BAMA517 Final Assignment:

Pharmaceutical Marketing Assessment

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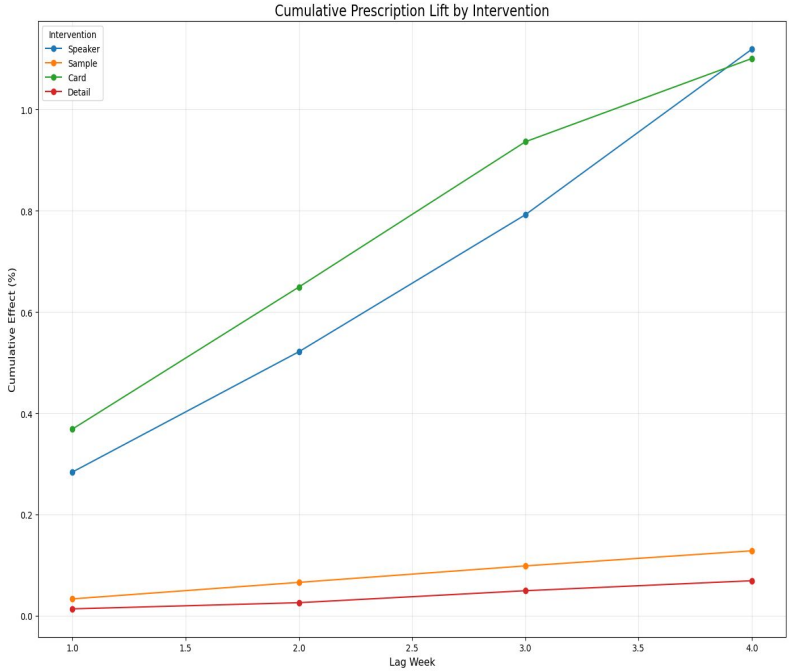
Executive Summary

By **analyzing marketing program effectiveness** and segmenting physicians by rank, we developed strategies to optimize prescription lift and maximize sales. We prioritized the most profitable programs over those with the highest engagement growth rates, ensuring resources target initiatives with the greatest financial impact.

- **Priority Targeting:** High-rank and low-rank physicians respond similarly to programs but differ in impact, with high-rank physicians consistently driving significantly higher prescription volumes. Targeting these high-prescribing physicians is the most effective strategy, especially when resources are limited.
- **Marketing programs Effectiveness (Prescription Lift):** Among the programs, Loyalty Cards deliver the highest initial impact but taper off after the third week, while the Speaker Program shows sustained and growing effectiveness over time. In contrast, the impact of Sales Representatives and Samples remains relatively flat post-intervention.
- **Actionable Recommendations for Growth:** Allocate more resources to high-performing programs: prioritizing Loyalty Card and Speaker Engagement over Details and Free Sample Engagement.
- **Leverage Medical Conferences for Strategic Engagement:** Sponsoring booths at medical conferences presents an opportunity to engage high rank physicians. Tracking metrics such as booth visits, sign-ups to loyalty programs and post-event prescriptions trends can indicate success**.**

Analysis Result (1/2): Lift Analysis

- **Speaker Programs**: Strong, sustained impact, peaking at **Week 4* (+1.0%)**. Effective over multiple weeks, with consistent growth observed.
- **Samples**: Modest initial impact (**+0.05% at Week 1**), with minimal growth over time, ending at **+0.15% by Week 4**. Effect remains relatively low throughout.
- **Loyalty Cards**: High immediate lift (**+0.4% at Week 1**), with continued significant growth, reaching **+1.4% by Week 4**. Most impactful intervention with consistent gains.
- **Sales Rep Visits (Detail)**: Moderate initial effect (**+0.0% at Week 1**), with steady growth, ending at **+0.4% by Week 4**. Effectiveness builds gradually over time.
- **Physician Ranking**: Physician ranking has a significant impact on prescriptions (i.e. each decile increase is associated with a ~0.3 units increase in prescription).



	Coefficient	P-Value
Physician Decile	0.2953	~0.000

* Week 1 in the charts refer to 1 week after week of intervention.

Analysis Result (2/2): Segmentation

Team 20

HRP: High Rank (low Decile) Physician
LRP: Low Rank (high decile) Physicians

Recommendations:

- Consider reducing low efforts of samples engagements with small physicians, as these have the lowest return on investment.
- Allocate a higher proportion of resources (time, effort, budget) to engage with HRPs.
- Focus on Card Engagement and Speaker Engagement over Details and Sample Engagement because, across both HRP & LRP, Card Engagement and Sample Engagement consistently outperform Sample and Details Engagement.

Segment/Program	Speaker	Sample	Card	Details
High Engagement & Large Physician	196.55 Prescriptions	148.28 Prescriptions	197.63 Prescriptions	178.85 Prescriptions
High Engagement & Small Physician	63.51 Prescriptions	57.54 Prescriptions	68.86 Prescriptions	71.55 Prescriptions
Low Engagement & Large Physician	150.36 Prescriptions	72.66 Prescriptions	102.32 Prescriptions	76.93 Prescriptions
Low Engagement & Small Physician	35.47 Prescriptions	15.72 Prescriptions	34.04 Prescriptions	18.09 Prescriptions

Methodology (1/2) - Segmentation Analysis

- Data was divided into four distinct segments for each program, categorizing them as follows: **High** program Engagement with **Large** Physicians, **High** program Engagement with **Small** Physicians, **Low** program Engagement with **Large** Physicians, **Low** program Engagement with **Small** Physicians

- The segmentation aimed to evaluate whether strategy effectiveness varies by physician rank (Large vs. Small) and to compare outcomes between actively engaged and unengaged physicians in the strategy, guiding tailored recommendations and assessing overall impact of the strategy. **Segmentation Criteria:**

Engagement Type	Low Engagement Threshold	High Engagement Threshold
Speaker Engagement (Based on Speaker engagement distribution)	<=0	≥ 2
Sample Engagement (Percentile-based thresholds)	≤ 24 samples (25th percentile)	≥ 150.25 samples (75th percentile)
Card Engagement (Based on Card engagement distribution)	<=0	≥ 1
Details Engagement (Percentile-based thresholds)	≤ 15 visits (25th percentile)	≥ 44 visits (75th percentile)
Physicians Ranking (Categorized by industry decile ranking)	Industry Decile Ranking ≤ 5 (Small Physicians)	Industry Decile Ranking >5 (Large Physicians)

- **Calculation Method:** For each segment, the total number of prescriptions was divided by the number of physicians in that segment to derive the average prescriptions per physician.

Methodology (2/2) - Regression for Lift Analysis

- Ordinary Least Squares (OLS) regression to assess the impact of marketing interventions on prescription volumes. The model included direct effects of interventions such as Speaker Programs, Samples, Loyalty Cards, and Sales Rep Visits. To capture delayed impacts, lagged variables were created for each intervention up to 4 weeks (see Annex for full regression results).
- The baseline, i.e., pre-intervention, for calculating lift, is defined as all weeks without that program type over the dataset timeframe.
- Model controlled for physician characteristics using the Industry Decile Ranking and accounted for geographical differences with dummy variables (i.e. effect of regions and rank is being isolated).
- The results show that all the lagged program variables and control variables are significant at a 95% confidence level, indicating that the model is robust and the findings are statistically reliable. The formula for calculating cumulative lift based on the regression result is as follow:

$$L_{I,t} = \sum_{i=0}^{t} \beta_{I,i}$$

Where:

- $L_{I,t}$: The **cumulative lift** of intervention I at week t.
- $\beta_{I,0}$: The **coefficient** of intervention I at week 0 (i.e., the immediate effect).
- $\beta_{I,i}$: The **coefficient** of the lagged effect of intervention I at lag i.
- t: The current lag week (e.g., $t = 1, 2, 3, 4$).

Medical Conference Assessment

Team 20

HRP: High Rank (low Decile) Physician
LRP: Low Rank (high decile) Physicians

Strategic Focus

- Target **Northeast region** with the highest concentration of physicians to capture a larger market share
  - Number of doctors: **1,354 vs. regional/national average of 994.4**
  - **A/B Testing Approach**: Compare outcomes for doctors engaged at the conference vs. those exposed through existing marketing channels.

Metrics to Track

- **Physician Participation**: Track physician IDs and their engagement at the event.
  - Measure sign-ups for: Loyalty card programs, as they outperform Sample and Details Engagement across HRP and LRP, driving the highest short-term lift.
- **Prescription Trends**: Compare prescription volumes pre- and post-conference for both groups.
  - Group A: Physicians attending the conference.
  - Group B: Physicians reached via pre-existing marketing.

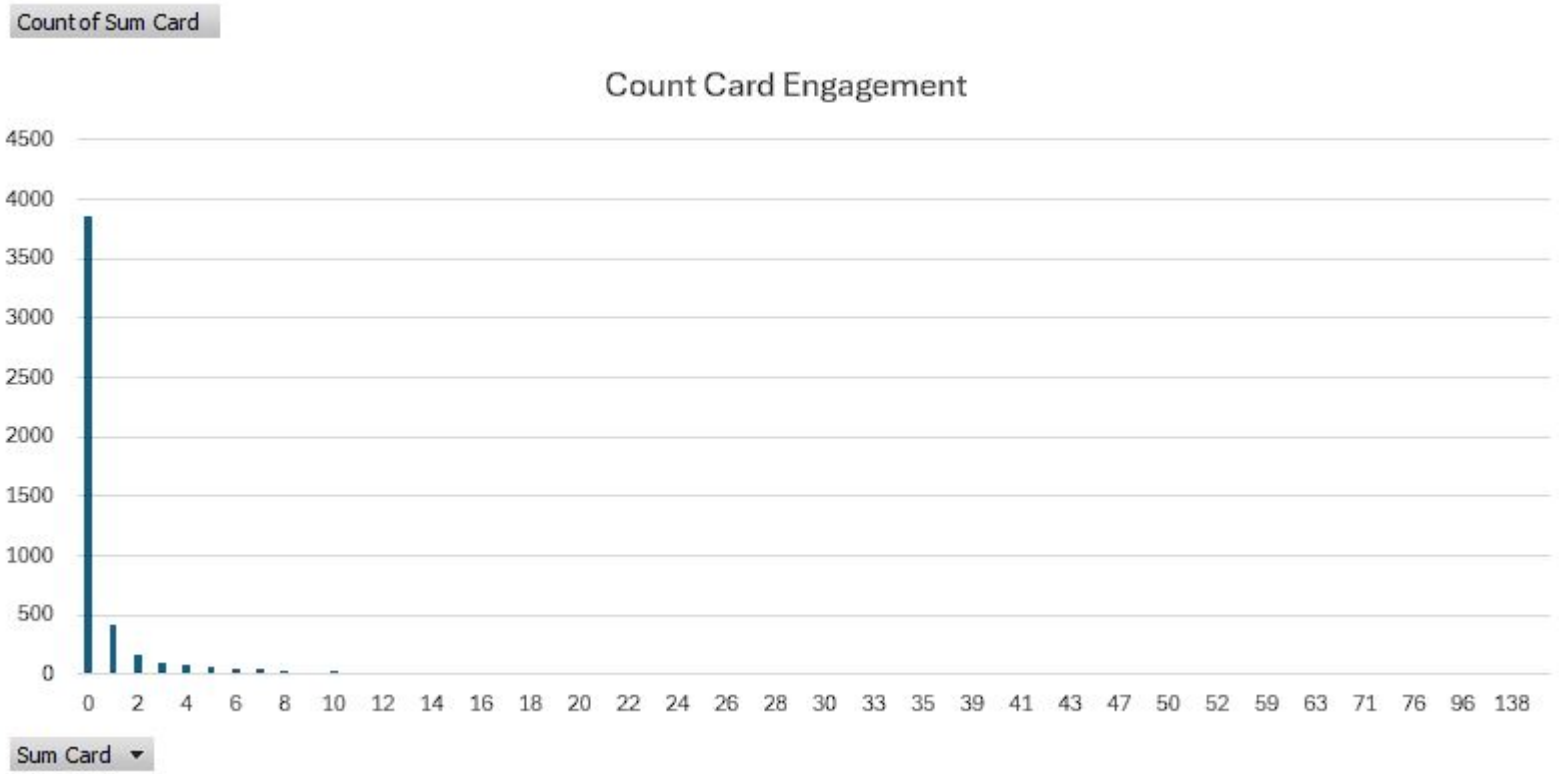
Effectiveness Evaluation

- Measure lift in sign-ups to the loyalty program and prescriptions driven by conference engagement.
- Compare results with historical data and regional benchmarks.
- **Key Question**: Does conference engagement significantly increase long-term prescriptions?

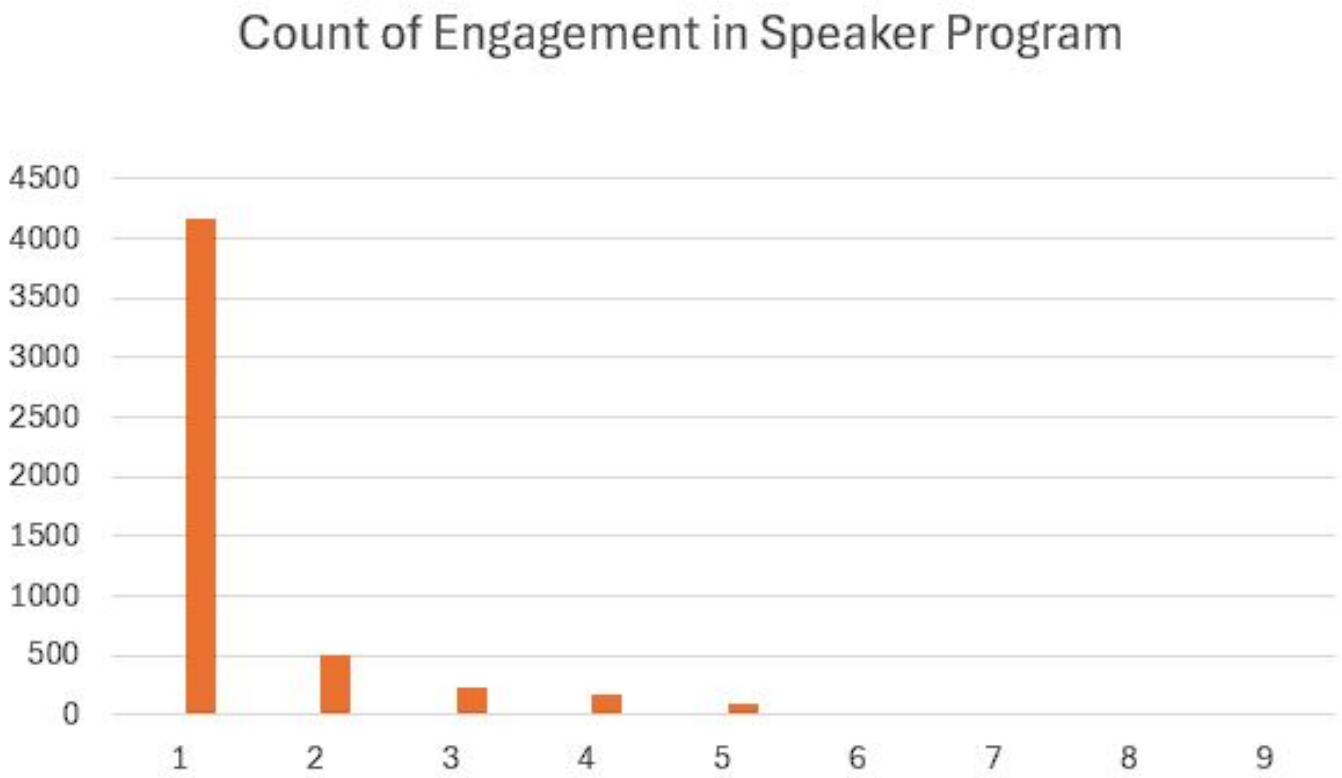
Gen AI usage

- Name, version, company of AI tool: OpenAI’s ChatGPT4o
- Chat objective:
  a. to fix code errors
  b. to code certain things that the team wanted to create but not learn in classes
  c. to create codes to plot graph in specific ways
  d. to check grammar and spelling of text parts
- Use of AI-generated content
  a. Python codes
  b. Result of grammar and spelling check

ANNEX: Distribution of the Speaker Program



ANNEX: Distribution of the Speaker Program



ANNEX: Lift Regression Results

$$\begin{aligned}\text{Prescription} = {} & \beta_0 + \beta_1 \cdot \text{Speaker} + \beta_2 \cdot \text{Speaker\_Lag\_1} + \beta_3 \cdot \text{Speaker\_Lag\_2} + \beta_4 \cdot \text{Speaker\_Lag\_3} + \beta_5 \cdot \text{Speaker\_Lag\_4} \\ & + \beta_6 \cdot \text{Sample} + \beta_7 \cdot \text{Sample\_Lag\_1} + \beta_8 \cdot \text{Sample\_Lag\_2} + \beta_9 \cdot \text{Sample\_Lag\_3} + \beta_{10} \cdot \text{Sample\_Lag\_4} \\ & + \beta_{11} \cdot \text{Card} + \beta_{12} \cdot \text{Card\_Lag\_1} + \beta_{13} \cdot \text{Card\_Lag\_2} + \beta_{14} \cdot \text{Card\_Lag\_3} + \beta_{15} \cdot \text{Card\_Lag\_4} \\ & + \beta_{16} \cdot \text{Detail} + \beta_{17} \cdot \text{Detail\_Lag\_1} + \beta_{18} \cdot \text{Detail\_Lag\_2} + \beta_{19} \cdot \text{Detail\_Lag\_3} + \beta_{20} \cdot \text{Detail\_Lag\_4} \\ & + \beta_{21} \cdot \text{Industry\_Decile\_Ranking} \\ & + \beta_{22} \cdot \text{Geography\_RT01} + \beta_{23} \cdot \text{Geography\_RT02} + \beta_{24} \cdot \text{Geography\_RT03} + \beta_{25} \cdot \text{Geography\_RT04} + \beta_{26} \cdot \text{Geography\_RT05}\end{aligned}$$

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	0.2972	0.094	3.169	0.002	0.113	0.481
Geography_RT01___NORTHEAST[T.True]	−0.8505	0.094	−9.078	0.000	−1.034	−0.667
Geography_RT02___SOUTH[T.True]	−0.8815	0.094	−9.404	0.000	−1.065	−0.698
Geography_RT03___WEST[T.True]	−0.8945	0.094	−9.543	0.000	−1.078	−0.711
Geography_RT04___CENTRAL[T.True]	−0.9807	0.094	−10.461	0.000	−1.164	−0.797
Geography_RT05___GREAT_LAKES[T.True]	−1.0003	0.094	−10.672	0.000	−1.184	−0.817
Geography_na[T.True]	−0.3754	0.099	−3.785	0.000	−0.570	−0.181
Speaker	0.2589	0.038	6.870	0.000	0.185	0.333
Speaker_Lag_1	0.2837	0.038	7.529	0.000	0.210	0.358
Speaker_Lag_2	0.2378	0.038	6.331	0.000	0.164	0.311
Speaker_Lag_3	0.2707	0.037	7.278	0.000	0.198	0.344
Speaker_Lag_4	0.3271	0.037	8.809	0.000	0.254	0.400
Sample	0.0351	0.001	54.875	0.000	0.034	0.036
Sample_Lag_1	0.0332	0.001	52.002	0.000	0.032	0.034
Sample_Lag_2	0.0326	0.001	51.132	0.000	0.031	0.034
Sample_Lag_3	0.0326	0.001	51.290	0.000	0.031	0.034
Sample_Lag_4	0.0298	0.001	46.933	0.000	0.029	0.031
Card	0.6209	0.016	38.817	0.000	0.590	0.652
Card_Lag_1	0.3687	0.016	23.429	0.000	0.338	0.399
Card_Lag_2	0.2807	0.016	17.777	0.000	0.250	0.312
Card_Lag_3	0.2870	0.016	17.557	0.000	0.255	0.319
Card_Lag_4	0.1645	0.017	9.601	0.000	0.131	0.198
Detail	0.0226	0.005	4.724	0.000	0.013	0.032
Detail_Lag_1	0.0135	0.005	2.838	0.005	0.004	0.023
Detail_Lag_2	0.0122	0.005	2.569	0.010	0.003	0.022
Detail_Lag_3	0.0237	0.005	4.987	0.000	0.014	0.033
Detail_Lag_4	0.0197	0.005	4.118	0.000	0.010	0.029
Industry_Decile_Ranking	0.2953	0.001	234.701	0.000	0.293	0.298