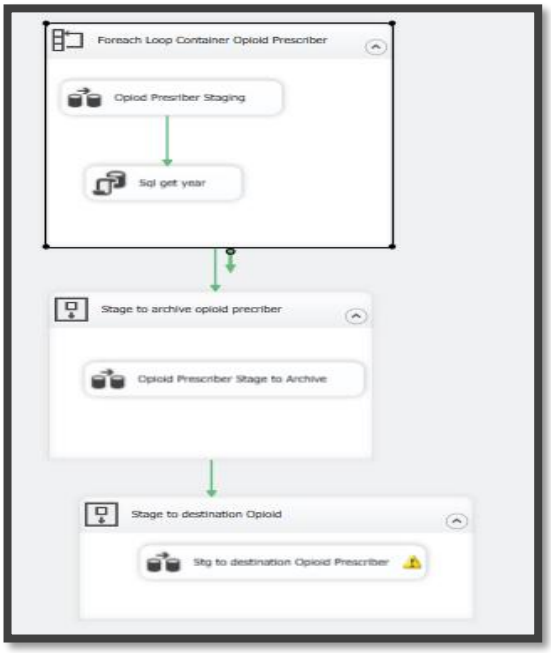
INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

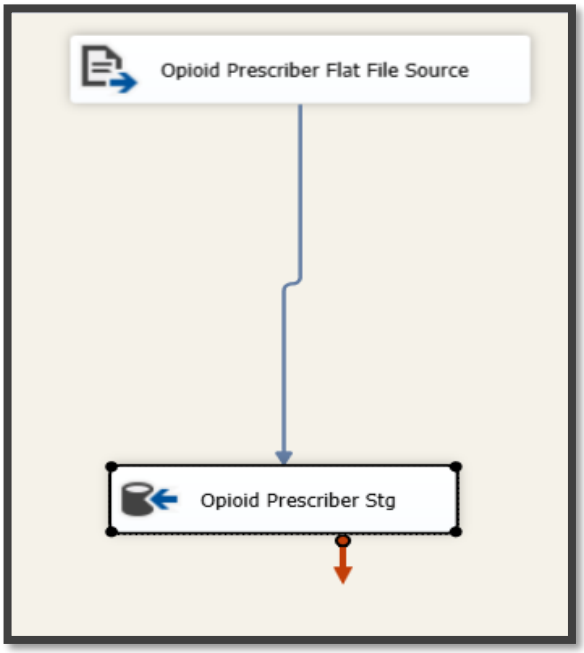
Design Document – GW03 – Team Echo

- **Overall Pipeline**



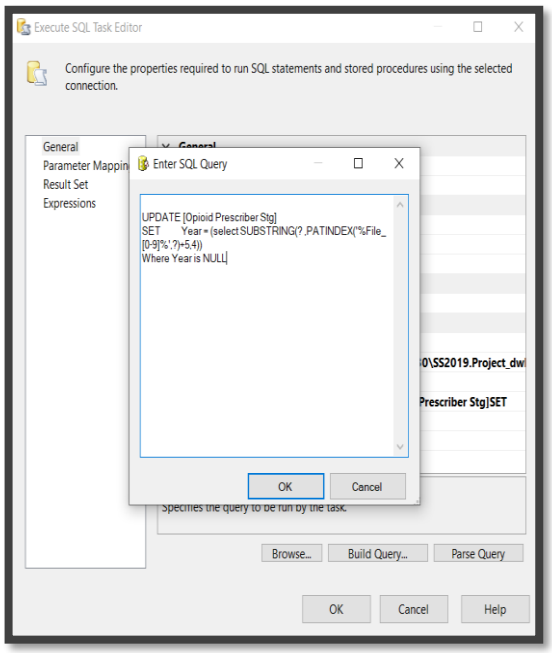
- **Opioid Prescriber Pipeline**

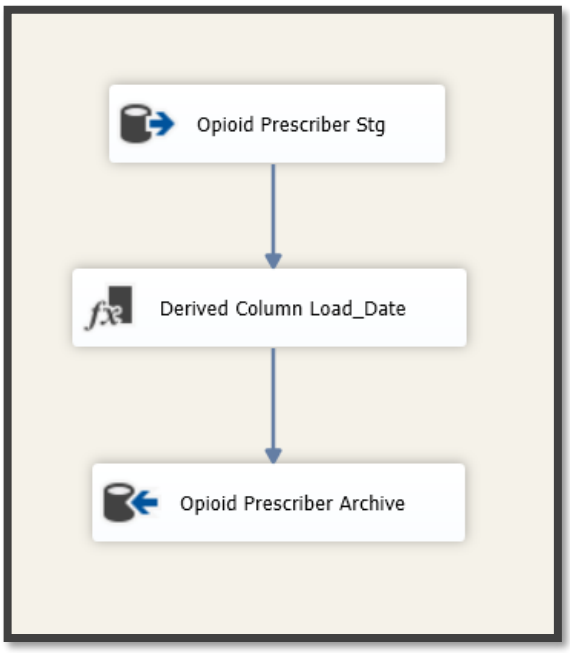


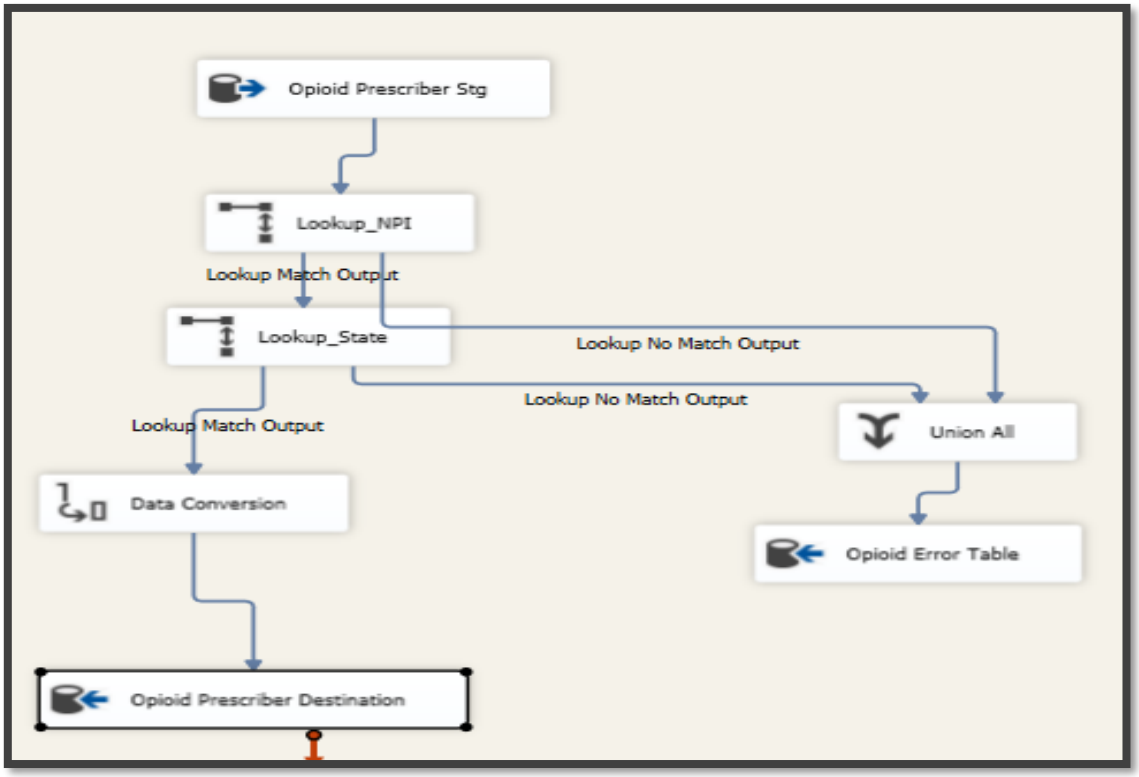


INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo



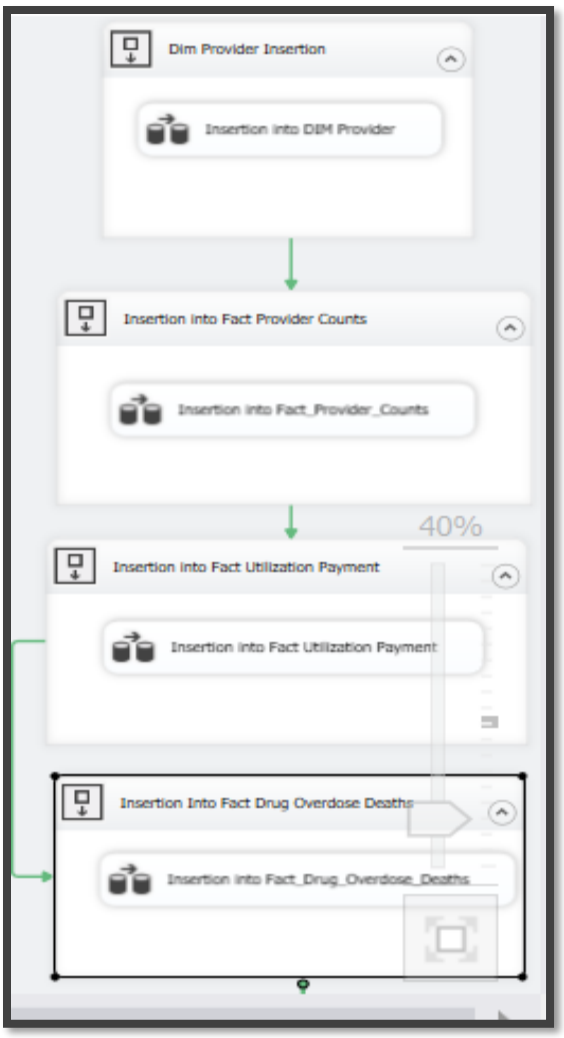


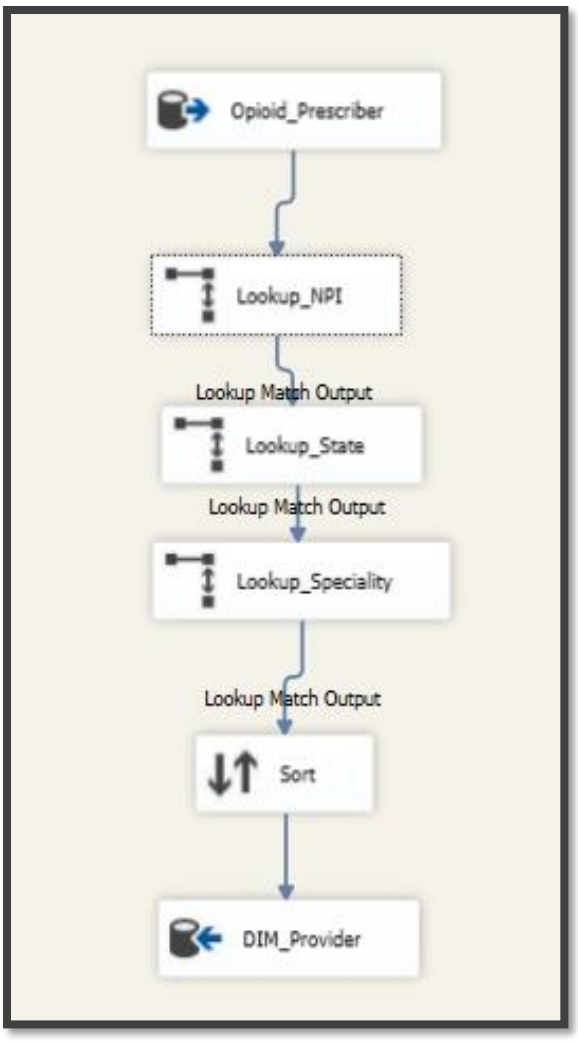


INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

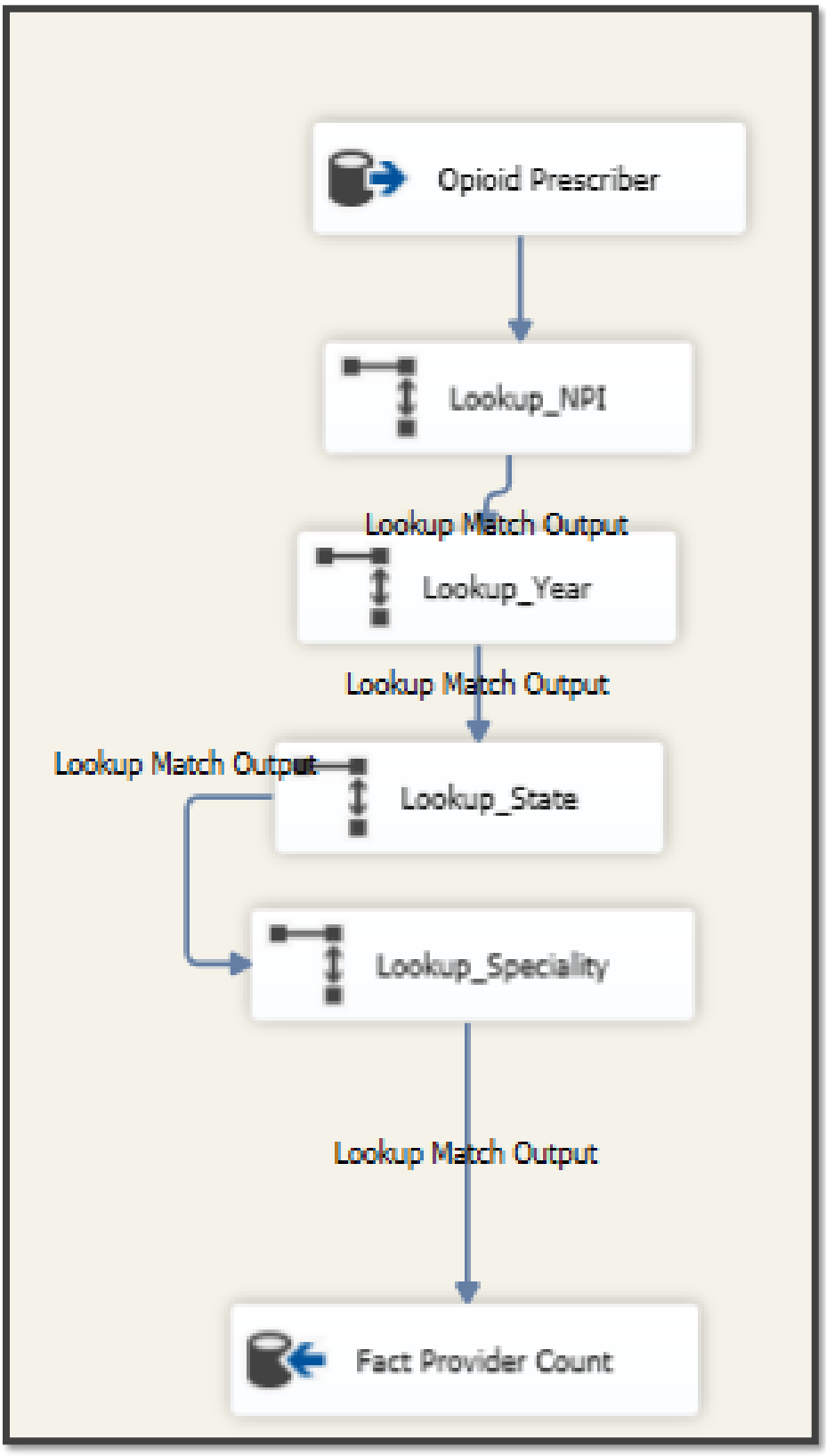
- **Star Schema Pipeline**





INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo



INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

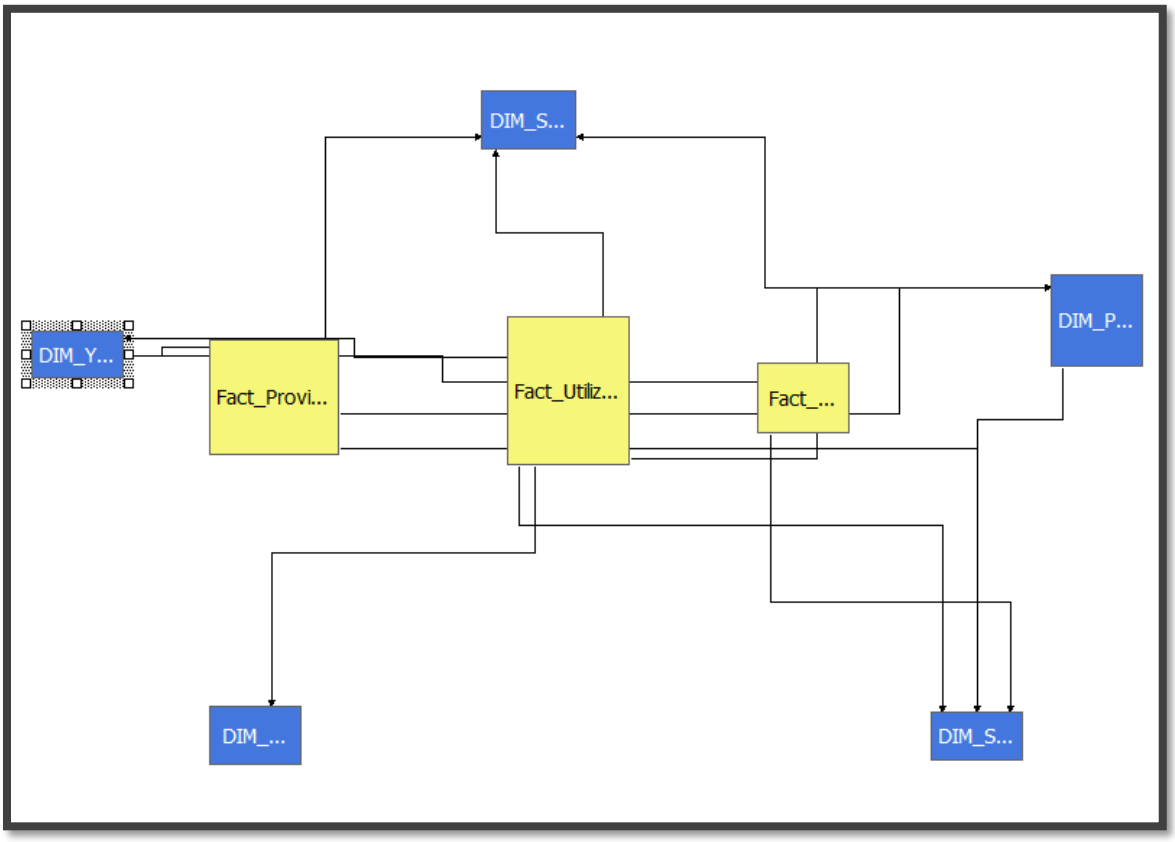
❖ Online Analytical Processing Cubes

OLAP multidimensional cubes are created using SSAS in MS Visual Studio Developer Tools. The data source view is first created by connecting to the EDW database in SQL server and by selecting the required fact tables and its related dimension tables.

The dimension hierarchies are then created and linked using attribute relationships. For instance, Dim_Provider has the hierarchy NPIID -> NPI -> LastName -> FirstName -> StateID -> SpecialtyID. Finally, the dimension tables and OLAP cube are processed by running the deployment code.

In the cube browse section; the required measures and the hierarchies are passed in as query and executed to create organization specific reports.

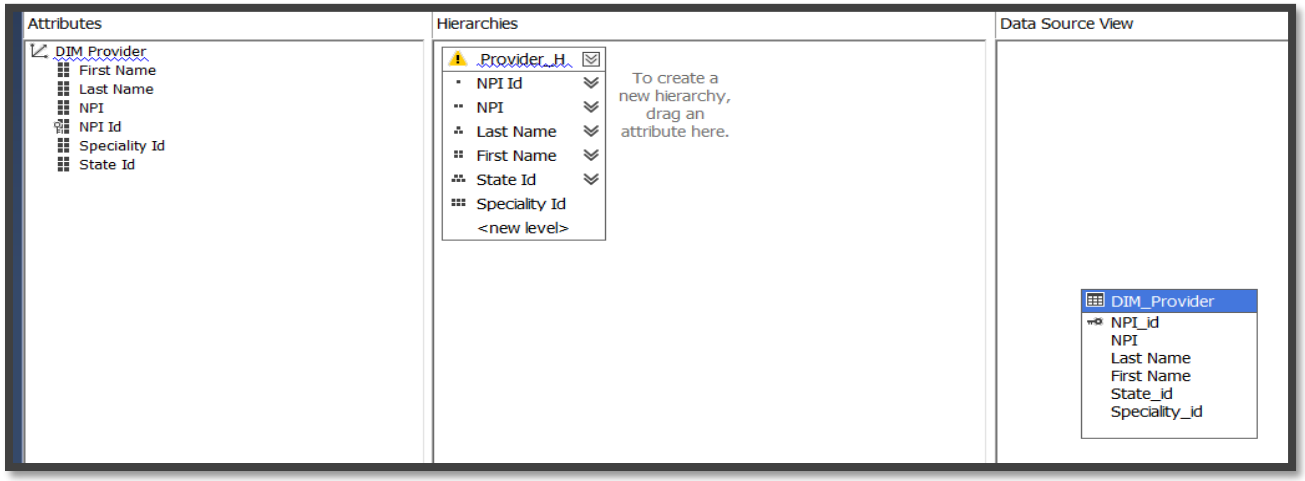
▪ OLAP Cube

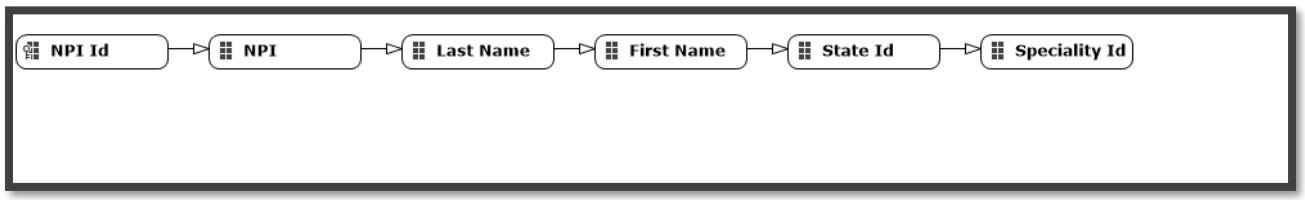


INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

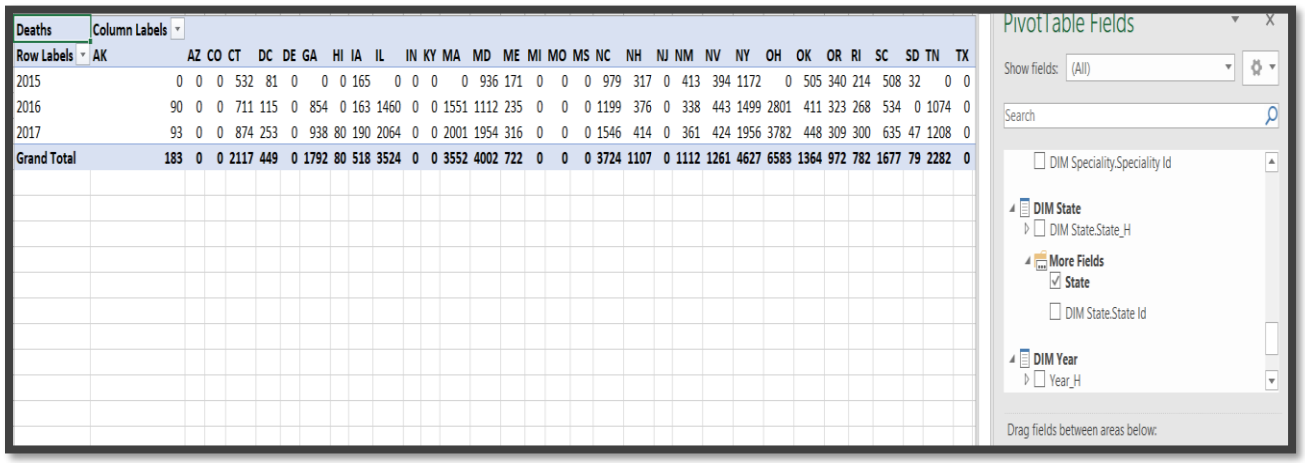
Design Document – GW03 – Team Echo

- **DIM_Provider Hierachy**





- **Analysed in Excel**



Deaths	Column Labels																																							
Row Labels	AK		AZ	CO	CT	DC	DE	GA	HI	IA	IL	IN	KY	MA	MD	ME	MI	MO	MS	NC	NH	NJ	NM	NV	NY	OH	OK	OR	RI	SC	SD	TN	TX								
2015		0	0	0	532	81	0	0	0	165	0	0	0	0	936	171	0	0	0	979	317	0	413	394	1172	0	505	340	214	508	32	0	0								
2016		90	0	0	711	115	0	854	0	163	1460	0	0	1551	1112	235	0	0	0	1199	376	0	338	443	1499	2801	411	323	268	534	0	1074	0								
2017		93	0	0	874	253	0	938	80	190	2064	0	0	2001	1954	316	0	0	0	1546	414	0	361	424	1956	3782	448	309	300	635	47	1208	0								
Grand Total		183	0	0	2117	449	0	1792	80	518	3524	0	0	3552	4002	722	0	0	0	3724	1107	0	1112	1261	4627	6583	1364	972	782	1677	79	2282	0								

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

- **OLAP Reports**

State Id	State	Year Id	Year	Deaths
1	AK	3	2015	0
1	AK	4	2016	90
1	AK	5	2017	93
4	AZ	3	2015	0
4	AZ	4	2016	0
4	AZ	5	2017	0
6	CO	3	2015	0
6	CO	4	2016	0
6	CO	5	2017	0
7	CT	3	2015	532
7	CT	4	2016	711
7	CT	5	2017	874
8	DC	3	2015	81
8	DC	4	2016	115
8	DC	5	2017	253
9	DE	3	2015	0
9	DE	4	2016	0
9	DE	5	2017	0
11	GA	3	2015	0
11	GA	4	2016	854
11	GA	5	2017	938
12	HI	3	2015	0
12	HI	4	2016	0

Dimension | Hierarchy | Operator | Filter Expression | Param

NPI Id	NPI	Last Name	First Name	State Id	Speciality Id	Opioid Claim Count
1	1003000126	ENKESHAFI	ARDALAN	21	112	139
2	1003000142	KHALIL	RASHID	36	12	3505
3	1003000159	VOGES	MARSHA	41	151	0
4	1003000167	ESCOBAR	JULIO	34	60	83
5	1003000175	REYES-VAS...	BELINDA	5	60	0
6	1003000183	CYPHERS	DENNIS	48	128	0
7	1003000282	BLAKEMORE	ROSIE	43	151	21
8	1003000407	GIRARDI	DAVID	39	80	110
9	1003000415	WEBSTER	MARSHALL	11	31	0
10	1003000423	VELOTTA	JENNIFER	36	157	0
11	1003000480	ROTHCHILD	KEVIN	6	85	41
12	1003000522	WEIGAND	FREDERICK	10	80	954
13	1003000530	SEMONCHE	AMANDA	39	112	1041
14	1003000597	KIM	DAE	37	262	212
15	1003000639	BENHARASH	PEYMAN	5	22	0
16	1003000654	RHODES	CAROLINE	44	60	0
17	1003000720	HERNANDEZ	OTNIEL	10	151	23
18	1003000746	GALLEGOS	MIKE	33	185	0
19	1003000753	DEITLE	JAMES	38	195	11
20	1003000837	JOHN	RICHARD	5	151	0
21	1003000902	LOHANO	JAIVANTI	18	80	636
22	1003000936	STELLINGW...	MARK	41	112	14
23	1003001017	NICHOLS	LAWRENCE	5	63	0

Dimension | Hierarchy | Operator | Filter Expression | Param

Drug Id	Drug Name	Generic Name	Total Day Supply	Total 30 Day Fill Count	Total Drug Cost
1	1ST TIER UNI...	NEEDLES, INSULIN DISP...	303236	10671	181848
3	1ST TIER UNI...	NEEDLES, INSULIN DISP...	401509	13810	208370
5	8-MOP	METHOXSALEN	300	11	15306
6	ABACAVIR	ABACAVIR SULFATE	8080996	273969	89593884
7	ABACAVIR-LA...	ABACAVIR SULFATE/LAM...	2176362	74013	46163015
8	ABACAVIR-LA...	ABACAVIR/LAMIVUDINE/...	750326	25418	32467896
9	ABELCET	AMPHOTERICIN B LIPID ...	35479	1570	1713999
10	ABILIFY	ARIPIPRAZOLE	188278316	7062936	1119909984
11	ABILIFY DISC...	ARIPIPRAZOLE	115727	4720	5123365
12	ABILIFY MAIN...	ARIPIPRAZOLE	9023639	320233	553392243
13	ABRAXANE	PACLITAXEL PROTEIN-B...	35256	1631	8346301
14	ABSORICA	ISOTRETINOIN	690	23	23105
15	ABSTRAL	FENTANYL CITRATE	45656	1803	16755835
16	ACAMPROSA...	ACAMPROSATE CALCIUM	1035451	37322	5324307
17	ACANYA	CLINDAMYCIN PHOS/BE...	3859	154	62568
18	ACARBOSE	ACARBOSE	26694462	905830	34329489
19	ACCOLATE	ZAFIRLUKAST	86186	2892	442192
20	ACCUNEB	ALBUTEROL SULFATE	126	16	421
21	ACCUPRIL	QUINAPRIL HCL	309589	10563	1294511
22	ACCURETIC	QUINAPRIL/HYDROCHL...	18382	624	74911
23	ACEBUTOLO...	ACEBUTOLOL HCL	13255341	445406	6586579
24	ACEON	PERINDOPRIL ERBUMINE	720	24	1664

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

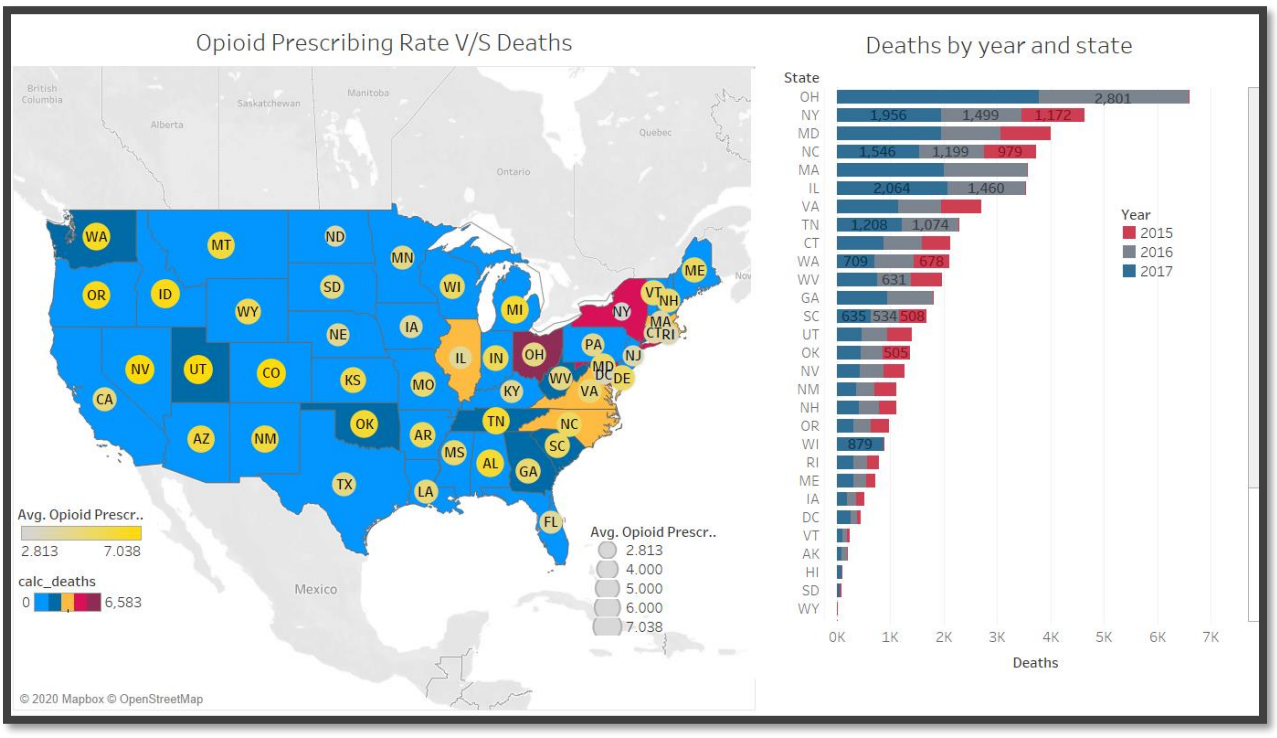
❖ Business Intelligence

Tableau was used for BI; to create visual reports and dashboards. Visualizations were generated in Tableau with the help of a live connection to SQL Server. This live connection helps us to query directly from the database.

A sample of reports were generated using the various tools offered in tableau. For instance, a map-based visualization was created to view the overall opioid prescribing rate and death toll in the respective states for the years 2013 - 2017. This was generated using two maps with the help of dual axis. Map 1 contains the opioid prescribing rates as bubbles and map 2 contains the deaths as colors.

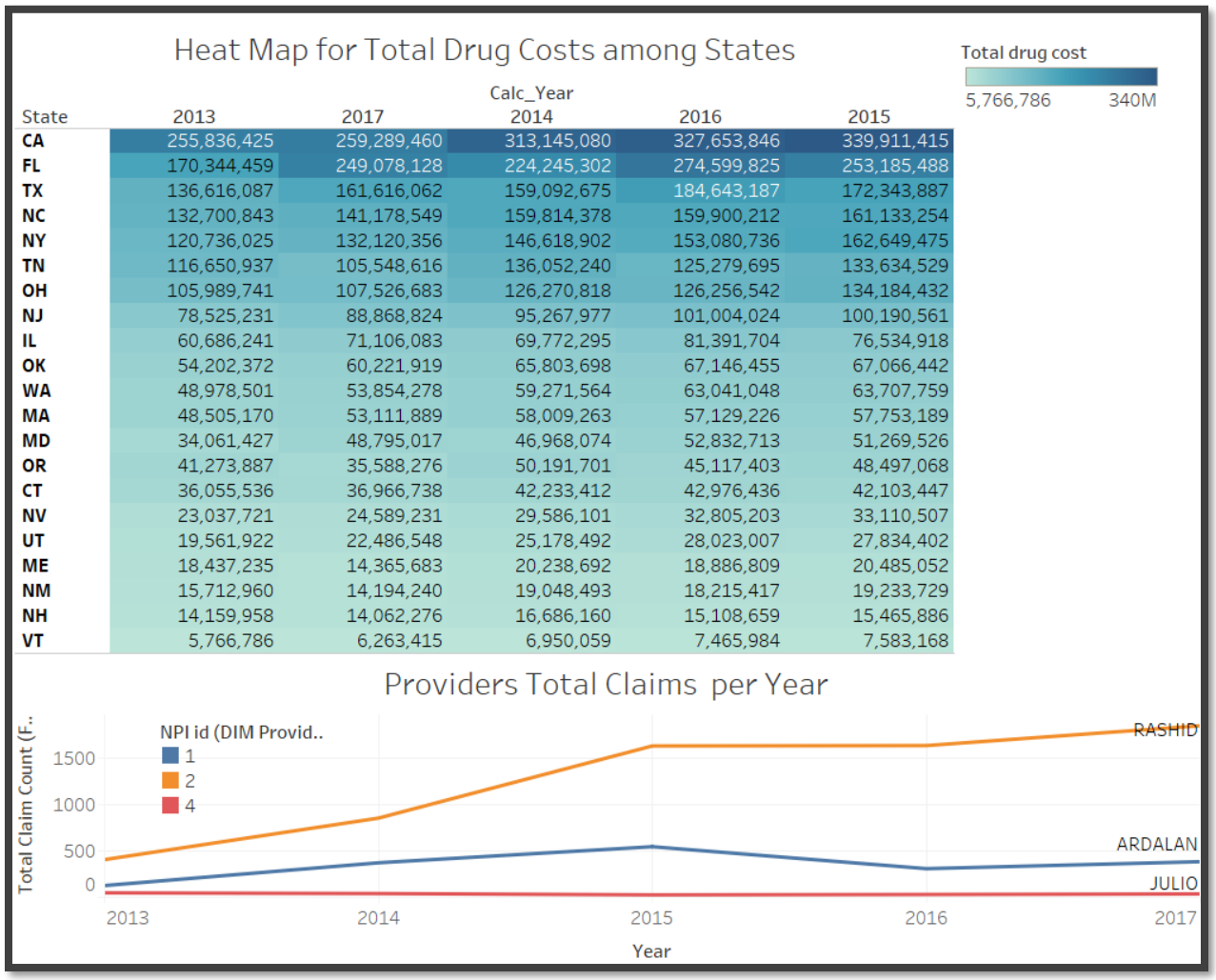
A tooltip was also made of use to view the information as texts when hovered over.

A dashboard is finally created by combining these visualizations.



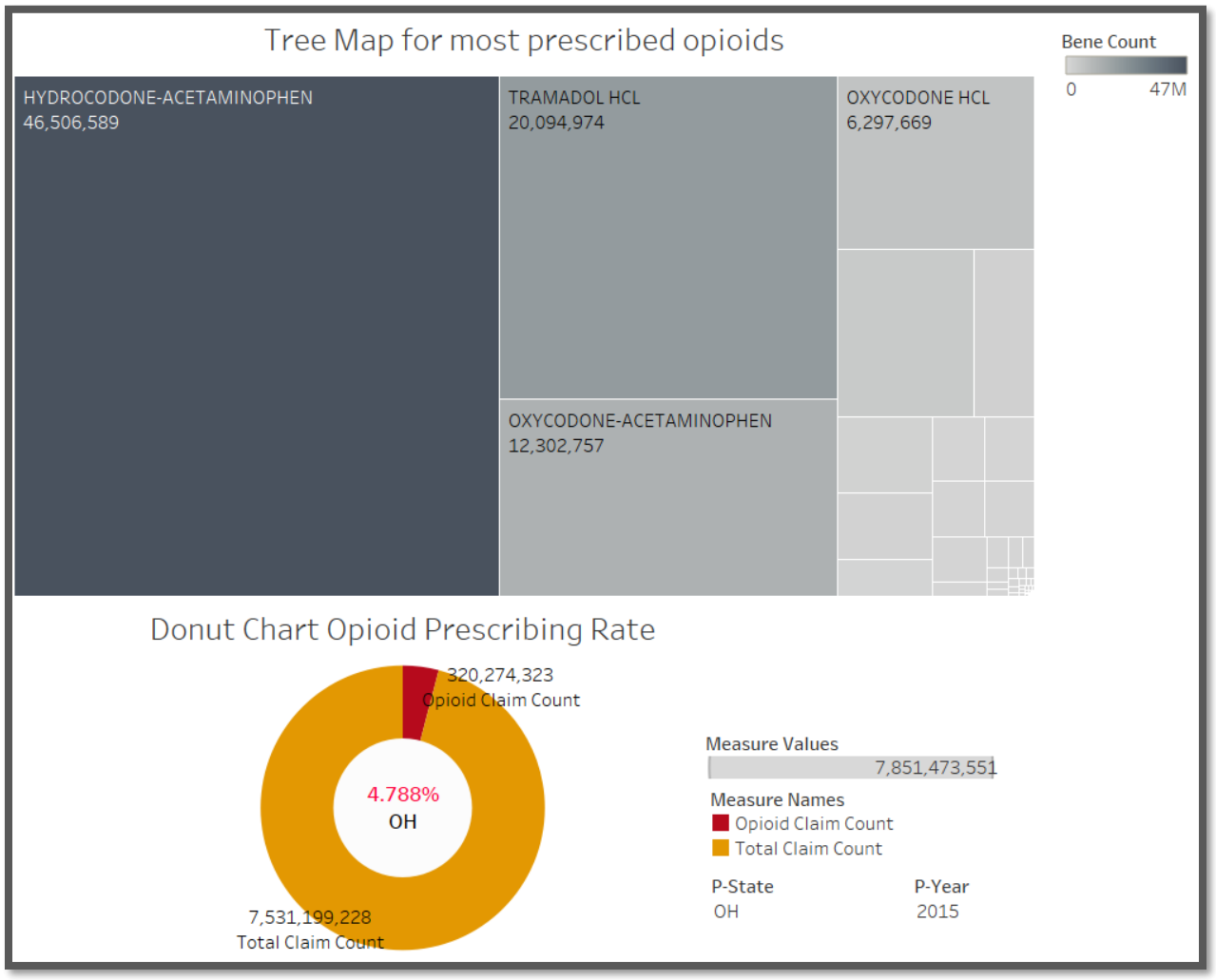
INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo



INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo



INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

❖ Inference:

- **Opioid Prescribing Rates V/S Deaths**

States	OH	NY	MD	NC	MA	IL
OPR	4.723	2.813	5.109	5.420	3.966	4.358
Deaths #	6,583	4,627	4,002	3,724	3,552	3,524

- From the visualizations and table, we find that the death and the opioid prescribing rates are contradicting. The states of Ohio, New York, Maryland have the greatest number of deaths but comparatively less opioid prescribing rates. From these results, we could presume that that the sources are not Medicare related.

States	UT	WA	OK	TN	SC	GA
OPR	7.038	6.426	6.350	6.215	5.295	5.134
Deaths #	6,583	2,108	1,364	2,282	1,677	1,792

- From this, we can conclude that the above states might be misusing the prescribed opioids.

States	NV	OR	NM	WI	VT	SD
OPR	6.897	6.656	6.027	5.292	5.194	4.770
Deaths #	1,261	972	1,112	879	246	79

- From the above few states, we can infer that there is no misuse of prescribed opioids even though the opioid prescription rate is high.

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

- **Heat Map for Total Drug Cost among States**

  - From the heat map, we find that the states California, Florida and Texas have the highest Opioid Cost.

  - We can also infer that the opioid costs have increased as the years have passed.

- **Tree Map for Total Claim Count among Opioids**

  - Opioids such as Hydrocodone – Acetaminophen, Tramadol – HCL, Oxycodone – Acetaminophen are the most prescribed opioids.

INFO7290 32447 Data Warehouse & Bus Intelligence SEC 01 Spring 2020 [VTL-2-OL]

Design Document – GW03 – Team Echo

❖ Document History:

Date	Who	What	Version
03-15-2020	*All*	*Project Proposal*	*0.1*
03-20-2020	*All*	*Project Proposal with ER Model*	*1.0*
04-08-2020	*All*	*Design Document*	*2.0*
04-22-2020	*All*	*Design Document*	*3.0*