eCommerce and AI

A guide by **Data Drillers**

Introduction

1. Pfizer's go-to-market motions for their vaccines business revolve around two major customer bases: healthcare providers (HCP) and their patients (D2C)
2. The executive leadership team ("ELT") recently discovered that healthcare providers are routinely under-stocking their vaccine fridges
3. Pfizer has a direct sales channel that allows for the distribution of vaccines to healthcare providers through next-day mail
4. Our responsibility as data analysts is to develop an application to help solve this problem

Goals of Our Study

1. Develop an application to help solve the problem of health care providers routinely under-stocking their vaccine fridges.
2. Conduct an analysis that helps Pfizer understand which health care providers are under-stocking their fridges.
3. Make recommendations based on our analysis to solve this problem
4. (If possible) make predictions on the expected increase in revenue

Business Question
&
Hypothesis

Business Questions

1. What is the difference between the purchasing pattern between PHYSICIANS and LARGE GROUPS?

2. How do we predict the demand based on the data we have?

3. How can we tell which customers are understocking?

4. What is the expected increase in revenue after we design the app?
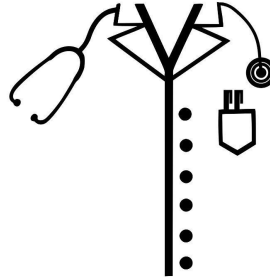
Hypotheses

- We predict that demands will be higher for LARGE groups (pharmacies: CVS, Walgreen, etc.) than for PHYSICIANS.
    - LARGE groups sees more patients on a regular basis, PHYSICIANS purchase vaccines more on specific needs of their patients
- We expect that vitamins and meds for common diseases such as flu, heart, allergy are the best-seller of Pfizer.
- We expect an increase in revenue of over 100 million (~2%) after our app
- We predict the demands to be higher during the fall and winter seasons and more customers will understock when it's out-of-season
    - Flu season and flu vaccine

Data & Methods

Data and Methods

- Data - customer_id, date, large group/physician, state, brand, doses, price
- Linear regression to predict doses based on time
  - On each individual customer and brand of vaccine
  - On Large Groups vs Physicians
  - On all customers based on state
- Split time into time periods and predict doses for future 5 periods
- Difference between the mean doses of future and past is understocking
- Assumptions:
  - Our data satisfies the conditions of linear regression
  - Mean doses in each period reflects demands

Findings

Single Customer Prediction
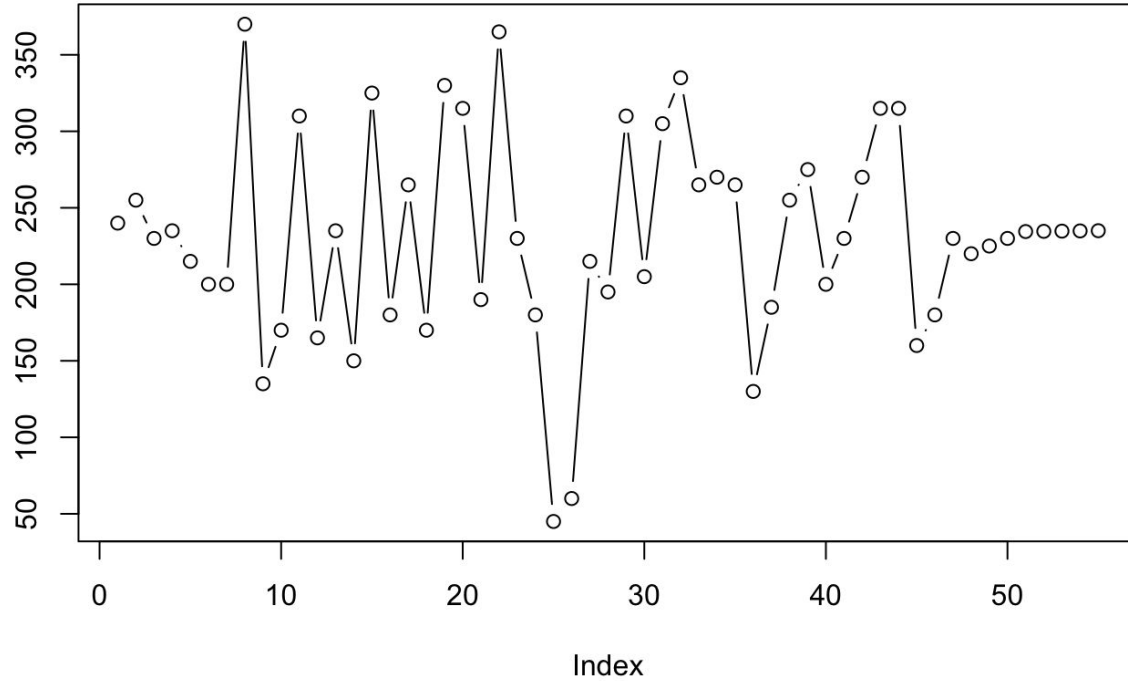
Predicted Values For Each Customer

	customer	brand	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5	difference
1	b1012b15b9f97fd6685406d6d323b59d	CEFASIBAN	5	30	40	40	70	595.743243243243	607.432432432432	619.121621621622	630.810810810811	642.5	-582
2	c1a5de5693ee709f50a1c01af4667bcd	ARILATAPIDE	55	35	50	55	305	433.7339055794	456.909871244635	480.085836909872	503.261802575108	526.437768240344	-380
3	d17aa00f8749c73f1e4dadd74c28d593	ARILATAPIDE	30	550	15	70	355	535.010266940452	543.244353182752	551.478439425051	559.712525667351	567.946611909651	-347
4	5ec2319a3444be8a5b63dd0fa7ea6d83	SULFAARELIN	5	0	5	5	50	256.071428571429	263.214285714286	270.357142857143	277.5	284.642857142857	-257
5	b1012b15b9f97fd6685406d6d323b59d	PREDACRINAT	140	150	75	35	230	341.860465116279	346.395348837209	350.930232558139	355.46511627907	360	-225
6	f1a6adfdd381a6363dea6e83967e4600	ARILATAPIDE	385	35	70	240	485	422.047619047619	435.84126984127	449.634920634921	463.428571428572	477.222222222222	-207
7	4f0a55a00d78d942885a1ca104dde2c4	ARILATAPIDE	465	485	75	140	440	486.620563674321	494.112734864301	501.60490605428	509.097077244259	516.589248434238	-181
8	b1012b15b9f97fd6685406d6d323b59d	SULFAARELIN	45	10	10	30	105	155.238095238095	157.52380952381	159.809523809524	162.095238095238	164.380952380953	-120
9	d17aa00f8749c73f1e4dadd74c28d593	CEFASIBAN	15	10	10	25	35	62.0505920344457	63.2938643702907	64.5371367061356	65.7804090419806	67.0236813778256	-46
10	70b176c2eaedeef98be5367aa891ab31	ARILATAPIDE	25	60	440	240	115	217.481662591687	215.122249388753	212.762836185819	210.403422982885	208.044009779951	-37
11	c506668f6d29becbb794282542a1cbc3	PREDACRINAT	10	5	25	10	15	40.4955947136564	41.1233480176212	41.7511013215859	42.3788546255507	43.0066079295154	-29
12	90e9cbe2275cfc29830a56e6f373b5ca	SULFAARELIN	25	30	25	25	40	51.6927083333333	50.822218547913	49.9517287624927	49.0812389770723	48.210749191652	-21
13	148b20897005e9c384a9f4322d61b0c2	CEFASIBAN	180	230	220	225	230	234.489795918367	234.626650660264	234.763505402161	234.900360144058	235.037214885954	-18
14	d17aa00f8749c73f1e4dadd74c28d593	NALIMORELIN	20	10	30	30	25	39.4204545454545	39.9034090909091	40.3863636363636	40.8693181818182	41.3522727272727	-17
15	70b176c2eaedeef98be5367aa891ab31	PREDACRINAT	10	20	75	25	25	47.4992817330345	47.8720622881113	48.244842843188	48.6176233982647	48.9904039533414	-17
16	d8a4beea9a4cdea3ab44c8dbef4052fe	NIFURIARILATADINE	5	10	15	10	10	25.3478998727196	25.7976240984302	26.2473483241409	26.6970725498515	27.1467967755622	-16
17	5ec2319a3444be8a5b63dd0fa7ea6d83	PREDSTATATRIPTAN	5	5	35	40	50	41.3747499444321	42.10935763503	42.8439653256279	43.5785730162258	44.3131807068237	-16
18	682e26f9283b97db6ba047fe2a4f0985	SOMATOXMONAM	5	10	15	10	15	24.874213836478	25.377358490566	25.8805031446541	26.3836477987421	26.8867924528302	-15
19	148b20897005e9c384a9f4322d61b0c2	DILIAXOIIMOD	5	5	10	15	30	27.2414962442942	26.8432511039628	26.4450059636314	26.0467608233001	25.6485156829687	-13
20	d8a4beea9a4cdea3ab44c8dbef4052fe	GADOINABIMELINE	10	10	10	10	25	25.688855770823	26.0821328034443	26.4754098360656	26.8686868686869	27.2619639013082	-12
21	70b176c2eaedeef98be5367aa891ab31	SOMATOXMONAM	20	130	10	40	25	56.8329221399835	56.853259540797	56.8735969416105	56.893934342424	56.9142717432375	-12
22	911362457ef9851386355eca5a291e87	DILIAXOIIMOD	30	10	10	20	10	27.6683248992195	27.6117162706922	27.5551076421648	27.4984990136375	27.4418903851102	-12
23	1c7309ad2b41c88469476f185354a4f4	GADOINABIMELINE	10	60	20	30	20	38.4900110307636	39.0121338399314	39.5342566490992	40.056379458267	40.5785022674347	-12
24	7742cabf14bb03f776cf88bc6c1c84c1	NALIMORELIN	10	30	25	30	30	36.7000160076827	37.5203140227290	38.2584120377781	39.1876109538354	40.0168089678726	-11

Split by Customer Type - Large Groups

	X1	t−4	t−3	t−2	t−1	t	t+1	t+2	t+3	t+4	t+5	difference
1	ARILATAPIDE	3135	310425	286615	124925	7530	165795.426578123	169516.562527981	173237.698477839	176958.834427697	180679.970377556	−26712
2	CEFASIBAN	11665	6915	6270	7510	6870	13124.4612244898	13220.1930372149	13315.92484994	13411.6566626651	13507.3884753902	−5470
3	PERFLUSULFAN	9240	5770	4675	5925	4775	10696.9510204082	10766.1726290516	10835.3942376951	10904.6158463385	10973.837454982	−4758
4	DILIAXOIIMOD	8105	5545	5645	9245	5620	9886.14693877551	9938.94093637455	9991.73493397359	10044.5289315726	10097.3229291717	−3160
5	VINIGESTDUTANT	1480	1745	1450	2000	1000	4336.90122448979	4391.98362545018	4447.06602641056	4502.14842737095	4557.23082833133	−2912
6	SULFAARELIN	2200	1770	810	865	1205	3413.24897959184	3419.36678271309	3425.46458583433	3431.57238895558	3437.68019207683	−2055
7	PREDACRINAT	1960	1905	2235	3080	2090	3934.90204081633	3947.2393757503	3959.57671068427	3971.91404561825	3984.25138055222	−1706
8	SOMATOXMONAM	900	750	995	860	820	1980.71428571429	2016.33343400785	2051.95258230142	2087.57173059499	2123.19087888855	−1187
9	GADOINABIMELINE	770	660	865	495	465	1767.63673469388	1771.41464585834	1775.19255702281	1778.97046818728	1782.74837935174	−1124
10	DILBOLIPARCIL	4855	3845	3399	3714	4240	5093.8253968254	4962.54980842912	4831.27422003284	4699.99863163657	4568.72304324029	−821
11	PREDSTATATRIPTAN	1800	1395	1485	2340	1415	2489.40816326531	2498.38103241297	2507.35390156062	2516.32677070828	2525.29963985594	−820
12	NALIMORELIN	985	770	1095	1795	720	1819.29387755102	1827.84657863145	1836.39927971188	1844.95198079232	1853.50468187275	−763
13	NIFURIARILATADINE	655	335	645	430	335	1210.8612244898	1215.13421368547	1219.40720288115	1223.68019207683	1227.95318127251	−739
14	GADOAZOLINE	1070	1091	662	341	246	413.753469387755	415.429291716687	417.105114045618	418.78093637455	420.456758703481	265

Split by Customer Type - Physicians

	X1	t−4	t−3	t−2	t−1	t	t+1	t+2	t+3	t+4	t+5	difference
1	DILIAXOIIMOD	82120	62285	71465	77120	56570	90280.4367346939	91536.5087635054	92792.5807923169	94048.6528211285	95304.72484994	−22881
2	ARILATAPIDE	1150985	1039440	608945	14860	270	555324.807041242	566603.257493503	577881.707945763	589160.158398023	600438.608850284	−14982
3	VINIGESTDUTANT	20915	16855	16920	20555	11215	27681.2612244898	27963.8236254502	28246.3860264106	28528.9484273709	28811.5108283313	−10954
4	SULFAARELIN	22070	17700	16765	18145	14215	28202.8857142857	28411.6890756303	28620.4924369748	28829.2957983193	29038.0991596639	−10841
5	PERFLUSULFAN	39410	30780	28530	32270	25590	41772.6367346939	41824.4381752701	41876.2396158463	41928.0410564226	41979.8424969988	−10560
6	CEFASIBAN	87030	66335	63830	73480	58460	80021.4326530612	80195.0535414165	80368.6744297719	80542.2953181272	80715.9162064826	−10542
7	DILBOLIPARCIL	48410	47475	42050	44877	39719	48794.753968254	49748.771483306	50702.788998358	51656.80651341	52610.824028462	−6197
8	SOMATOXMONAM	15505	14230	14760	16690	12615	16528.8900634249	16710.4164904863	16891.9429175476	17073.4693446089	17254.9957716702	−2132
9	NALIMORELIN	15055	12215	15655	15570	11455	15946.9224489796	15984.4096038415	16021.8967587035	16059.3839135654	16096.8710684274	−2032
10	PREDACRINAT	33540	28175	30435	34250	24375	31258.0571428571	31282.1613445378	31306.2655462185	31330.3697478992	31354.4739495798	−1151
11	GADOINABIMELINE	14785	11705	12020	12755	9045	13432.7632653061	13314.1971188475	13195.630972389	13077.0648259304	12958.4986794718	−1134
12	PREDSTATATRIPTAN	4830	4040	3610	5010	3465	4913.47755102041	4890.01392557023	4866.55030012005	4843.08667466987	4819.62304921969	−676
13	GADOAZOLINE	1001	598	348	282	436	475.755102040816	475.409027611044	475.062953181272	474.716878751501	474.370804321729	58
14	NIFURIARILATADINE	12695	10520	12720	13320	8965	11499.106122449	11412.3534213685	11325.6007202881	11238.8480192077	11152.0953181272	318
15	NIFURMANTADINE	205	380	390	380	355	0.535714285714505	−7.67857142857122	−15.8928571428569	−24.1071428571426	−32.3214285714283	358
16	BOLCOICAMSULE	1170	1095	1055	540	1140	−986.120879120878	−1039.27472527472	−1092.42857142857	−1145.58241758242	−1198.73626373626	2092

Split by State

	state	brand	t−4	t−3	t−2	t−1	t	t+1	t+2	t+3	t+4	t+5	difference
1	NY	ARILATAPIDE	1130	111370	104180	55715	3915	70513.2102073114	71998.6805158816	73484.1508244518	74969.6211330221	76455.0914415923	−18222
2	TX	ARILATAPIDE	710	112765	98715	47670	2420	64117.7709203362	65487.1762171592	66856.5815139821	68225.9868108051	69595.3921076281	−14401
3	PA	ARILATAPIDE	1405	92830	58645	30115	830	46937.5909286284	47928.5235483145	48919.4561680005	49910.3887876865	50901.3214073725	−12154
4	CA	ARILATAPIDE	154940	140080	87695	2660	70	84795.7156506843	86545.9768458679	88296.2380410515	90046.4992362352	91796.7604314188	−11207
5	GA	ARILATAPIDE	2215	60180	55030	35365	55	38294.333903148	39139.6665041564	39984.9991051647	40830.3317061731	41675.6643071815	−9416
6	NJ	ARILATAPIDE	35	63915	74825	39175	460	40866.3184725241	41731.6962123564	42597.0739521888	43462.4516920211	44327.8294318535	−6915
7	FL	ARILATAPIDE	415	95270	80515	55650	1600	50831.8819031436	51893.0118946474	52954.1418861512	54015.2718776551	55076.4018691589	−6264
8	IL	ARILATAPIDE	385	43590	35085	14335	245	23557.6991407033	24035.1693552638	24512.6395698244	24990.109784385	25467.5799989456	−5785
9	TN	ARILATAPIDE	15	29030	29540	18620	2525	20561.6976524402	21014.0325104903	21466.3673685404	21918.7022265906	22371.0370846407	−5520
10	NC	ARILATAPIDE	300	45060	38815	23430	1160	25962.7399415882	26522.6527015459	27082.5654615036	27642.4782214613	28202.390981419	−5330
11	MA	ARILATAPIDE	215	24530	32810	13340	505	18123.5592209857	18522.2267488076	18920.8942766296	19319.5618044515	19718.2293322734	−4641
12	VA	ARILATAPIDE	95	36820	40870	19760	170	23006.8403237222	23494.3374003754	23981.8344770286	24469.3315536819	24956.8286303351	−4439
13	IA	ARILATAPIDE	1285	23945	25800	10930	330	16032.3884483169	16372.4810251523	16712.5736019877	17052.666178823	17392.7587556584	−4255
14	MI	ARILATAPIDE	560	36490	39825	21510	65	22946.2682871508	23428.9496465429	23911.6310059351	24394.3123653272	24876.9937247193	−4222
15	CO	ARILATAPIDE	830	27060	25055	9955	100	16077.1676010376	16415.107104008	16753.0466069785	17090.986109949	17428.9256129194	−4153
16	MO	ARILATAPIDE	210	30185	40780	15350	80	20378.9013465391	20834.2143334075	21289.527320276	21744.8403071444	22200.1532940129	−3969
17	OK	ARILATAPIDE	920	15430	11725	14650	290	11768.2129287423	12024.2059148107	12280.1989008791	12536.1918869476	12792.184873016	−3677
18	OH	ARILATAPIDE	685	49095	37805	22940	280	24294.3826755233	24772.1076311115	25249.8325866996	25727.5575422878	26205.282497876	−3089
19	MS	ARILATAPIDE	285	15975	13035	10210	50	10522.4514308217	10736.5378051982	10950.6241795747	11164.7105539512	11378.7969283276	−3040
20	MD	ARILATAPIDE	565	34315	31170	20100	235	19441.874991584	19837.0811171108	20232.2872426376	20627.4933681645	21022.6994936913	−2955
21	AL	ARILATAPIDE	220	24590	24350	14015	920	15038.4620505992	15360.8355525965	15683.2090545939	16005.5825565912	16327.9560585886	−2864
22	LA	ARILATAPIDE	300	24695	22965	9690	90	13702.7834568058	14001.0810467076	14299.3786366093	14597.6762265111	14895.9738164128	−2751
23	AR	ARILATAPIDE	790	14655	8790	5830	5	8342.28571428572	8529.52026342452	8716.75481256332	8903.98936170213	9091.22391084093	−2703
24	NY	DILIAXOIIMOD	8905	5890	7735	7155	6050	9526.59591836734	9663.42713085234	9800.25834333733	9937.08955582233	10073.9207683073	−2653

Each State's Largest Difference

	state	brand	t−4	t−3	t−2	t−1	t	t+1	t+2	t+3	t+4	t+5	difference
1	AK	ARILATAPIDE	305	1525	1435	65	65	837.56501793041	841.81727134688	846.069524763351	850.321778179821	854.574031596291	−167
2	AL	ARILATAPIDE	220	24590	24350	14015	920	15038.4620505992	15360.8355525965	15683.2090545939	16005.5825565912	16327.9560585886	−2864
3	AR	ARILATAPIDE	790	14655	8790	5830	5	8342.28571428572	8529.52026342452	8716.75481256332	8903.98936170213	9091.22391084093	−2703
4	AZ	PERFLUSULFAN	640	975	880	490	570	1859.86530612245	1887.23649459784	1914.60768307323	1941.97887154862	1969.35006002401	−1204
5	CA	ARILATAPIDE	154940	140080	87695	2660	70	84795.7156506843	86545.9768458679	88296.2380410515	90046.4992362352	91796.7604314188	−11207
6	CO	ARILATAPIDE	830	27060	25055	9955	100	16077.1676010376	16415.107104008	16753.0466069785	17090.986109949	17428.9256129194	−4153
7	CT	ARILATAPIDE	260	24545	22655	12285	930	14062.8423946688	14342.7596864644	14622.6769782601	14902.5942700557	15182.5115618514	−2488
8	DC	ARILATAPIDE	65	15	1375	605	1600	1101.62832494608	1120.98130841121	1140.33429187635	1159.68727534148	1179.04025880661	−408
9	DE	ARILATAPIDE	1955	800	6100	1450	3315	3839.2652745553	3920.10404006924	4000.94280558318	4081.78157109712	4162.62033661106	−1277
10	FL	ARILATAPIDE	415	95270	80515	55650	1600	50831.8819031436	51893.0118946474	52954.1418861512	54015.2718776551	55076.4018691589	−6264
11	GA	ARILATAPIDE	2215	60180	55030	35365	55	38294.333903148	39139.6665041564	39984.9991051647	40830.3317061731	41675.6643071815	−9416
12	HI	ARILATAPIDE	3000	5915	7285	4700	30	4960.64285287439	5062.18163618979	5163.7204195052	5265.2592028206	5366.79798613601	−978
13	IA	ARILATAPIDE	1285	23945	25800	10930	330	16032.3884483169	16372.4810251523	16712.5736019877	17052.666178823	17392.7587556584	−4255
14	ID	ARILATAPIDE	2190	295	2075	4835	475	2554.64068299926	2609.39142538975	2664.14216778025	2718.89291017075	2773.64365256125	−690
15	IL	ARILATAPIDE	385	43590	35085	14335	245	23557.6991407033	24035.1693552638	24512.6395698244	24990.109784385	25467.5799989456	−5785
16	IN	ARILATAPIDE	325	28540	27290	15410	460	16029.8350710549	16361.3238840859	16692.812697117	17024.301510148	17355.7903231791	−2288
17	KS	ARILATAPIDE	65	25	13010	14585	9335	9198.57393744781	9387.21343158946	9575.85292573111	9764.49241987276	9953.13191401441	−2172
18	KY	ARILATAPIDE	17545	19035	8955	215	140	10758.5085598022	10961.1680584766	11163.827557151	11366.4870558254	11569.1465544998	−1986
19	LA	ARILATAPIDE	300	24695	22965	9690	90	13702.7834568058	14001.0810467076	14299.3786366093	14597.6762265111	14895.9738164128	−2751
20	MA	ARILATAPIDE	215	24530	32810	13340	505	18123.5592209857	18522.2267488076	18920.8942766296	19319.5618044515	19718.2293322734	−4641
21	MD	ARILATAPIDE	565	34315	31170	20100	235	19441.874991584	19837.0811171108	20232.2872426376	20627.4933681645	21022.6994936913	−2955
22	ME	ARILATAPIDE	360	25	815	1695	820	1243.48800834202	1269.33035714286	1295.17270594369	1321.01505474453	1346.85740354536	−552
23	MI	ARILATAPIDE	560	36490	39825	21510	65	22946.2682871508	23428.9496465429	23911.6310059351	24394.3123653272	24876.9937247193	−4222
24	MN	ARILATAPIDE	265	26380	5300	5885	85	9710.42311760746	9901.35868833542	10092.2942590634	10283.2298297913	10474.1654005193	−2509

Discussion

Physicians vs. Large Groups

Physicians

- Physicians understock more in volume

Large Groups

- Large groups understock in more product types

shutterstock.com · 212251981

Split by Customer Type - Physicians

	X1	t−4	t−3	t−2	t−1	t	t+1	t+2	t+3	t+4	t+5	difference
1	DILIAXOIIMOD	82120	62285	71465	77120	56570	90280.4367346939	91536.5087635054	92792.5807923169	94048.6528211285	95304.72484994	−22881
2	ARILATAPIDE	1150985	1039440	608945	14860	270	555324.807041242	566603.257493503	577881.707945763	589160.158398023	600438.608850284	−14982
3	VINIGESTDUTANT	20915	16855	16920	20555	11215	27681.2612244898	27963.8236254502	28246.3860264106	28528.9484273709	28811.5108283313	−10954
4	SULFAARELIN	22070	17700	16765	18145	14215	28202.8857142857	28411.6890756303	28620.4924369748	28829.2957983193	29038.0991596639	−10841
5	PERFLUSULFAN	39410	30780	28530	32270	25590	41772.6367346939	41824.4381752701	41876.2396158463	41928.0410564226	41979.8424969988	−10560
6	CEFASIBAN	87030	66335	63830	73480	58460	80021.4326530612	80195.0535414165	80368.6744297719	80542.2953181272	80715.9162064826	−10542
7	DILBOLIPARCIL	48410	47475	42050	44877	39719	48794.753968254	49748.771483306	50702.788998358	51656.80651341	52610.824028462	−6197
8	SOMATOXMONAM	15505	14230	14760	16690	12615	16528.8900634249	16710.4164904863	16891.9429175476	17073.4693446089	17254.9957716702	−2132
9	NALIMORELIN	15055	12215	15655	15570	11455	15946.9224489796	15984.4096038415	16021.8967587035	16059.3839135654	16096.8710684274	−2032
10	PREDACRINAT	33540	28175	30435	34250	24375	31258.0571428571	31282.1613445378	31306.2655462185	31330.3697478992	31354.4739495798	−1151
11	GADOINABIMELINE	14785	11705	12020	12755	9045	13432.7632653061	13314.1971188475	13195.630972389	13077.0648259304	12958.4986794718	−1134
12	PREDSTATATRIPTAN	4830	4040	3610	5010	3465	4913.47755102041	4890.01392557023	4866.55030012005	4843.08667466987	4819.62304921969	−676
13	GADOAZOLINE	1001	598	348	282	436	475.755102040816	475.409027611044	475.062953181272	474.716878751501	474.370804321729	58
14	NIFURIARILATADINE	12695	10520	12720	13320	8965	11499.106122449	11412.3534213685	11325.6007202881	11238.8480192077	11152.0953181272	318
15	NIFURMANTADINE	205	380	390	380	355	0.535714285714505	−7.67857142857122	−15.8928571428569	−24.1071428571426	−32.3214285714283	358
16	BOLCOICAMSULE	1170	1095	1055	540	1140	−986.120879120878	−1039.27472527472	−1092.42857142857	−1145.58241758242	−1198.73626373626	2092

Split by Customer Type - Large Groups

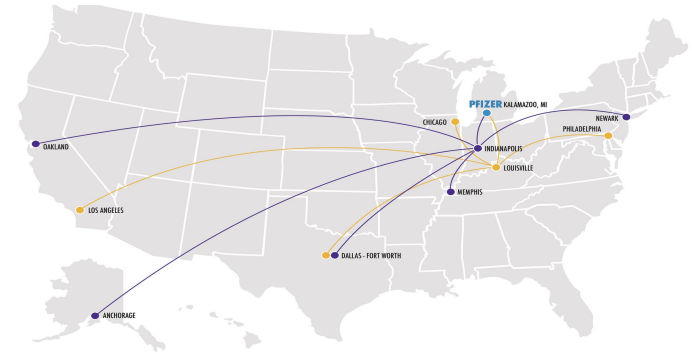|	X1	t−4	t−3	t−2	t−1	t	t+1	t+2	t+3	t+4	t+5	difference
1	ARILATAPIDE	3135	310425	286615	124925	7530	165795.426578123	169516.562527981	173237.698477839	176958.834427697	180679.970377556	−26712
2	CEFASIBAN	11665	6915	6270	7510	6870	13124.4612244898	13220.1930372149	13315.92484994	13411.6566626651	13507.3884753902	−5470
3	PERFLUSULFAN	9240	5770	4675	5925	4775	10696.9510204082	10766.1726290516	10835.3942376951	10904.6158463385	10973.837454982	−4758
4	DILIAXOIIMOD	8105	5545	5645	9245	5620	9886.14693877551	9938.94093637455	9991.73493397359	10044.5289315726	10097.3229291717	−3160
5	VINIGESTDUTANT	1480	1745	1450	2000	1000	4336.90122448979	4391.98362545018	4447.06602641056	4502.14842737095	4557.23082833133	−2912
6	SULFAARELIN	2200	1770	810	865	1205	3413.24897959184	3419.35678271309	3425.46458583433	3431.57238895558	3437.68019207683	−2055
7	PREDACRINAT	1960	1905	2235	3080	2090	3934.90204081633	3947.2393757503	3959.57671068427	3971.91404561825	3984.25138055222	−1706
8	SOMATOXMONAM	900	750	995	860	820	1980.71428571429	2016.33343400785	2051.95258230142	2087.57173059499	2123.19087888855	−1187
9	GADOINABIMELINE	770	660	865	495	465	1767.63673469388	1771.41464585834	1775.19255702281	1778.97046818728	1782.74837935174	−1124
10	DILBOLIPARCIL	4855	3845	3399	3714	4240	5093.8253968254	4962.54980842912	4831.27422003284	4699.99863163657	4568.72304324029	−821
11	PREDSTATATRIPTAN	1800	1395	1485	2340	1415	2489.40816326531	2498.38103241297	2507.35390156062	2516.32677070828	2525.29963985594	−820
12	NALIMORELIN	985	770	1095	1795	720	1819.29387755102	1827.84657863145	1836.39927971188	1844.95198079232	1853.50468187275	−763
13	NIFURIARILATADINE	655	335	645	430	335	1210.8612244898	1215.13421368547	1219.40720288115	1223.68019207683	1227.95318127251	−739
14	GADOAZOLINE	1070	1091	662	341	246	413.753469387755	415.429291716687	417.105114045618	418.78093637455	420.456758703481	265

Predicting Demand

- Using regression, we can predict the demand for each customer based off of existing data
- Problem: Inefficient
- Solution: Segment data by a combination of order type (physician/ large group) and product → Eliminate understocking

 →

Managing the Supply Chain

- Segmenting data → Focus on understocking problem
- By state: Focus both on product type as well as states with larger understocking problem

Each State's Largest Difference

	state	brand	t−4	t−3	t−2	t−1	t	t+1	t+2	t+3	t+4	t+5	difference
1	AK	ARILATAPIDE	305	1525	1435	65	65	837.56501793041	841.81727134688	846.069524763351	850.321778179821	854.574031596291	−167
2	AL	ARILATAPIDE	220	24590	24350	14015	920	15038.4620505992	15360.8355525965	15683.2090545939	16005.5825565912	16327.9560585886	−2864
3	AR	ARILATAPIDE	790	14655	8790	5830	5	8342.28571428572	8529.52026342452	8716.75481256332	8903.98936170213	9091.22391084093	−2703
4	AZ	PERFLUSULFAN	640	975	880	490	570	1859.86530612245	1887.23649459784	1914.60768307323	1941.97887154862	1969.35006002401	−1204
5	CA	ARILATAPIDE	154940	140080	87695	2660	70	84795.7156506843	86545.9768458679	88296.2380410515	90046.4992362352	91796.7604314188	−11207
6	CO	ARILATAPIDE	830	27060	25055	9955	100	16077.1676010376	16415.107104008	16753.0466069785	17090.986109949	17428.9256129194	−4153
7	CT	ARILATAPIDE	260	24545	22655	12285	930	14062.8423946688	14342.7596864644	14622.6769782601	14902.5942700557	15182.5115618514	−2488
8	DC	ARILATAPIDE	65	15	1375	605	1600	1101.62832494608	1120.98130841121	1140.33429187635	1159.68727534148	1179.04025880661	−408
9	DE	ARILATAPIDE	1955	800	6100	1450	3315	3839.2652745553	3920.10404006924	4000.94280558318	4081.78157109712	4162.62033661106	−1277
10	FL	ARILATAPIDE	415	95270	80515	55650	1600	50831.8819031436	51893.0118946474	52954.1418861512	54015.2718776551	55076.4018691589	−6264
11	GA	ARILATAPIDE	2215	60180	55030	35365	55	38294.333903148	39139.6665041564	39984.9991051647	40830.3317061731	41675.6643071815	−9416
12	HI	ARILATAPIDE	3000	5915	7285	4700	30	4960.64285287439	5062.18163618979	5163.7204195052	5265.2592028206	5366.79798613601	−978
13	IA	ARILATAPIDE	1285	23945	25800	10930	330	16032.3884483169	16372.4810251523	16712.5736019877	17052.666178823	17392.7587556584	−4255
14	ID	ARILATAPIDE	2190	295	2075	4835	475	2554.64068299926	2609.39142538975	2664.14216778025	2718.89291017075	2773.64365256125	−690
15	IL	ARILATAPIDE	385	43590	35085	14335	245	23557.6991407033	24035.1693552638	24512.6395698244	24990.109784385	25467.5799989456	−5785
16	IN	ARILATAPIDE	325	28540	27290	15410	460	16029.8350710549	16361.3238840859	16692.812697117	17024.301510148	17355.7903231791	−2288
17	KS	ARILATAPIDE	65	25	13010	14585	9335	9198.57393744781	9387.21343158946	9575.85292573111	9764.49241987276	9953.13191401441	−2172
18	KY	ARILATAPIDE	17545	19035	8955	215	140	10758.5085598022	10961.1680584766	11163.827557151	11366.4870558254	11569.1465544998	−1986
19	LA	ARILATAPIDE	300	24695	22965	9690	90	13702.7834568058	14001.0810467076	14299.3786366093	14597.6762265111	14895.9738164128	−2751
20	MA	ARILATAPIDE	215	24530	32810	13340	505	18123.5592209857	18522.2267488076	18920.8942766296	19319.5618044515	19718.2293322734	−4641
21	MD	ARILATAPIDE	565	34315	31170	20100	235	19441.874991584	19837.0811171108	20232.2872426376	20627.4933681645	21022.6994936913	−2955
22	ME	ARILATAPIDE	360	25	815	1695	820	1243.48800834202	1269.33035714286	1295.17270594369	1321.01505474453	1346.85740354536	−552
23	MI	ARILATAPIDE	560	36490	39825	21510	65	22946.2682871508	23428.9496465429	23911.6310059351	24394.3123653272	24876.9937247193	−4222
24	MN	ARILATAPIDE	265	26380	5300	5885	85	9710.42311760746	9901.35868833542	10092.2942590634	10283.2298297913	10474.1654005193	−2509

Recommendations

Recommendations

- Focus on selling to physicians
  - More number of vaccines understocking
  - Less brands that are understocked
- Sell smaller quantities more frequently to manage supply chain

Recommendations: Working with Physicians

- Encourage HCP to create an appointment-based system
    - Reduce the amount of walk in patients
    - Especially helpful for rare meds that we don't produce a lot of
- Send notification to HCP (through texts or emails) based on past purchasing behavior
    - When they should expect a shortage of certain meds
    - Useful for erratic or cyclical order histories

Recommendation: Working with Large Groups

- Focus on "ARILATAPIDE" brand
  - Over 50% of understocking doses for large groups
- Try to sell larger bundles

Impact

Impact

- Fasten the process of delivering meds from Pfizer to patients
- Reduce delivery costs
- Maximize resources efficiency at pharmacies
- **Expected increase in revenues of ~ 2%**

E(revenue increased) = estimated understocking rate (25 doses)

* estimated successful of the program (70%)

* average price for doses ($307)

* customers (28,625)

= **$153,787,812.5**

References

Weiss, D. (n.d.). How To Avoid Inventory Overstocks And Understocks. How to Avoid Inventory Overstocks and

Understocks. https://www.skunexus.com/blog/how-to-avoid-inventory-overstocks-and-understocks

Slobin, Jacqueline. "How Much Do Vaccines Cost without Insurance in 2021?" *Mira*, Mira, 23 Sept. 2021,

https://www.talktomira.com/post/how-much-do-vaccines-cost-with-and-without-insurance.

Q&A