

Pharmaceutical Industry Analysis in Rochester for BAC



Ansel Ammana / MIS / SCM / axa5503@rit.edu

Anna Loso / MIS / all1779@rit.edu

Nathan Parker / MIS / nsp1621@rit.edu

Table of Contents

Executive Summary	3
Data Preparation	3
Data Analysis	4
Results	7
Recommendations	7
Appendix	8

Executive Summary

Our team of consultants has analyzed the pharmaceutical environment in Rochester, NY for the benefit of BAC Inc to expand after performing well during the COVID-19 Pandemic. Through multiple discoveries, we see that the pharmaceutical environment in Rochester is dominated by Wegmans. Their best selling and best margin product mix is related to Over-the-counter / Vitamins, Minerals and Supplements (OTC/VMS), while its closest related product mixes include Skincare and Personal care products. We have taken into account that BAC Inc. is primarily a pharmaceutical company, so we have focused on the previously mentioned commodity areas. As proved below, we recommend that BAC Inc. become a preferred seller for Wegmans Pharmacy for the OTC/VMS, Skincare, and Personal care product mixes.

Data Preparation

We began with two datasets; one is called ‘Pharmacies in ROC’ that gives location and identification information on the pharmacies in the Rochester area. The other is ‘Pharmacy Sales’, which has unique invoices for each pharmacy sale detailing price and sale specific information.

Our first step was to limit the pharmacies listed in ‘Pharmacies in ROC’ to the ones with a store number. We did so in order to only study pharmacies that keep visible records of their sales, which were the companies with store numbers. There are 130 total observations and 61 Stores with no Store ID (See Appendix Figure 1). The companies with a Store ID are who BAC Inc. would be competing against if they buy or build into the Rochester Pharmacy market, or would become a preferred seller of pharmaceuticals for. So it makes sense to only study those pharmacies, being: CVS, Rite-Aid, Target, Walmart, Walgreens, and Wegmans.

Through viewing the number of stores for each pharmacy in R, we noticed that there were multiple Walgreens and Rite-Aid Organization Names listed, which we combined into one Walgreens and one Rite-Aid respectively. We transformed all “Walgreen Co.” to “Walgreen Co” and all “Rite Aid Corp.” to “Rite Aid of New York Inc”. This was done using the `case_when()` function in R Studio. See Appendix Figures 2, 3 and 4 for the transformations and code.

There was also an error in the calculation for Sales. The formula to calculate Sales is $\text{ProductRetailPrice} * \text{Units Sold}$. In Appendix Figure 5 we can see that observation 1 shows a Sales amount of \$120.59. For a ProductRetailPrice of \$9.95 and 12 units sold, we would expect a Sales amount of \$119.40. We replaced the Sales variable with a calculated field and correct formula. See Appendix Figure 6 below for the correct Sales column for observation 1.

For our data set, our group decided to filter down to only observations in 2018 and 2019 to keep the most rele. We did not include 2020 due to COVID-19. This reduced our total # of observations from 990746 to 235067. It should be noted that there were some items with \$0.00 item cost, however, these \$0.00 cost items were only observed in 2012.

Data Analysis

Our team was interested in analyzing the various categories of products that the pharmacies sell. In order to get a visualization of the sales per category at each store, we used Tableau for a quick comparison. By comparing Units Sold and Category, we learned that the top three most successful categories were OTC/VMS (over the counter medicine and vitamins), Skin Care Items, and Personal Hygiene Items.

Units Sold per Category

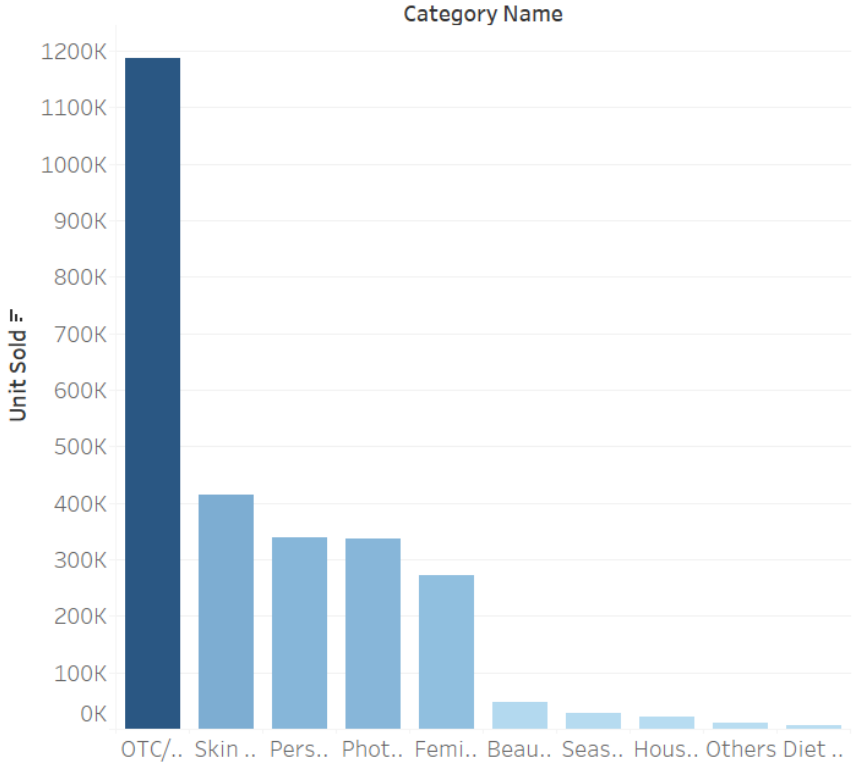


Figure 1: Tableau visualization of each category in the given dataset and how many units have been sold in each category in 2018-2019.

In order to gain an understanding of which stores were most successful, we used Tableau to visualize the amount of Sales each store had, using only the years 2018 and 2019 as previously mentioned.

Sales by Store

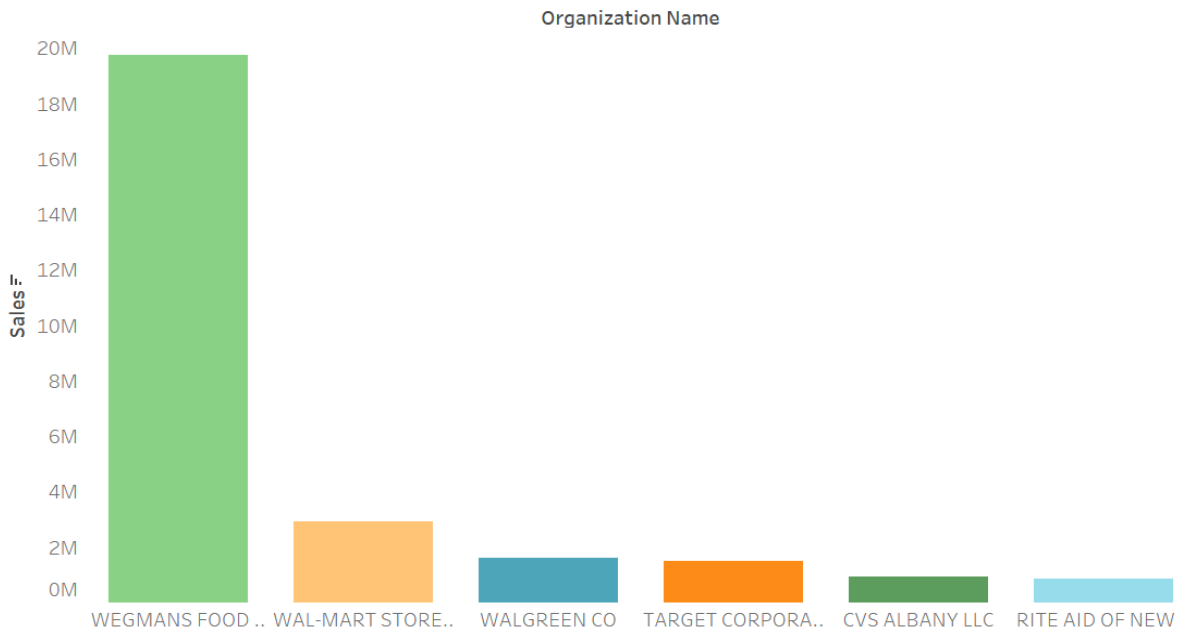


Figure 2: Tableau visualization of each organization in the given dataset and the amount of sales they had in 2018-2019.

We also looked into the sales margins per store to see if they were all about equal or if any lead by lot. We found that again, Wegmans was the leading store for Sales Margin.

Sales Margins by Store

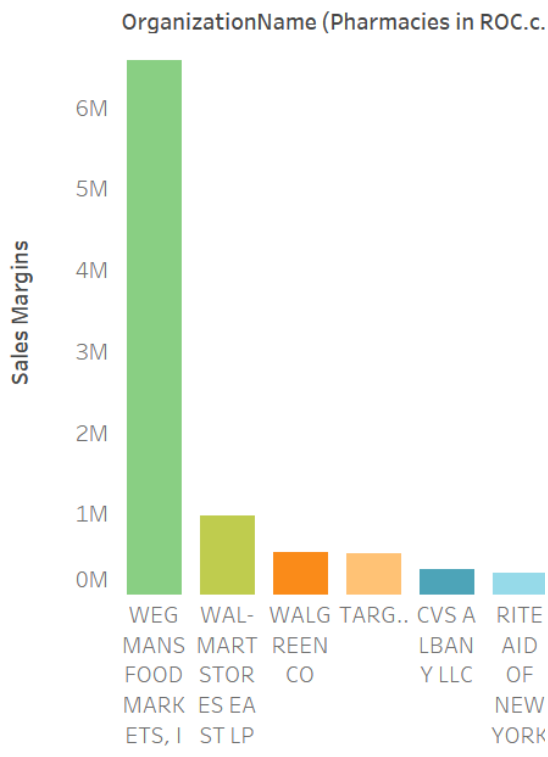


Figure 3: Tableau visualization of each organization and their sales margins based on product unit cost and product unit price.

Following the preliminary analysis that we obtained from these visualizations, we see that Wegmans is the leader for Sales and Sales Margins.

Using R, we took a count of the number of times that various categories were used for each invoice. Both this and our association analysis was done in R. The goal of the association analysis was to find the most commonly associated product categories. It required a binary matrix to set each row to represent 1 transaction and each column to represent 1 category purchased within the dataset. If the category was purchased in a given transaction, the cell will have a value of 1, otherwise the cell will have a value of 0. Finally, the association analysis uses an apriori algorithm with a support level of .1% and a confidence level of 10%. Appendix Figures 7 and 8 display the category counts as well as the association analysis conducted, further analysis is in the results section below.

Results

After reviewing the top selling commodity areas by sales and by margin we found the top three areas to be OTC/VMS, Personal Hygiene and Skincare products through the earlier Association Analysis and Figure 1 regarding units sold per category. OTC/VMS, Personal Hygiene and Skincare products were the most associated products; with the highest counts and support for them to be sold in the same store together. These three commodities also align with a pharmaceutical company like BAC Inc. Because of this, we do not recommend that BAC Inc. expand their mix and instead sell these pharmaceutical products.

Additionally, after looking at the top companies in Rochester, Wegmans is far and away the best performing company. Even excluding product mixes like food and beverage, Wegmans has the best margins and the most sales. Since Wegmans is such a dominant company, starting a new business or acquiring an existing business would not put BAC Inc. in a good position to be competitive against a player like Wegmans.

Recommendations

We recommend that BAC Inc. do not purchase an existing store nor create a store in the Rochester Area. Instead, we recommend that BAC Inc. does what they do best and sell pharmaceutical drugs, specifically to Wegmans. Wegmans Food Markets is the highest seller in all commodity areas, for all years. BAC Inc. should work with Wegmans and attempt to get BAC Inc's items in Wegmans stores. This process would involve BAC Inc. creating a strategic partnership with Wegmans. Since BAC Inc. is a successful company who performed well during the pandemic we believe that this would be mutually beneficial for both parties.

Appendix

```
StoreNumber
Min.      :2527
1st Qu.   :4012
Median    :4603
Mean      :4400
3rd Qu.   :5051
Max.      :6064
NA's     :61
```

Appendix Figure 1: Stores with no Store number

```
59 ClusteringSet$OrganizationName = case_when(
60   ClusteringSet$OrganizationName == "RITE AID CORP." ~ "RITE AID OF NEW YORK INC",
61   ClusteringSet$OrganizationName == "WALGREEN CO." ~ "WALGREEN CO",
62   TRUE ~ ClusteringSet$OrganizationName)
```

Appendix Figure 2: Transformation Code

```
> ClusteringSet %>% group_by(OrganizationName) %>%
# A tibble: 8 x 2
  OrganizationName      count
*   <chr>              <int>
1 CVS ALBANY LLC        15875
2 RITE AID CORP.         4118
3 RITE AID OF NEW YORK INC 27028
4 TARGET CORPORATION AND SUBSIDIARIES 11822
5 WAL-MART STORES EAST LP 23087
6 WALGREEN CO           9419
7 WALGREEN CO.           335
8 WEGMANS FOOD MARKETS, INC 143383
```

Appendix Figure 3: Non-transformed OrganizationName, summarized by # of transactions

```
> ClusteringSet %>% group_by(OrganizationName) %>%
# A tibble: 6 x 2
  OrganizationName      count
  <chr>                <int>
1 WEGMANS FOOD MARKETS, INC 143383
2 RITE AID OF NEW YORK INC 31146
3 WAL-MART STORES EAST LP 23087
4 CVS ALBANY LLC          15875
5 TARGET CORPORATION AND SUBSIDIARIES 11822
6 WALGREEN CO             9754
```

Appendix Figure 4: Transformed state of OrganizationName, summarized by # of transactions

ProductCost	ProductRetailPrice	UnitSold	Sales
6.63	9.95	12	120.59

Appendix Figure 5: Incorrect Sales \$ Calculations

ProductCost	ProductRetailPrice	UnitSold	Sales
6.63	9.95	12	119.40

Appendix Figure 6: Corrected Sales \$ Calculation

```

# OTC/VMS by Category
  CategoryName      count
<chr>              <int>
1 OTC/VMS          103653
2 Personal hygiene  34042
3 Skin care items   31440
4 Feminine products 14030
5 Beauty items      10937
6 Seasonal products  5639
7 Household cleaning items 4279
8 Others            2467
9 Photos            2275
10 Diet and nutrition items 1769
> |

```

Appendix Figure 7: Category Names by Count in all Invoices

```

> inspect(rules.sorted[1:20])

```

	lhs	rhs	support	confidence	coverage	lift	count
[1]	{}	=> {OTC/VMS}	0.9814815	0.9814815	1.0000000	1.0000000	53
[2]	{Personal hygiene}	=> {OTC/VMS}	0.9629630	1.0000000	0.9629630	1.0188679	52
[3]	{OTC/VMS}	=> {Personal hygiene}	0.9629630	0.9811321	0.9814815	1.0188679	52
[4]	{}	=> {Personal hygiene}	0.9629630	0.9629630	1.0000000	1.0000000	52
[5]	{}	=> {Skin care items}	0.8888889	0.8888889	1.0000000	1.0000000	48
[6]	{Skin care items}	=> {OTC/VMS}	0.8703704	0.9791667	0.8888889	0.9976415	47
[7]	{OTC/VMS}	=> {Skin care items}	0.8703704	0.8867925	0.9814815	0.9976415	47
[8]	{Personal hygiene,skin care items}	=> {OTC/VMS}	0.8518519	1.0000000	0.8518519	1.0188679	46
[9]	{OTC/VMS,skin care items}	=> {Personal hygiene}	0.8518519	0.9787234	0.8703704	1.0163666	46
[10]	{Skin care items}	=> {Personal hygiene}	0.8518519	0.9583333	0.8888889	0.9951923	46
[11]	{Personal hygiene}	=> {Skin care items}	0.8518519	0.8846154	0.9629630	0.9951923	46
[12]	{OTC/VMS,Personal hygiene}	=> {Skin care items}	0.8518519	0.8846154	0.9629630	0.9951923	46
[13]	{}	=> {others}	0.7777778	0.7777778	1.0000000	1.0000000	42
[14]	{Household cleaning items}	=> {OTC/VMS}	0.7592593	1.0000000	0.7592593	1.0188679	41
[15]	{others,Personal hygiene}	=> {OTC/VMS}	0.7592593	1.0000000	0.7592593	1.0188679	41
[16]	{OTC/VMS,others}	=> {Personal hygiene}	0.7592593	1.0000000	0.7592593	1.0384615	41
[17]	{others}	=> {Skin care items}	0.7592593	0.9761905	0.7777778	1.0982143	41
[18]	{others}	=> {Personal hygiene}	0.7592593	0.9761905	0.7777778	1.0137363	41
[19]	{others}	=> {OTC/VMS}	0.7592593	0.9761905	0.7777778	0.9946092	41
[20]	{Skin care items}	=> {others}	0.7592593	0.8541667	0.8888889	1.0982143	41

Appendix Figure 8: Top 20 rules sorted by Support and Confidence

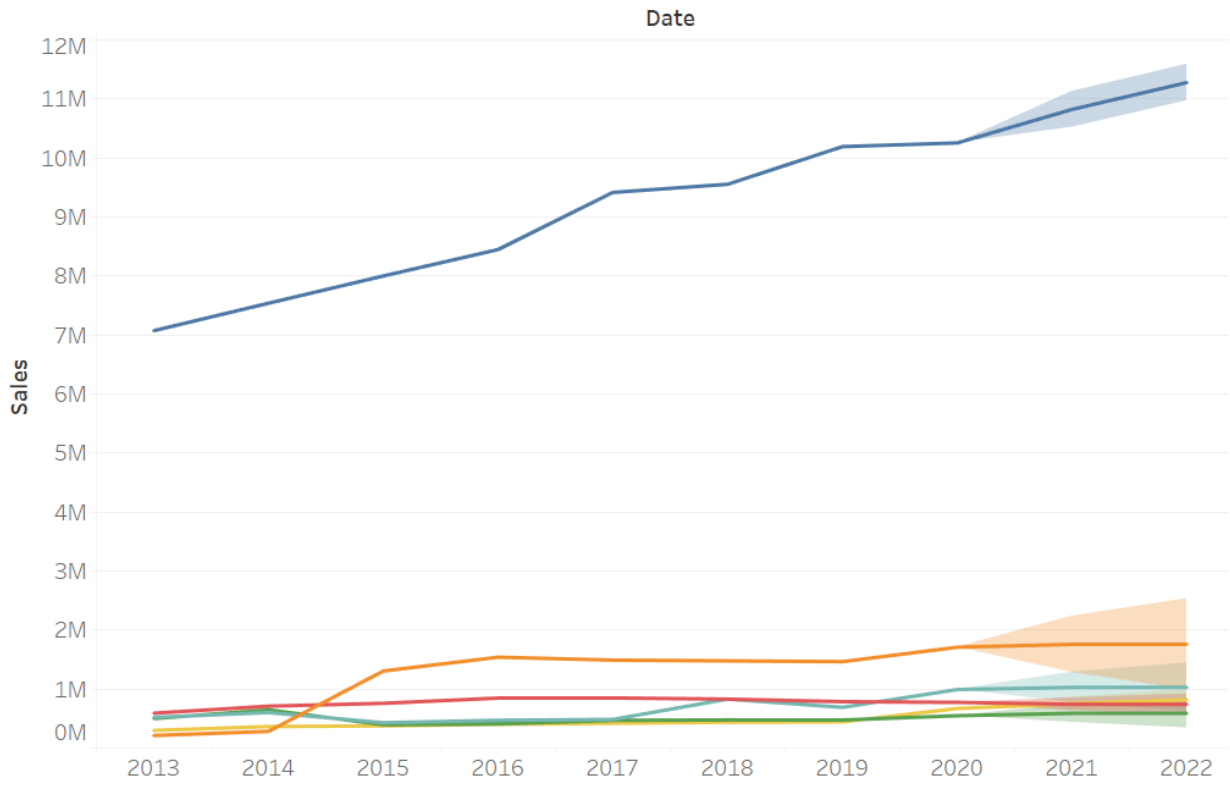
```

ClusteringSet = full_list2018_2019
Summarized_Data = ClusteringSet %>% group_by(StoreNumber, Zipcode, StoreName, Longitude, Latitude) %>%
summarise(TotalSales = sum(Sales)) %>% arrange(desc(TotalSales))

```

Appendix Figure 10: Summarized Data set with aggregate sales

Sales Data Forecast



- Organization Name
- WEGMANS FOOD MA..
 - WAL-MART STORES E..
 - WALGREEN CO
 - TARGET CORPORATIO..
 - CVS ALBANY LLC
 - RITE AID OF NEW YOR..