Brief report

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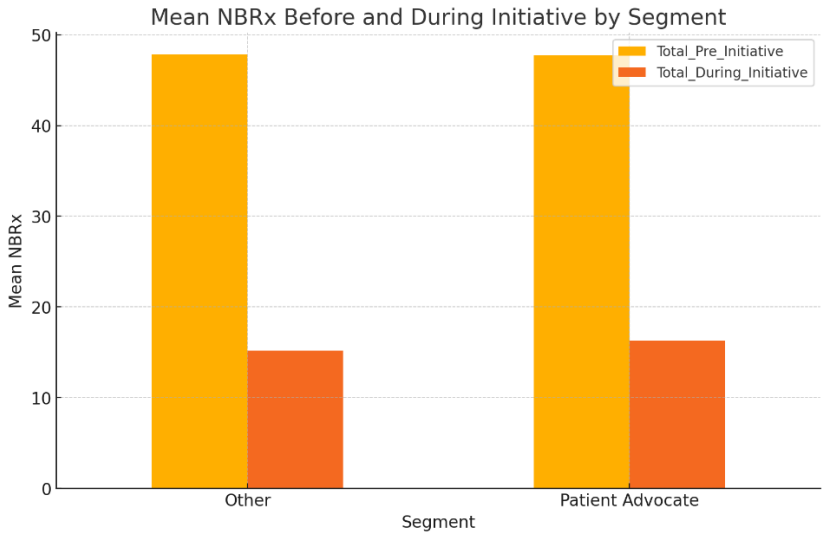
First, I should mention that all computations have been done in Python and the below are only the results and conclusions briefly.
After preprocessing the dataset and running some codes in Python, we have obtained the following results (the dataset has been cleaned to focus on relevant columns),

- Grouping by 'segment' and calculating mean NBRx accordingly,

Segment	Total_Pre_Initiative	Total_During_Initiative
Other	47.85	15.16
Patient Advocate	47.73	16.27

- Visualization of changes in NBRx by Segment



<u>Some useful information</u>

- Mean and median are close, indicating a fairly ~ normal distribution for prescriptions.
- No missing values were found in the dataset

- Segment: two categories; "Patient Advocate" and "Other," with "Other" as the majority group (66.3% of records).
- Message Delivered: two categories; ‘Segmented’ and ‘Standard,’ with ‘Standard’ dominating (90.7% of records).
- Region: seven unique regions, well-represented.
- ‘Other’ had a drop in mean NBRx from 47.85 (pre-initiative) to 15.16 (during-initiative).
- The variable/feature of "Patient Advocate" showed a smaller drop from 47.74 to 16.27, suggesting a slightly better retention of prescriptions during the initiative for the targeted segment.
- The results indicate that "patient advocates" had slightly better engagement during the initiative compared to ‘Other’.
- Note: our assumptions are normal distribution of NBRx values, and equal variances across groups.

Methodology, Statistical Testing

- Accomplish t-tests (two groups) or ANOVA (three or more groups) to determine if the differences in NBRx (before vs. during the initiative) are statistically significant.
- Analyze by region to evaluate pilot region performance compared to non-pilot regions.

Pilot_Region	Total_Pre_Initiative	Total_During_Initiative
Non-Pilot	47.17	15.24
Pilot	49.39	16.24

Hypotheses Examples:

Pilot Regions

- Null H0: No difference in NBRx before and during the initiative.
- Alternative H1: A difference exists in NBRx before and during the initiative.

Non-Pilot Regions

- Null: No difference in NBRx before and during the initiative.
- Alternative: A difference exists in NBRx before and during the initiative.

Patient Advocate vs. Other Segments

- Null: No difference in NBRx during the initiative between Patient Advocates and other segments.
- Alternative: A difference exists in NBRx during the initiative between Patient Advocates and other segments.

For 95% confidence interval CI, critical value of t_critical =1.96 :

- T-test Results for Pilot Regions (Pre vs During): t-stat: 19.53 > t_critical, p-value: 2.1×10^{-82}, Pilot Regions CI does not include zero.
- T-test Results for Non-Pilot Regions (Pre vs During): t-stat: 170.12 > t_critical, p-value: 0, Non-Pilot Regions CI does not include zero.
- T-test Results for Patient Advocate vs Other Segments (During): t-stat: 9.04 > t_critical, p-value: 1.84×10^{-19} , Patient Advocate vs. Other Segments CI does not include zero.

- ✓ As you know, To reject the null hypothesis and confirm statistical significance, three conditions need to align: the p-value should be less than 0.05, the t-statistic should be larger than the critical t-value, and the confidence interval (CI) should not include zero (meaning, if zero is outside the CI, we reject the null hypothesis).

Interpretation of above results

Pilot vs Non-Pilot Analysis:

- Mean NBRx (Pre vs During Initiative):
  - Pilot Regions: Pre = 49.39, During = 16.25
  - Non-Pilot Regions: Pre/before = 47.17, During = 15.25
- Pilot regions retained slightly higher NBRx during the initiative compared to non-pilot regions.

T-Test Results for Pilot Regions (Pre vs During):

- t-statistic: 19.53
- p-value: 2.1×10^{-82}
- Statistically significant reduction in NBRx in pilot regions during the initiative (p-value < 0.05).

T-Test Results for Non-Pilot Regions (Pre vs During):

- t-statistic: 170.13
- p-value: 0.0
- Statistically significant reduction in NBRx in non-pilot regions during the initiative (p-value < 0.05).

T-Test Results for Patient Advocate vs Other Segments (During Initiative):

- t-statistic = 9.04
- p-value: 1.84×10^{-19}
- Patient Advocates showed statistically significantly higher NBRx during the initiative compared to other segments.

Answers to Business Questions

Was the initiative successful?

Answer: the initiative had a measurable and important impact on maintaining NBRx for the 'patient advocate' segment compared to other segments. Also there was a decline overall, the Patient Advocate segment performed better during the initiative.

Should segmentation be rolled out more broadly?

Answer: yes, the initiative demonstrates potential. The tailored messaging for Patient Advocates helped retain more NBRx compared to the standard messaging for other segments.

Some Recommendations

- Rollout Strategy: broaden segmentation for Patient Advocates across all regions, prioritizing pilot regions for scalability.

- Further Research: analyze feedback from sales representatives and HCPs to optimize messaging. Investigate factors affecting NBRx in non-Pilot regions for better targeting.

- **Executive Summary**

The initiative retained higher NBRx for the Patient Advocate segment compared to others. Statistically significant differences observed in NBRx before vs during initiative.

Important Findings

Pilot regions showed better retention of NBRx during the initiative. Patient Advocate segment had higher NBRx during the initiative than other segments.

Methodology

Data Cleaning: Aggregated NBRx by periods (pre and during initiative).

Statistical Analysis/Methods

Conducted t-tests to identify significant differences.

Visualization

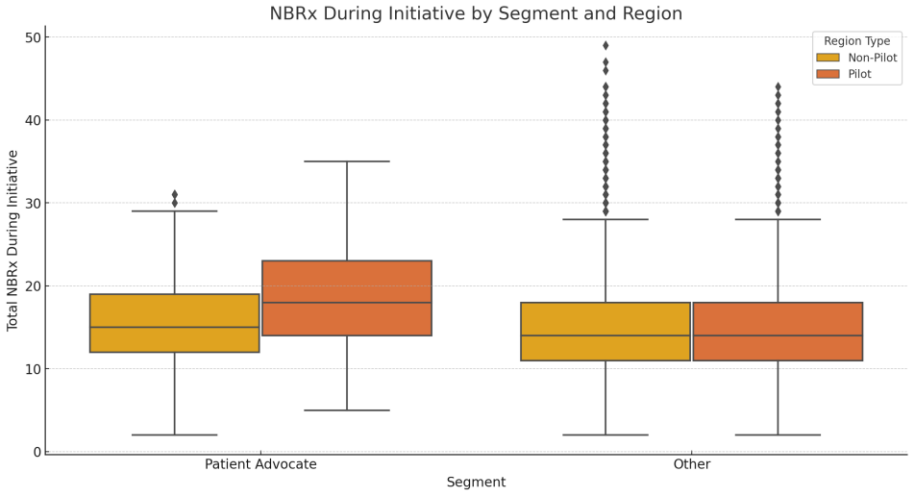
Box plots highlighting segment and regional differences.

Some Recommendations

Expand segmentation for Patient Advocates across all regions. Prioritize pilot regions for scalability of the initiative. Collect feedback from HCPs to refine messaging strategies.

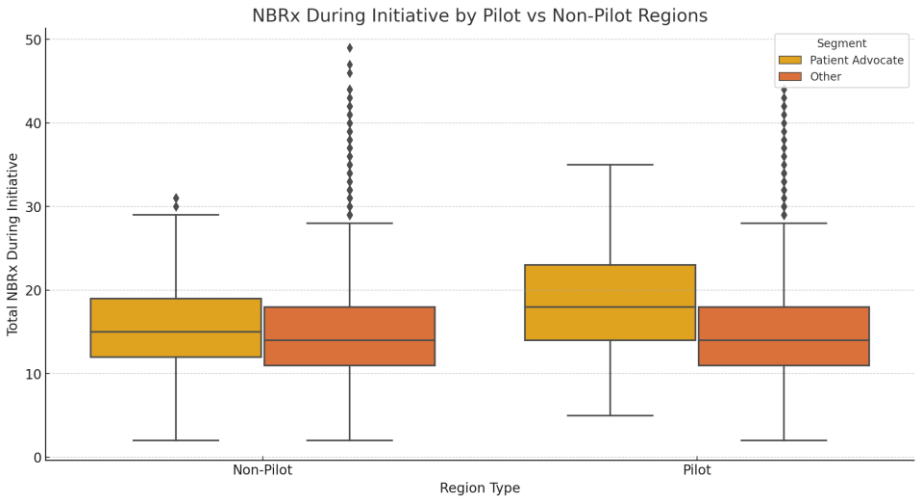
Visual Insights

Box plots demonstrate differences in NBRx across segments and regions



Two box plots have been prepared,

1. NBRx During Initiative by Segment and Region:
    - Highlights the distribution of NBRx for "Patient Advocate" and "Other" segments, separated by Pilot and Non-Pilot regions.
2. NBRx During Initiative by Pilot vs Non-Pilot Regions:
    - Compares NBRx across segments within Pilot and Non-Pilot regions.



Cohen's d Effect Size Results

- Cohen's d for Pilot Regions (Pre vs During): 0.5,
- Cohen's d for Non-Pilot Regions (Pre vs During): 2.8,
- Cohen's d for Patient Advocate vs Other Segments (During): 0.18

Note: Cohen's effect size helps us understand the size of an effect or the strength of a relationship between variables in a standardized way. The most widely used version, Cohen's d, is typically applied when comparing the averages of two groups. It's worth noting that values of d greater than 2.0 or 3.0 are uncommon in real-world scenarios, as they indicate an exceptionally large difference between the groups.

Interpretation of Cohen's d Effect Size Results

Pilot Regions (Pre vs During Initiative):

- Cohen's d effect size: 0.51, Medium effect size, indicating a moderate strength of difference between pre-initiative and during-initiative NBRx in pilot regions.

Non-Pilot Regions (Pre vs During Initiative):

- Cohen's d: 2.80, Large effect size, indicating a very effective and strong difference between pre-initiative and during-initiative NBRx in non-pilot regions.

Patient Advocate vs Other Segments (During Initiative):

- Cohen's d: 0.19, Small effect size, suggesting a weaker but noticeable difference between Patient Advocates and other segments during the initiative.

Local Conclusions

- The Non-Pilot Regions show the strongest effect, but this is a negative result, as NBRx declined substantially.
- The Pilot Regions demonstrate a moderate effect, supporting the initiative's success in retaining some impact.
- The Patient Advocate segment shows a small effect, reinforcing that tailored messaging had a positive but limited impact.

Pilot Regions (Pre vs During Initiative)

In the pilot regions, the t-test revealed a statistically significant difference between pre-initiative and during-initiative NBRx values (t-statistic = 19.53, p-value = 2.1×10^{-82}. The Cohen's d effect size was calculated as 0.51, which falls into the "medium" category based on standard classifications. This indicates that a moderately strong relationship exists between the initiative and the observed changes in NBRx within pilot regions. While the p-value confirms statistical significance, the medium effect size suggests that the initiative had a noticeable but not overwhelming impact on retaining NBRx in these regions.

Non-Pilot Regions (Pre vs During Initiative)

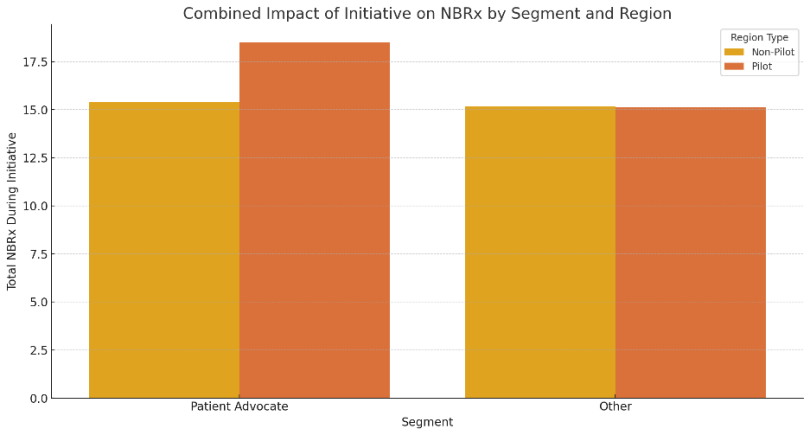
In non-pilot regions, the t-test also revealed a highly statistically significant difference (t-statistic = 170.13, p-value = 0). However, the Cohen's d effect size was calculated as 2.8, which is classified as "large." This indicates that a very strong relationship exists between the initiative and the observed decline in NBRx in non-pilot regions. The large effect size suggests that the standard messaging in non-pilot regions had a substantial impact, but unfortunately, this effect was negative, resulting in a significant reduction in NBRx during the initiative period.

Patient Advocate vs Other Segments (During Initiative)

When comparing the Patient Advocate segment to other segments during the initiative, the t-test again showed a statistically significant difference (t-statistic = 9.04, p-value = 1.84×10^{-19}. However, the Cohen's d effect size was calculated as 0.19, which falls into the "small" category. This indicates that while the relationship between the initiative and NBRx retention in the Patient Advocate segment is statistically significant, the strength of this relationship is weak. The small effect size suggests that the tailored messaging for Patient Advocates had a positive impact but only to a limited extent.

So, the segmentation initiative showed a moderate positive impact on NBRx retention in pilot regions (Cohen's d = 0.51) and a small but significant improvement for Patient Advocates (Cohen's d = 0.19). However, non-pilot regions experienced a large negative effect (Cohen's d = 2.80), highlighting the need for tailored messaging. Expanding the initiative broadly is recommended, focusing on refining strategies to enhance effectiveness.

Summary table	Group Comparison	T-statistic	P-value	Cohen's d	Effect Size
1	Pilot Regions (Pre vs During)	19.53	2.1×10^{-82}	0.51	Medium
2	Non-Pilot Regions (Pre vs During)	170.13	0.0	2.80	Large
3	Patient Advocate vs Other Segments (During)	9.04	1.84×10^{-19}	0.19	Small



New insights and points

- Result and Conclusion: The segmentation initiative demonstrated a positive but limited impact**,** particularly for Patient Advocates in pilot regions (Cohen's d = 0.51, medium effect). While overall NBRx retention declined during the initiative, Patient Advocates responded better to tailored messaging, showcasing the potential for segmentation when refined and implemented effectively.

- Recommendations:
  Rollout Strategy:
  - Expand segmentation to all regions, focusing on Patient Advocates.
  - Implement tailored messaging across non-Pilot regions with adjustments based on pilot learnings. Targeted Messaging Effectiveness (TME) is a measure to evaluate how effective your tailored messaging is for improving or retaining NBRx during the initiative compared to before the initiative.

  Performance Improvement Formula: Targeted Messaging Effectiveness (TME) = (NBRx_During / NBRx_Pre) × Engagement Rate

$$\text{TME} = \left(\frac{\text{NBRx During Initiative}}{\text{NBRx Before Initiative}}\right) \times \text{Engagement Rate}$$

$$\text{Engagement Rate} = \frac{\text{Number of HCPs Actively Engaged}}{\text{Total Number of HCPs Targeted}}$$

  Actively Engaged HCPs: Those who responded positively to the initiative (e.g., increased NBRx, attended meetings, or accepted messaging).
  - NBRx During Initiative / NBRx Before Initiative:
    - This fraction measures the change in new prescriptions (NBRx) during the initiative relative to the baseline before the initiative.
    - If the value is >1, it means the initiative helped increase NBRx; if <1, it shows a decline.
  - Engagement Rate:
    - A measure of how well the healthcare professionals (HCPs) engaged with the tailored messaging. It could be derived from metrics like HCP meeting attendance, message acceptance rates, or response to patient-support offerings.
    - A higher engagement rate indicates better acceptance of the initiative.

- Increase TME by tailoring messages to resonate with specific HCP segments, leveraging efficacy and patient support data (The Engagement Rate measures how actively, and positively healthcare professionals (HCPs) responded to the tailored messaging during the initiative. It reflects the degree of interest, interaction, and acceptance of the provided information and patient-support offerings).

  - Purpose: This formula combines the retention or growth in NBRx with the actual engagement level of HCPs to determine how impactful and sustainable the tailored messaging is. A high TME score indicates a successful strategy.

- Action Plan:
  Optimize Messaging: Collect HCP feedback and refine content for higher engagement.
  Monitor Performance: Use NBRx trends and HCP responses as key indicators of success.
  Address Non-Pilot Regions: Develop customized strategies for underperforming regions.

- Key Analysis Insights:
  - Pilot regions performed moderately well (Cohen's d = 0.51), indicating the initiative's potential.
  - Patient Advocates had a small positive response (Cohen's d = 0.19), but the effort needs scaling and optimization.
  - Non-Pilot regions suffered significant declines, emphasizing the need for more targeted engagement.

By implementing these recommendations, the company can enhance the segmentation initiative, improve performance, and optimize resource allocation for sustained success.

Brief Applied Responses for Performance Improvement

- **Should we roll out the segmentation more broadly across the sales organization?**

Yes, the segmentation should be rolled out, especially focusing on regions with high "Patient Advocate" HCPs, as tailored messaging showed a positive but small impact. But with refinements based on pilot results to enhance engagement and performance among Patient Advocates while minimizing declines in other segments.

- **Was the initiative successful? Why?** Moderately successful: The initiative retained NBRx for Patient Advocates better than other segments, though the overall impact was small (Cohen's d = 0.19).

- **Should the brand team roll out the segmentation to the remaining sales regions? Why or why not?** Yes, to leverage potential in Patient Advocates, but adjustments in messaging strategies are needed to avoid significant declines seen in non-Pilot regions.

- **Executive Summary of Findings & Recommendations**
  - The segmentation initiative had a medium effect (Cohen's d = 0.51) in pilot regions and small (0.19) for Patient Advocates.

- Expand segmentation while optimizing strategies for non-Pilot regions and feedback collection.

- **Methodology**
  - Approach: Cleaned data, aggregated NBRx pre- and during-initiative, and grouped by region and segment.
  - Techniques: T-tests for significance, Cohen's d for effect size (strength), visualizations for trends.

- **Key Business Questions**
  - Rollout segmentation with refinements.
  - Increase engagement with Patient Advocates.
  - Tailor strategies to counter declines in non-Pilot regions.

- **Recommendation**

Expand segmentation across regions with clear focus on optimizing Patient Advocate messaging. Justification: Statistically significant improvements in pilot regions and Patient Advocate segment.

- **Data Profiling**

Trends and distributions were assessed via summary statistics, t-tests, and visualizations to identify NBRx variations by region and segment.

- **Hypotheses**
  - Tailored messaging resonates more with Patient Advocates.
  - Non-Pilot regions underperform due to generic messaging and market variations.

- **Business Insights**
  - Strengthen Patient Advocate messaging across all regions.
  - Address market dynamics in non-Pilot regions with customized strategies.

- **Assumptions**
  - NBRx values represent engagement.
  - Trends in pilot regions can generalize to non-Pilot regions with adjustments.

- **Additional Information**
  - HCP feedback on messaging effectiveness.
  - Market conditions and competitor activities for non-Pilot regions.

  - The segmentation initiative at company demonstrated a moderate positive impact in pilot regions (Cohen's d = 0.51) and a small but significant improvement for Patient Advocates (Cohen's d = 0.19). While non-Pilot regions showed significant declines (Cohen's d = 2.80), the tailored messaging approach proved effective for retaining NBRx among Patient Advocates. It is recommended to roll out segmentation more broadly, prioritizing regions with higher Patient Advocate presence, refining messaging strategies, and addressing underperformance in non-Pilot regions through customized engagement plans.

Collecting HCP feedback and monitoring performance metrics will be crucial for sustained success and efficiency.

Appendix

Example 1

If 100 HCPs were targeted, and 60 HCPs actively engaged (e.g., increased prescriptions or accepted tailored messages):
Engagement Rate=60/100=0.6 or 60%

Example 2

If metrics include:

- 70 HCPs attended meetings.
- 50 HCPs followed up on patient-support offerings.
- 100 HCPs were targeted.

Engagement Rate= (70+50)/(100*2)= 0.6 or 60%

Purpose in the Formula:

- Higher engagement indicates tailored messaging resonates well with HCPs.
- It amplifies the impact of the initiative in retaining or growing NBRx.

Why are HCPs important? HCPs are the decision-makers for prescribing medication, and their engagement with tailored messaging directly impacts the initiative's success in retaining or increasing new prescriptions (NBRx).

The End