Data Analysis Report: A/B Test Summary

Objective

GloBox, an e-commerce company, conducted an A/B test to evaluate the impact of a promotional banner on user conversion rates and overall engagement in their food and drink category. The primary goal was to determine if the banner could effectively increase awareness and revenue.

Test Setup

- **Target Audience:** Users visiting the GloBox main page on the mobile website.
- **Randomization:** Users were randomly assigned to either a Control (group A) or Treatment (group B) group based on their join date.
- **Treatment Group:** Displayed a banner highlighting food and drink products.
- **Control Group:** Did not see the banner.

Dataset Tables

Table 1: Users — User Demographics

- **id:** Unique user identifier.
- **country:** ISO 3166 alpha-3 country code indicating user location.
- **gender:** User's gender (M = male, F = female, O = other).

Table 2: Groups — A/B Test Group Assignment

- **uid:** User identifier.
- **group:** Test group designation (Control or Treatment).
- **join_dt:** Date the user joined the test (visited the page).
- **device:** Device used to access the page (I = iOS, A = Android).

Table 3: Activity — User Purchasing Activity

- **uid:** User identifier.
- **dt:** Date of purchase activity.
- **device:** Device type used for the purchase (I = iOS, A = Android).
- **spent:** Purchase amount in USD.

KPIs

1. **User Conversion Rate:** Percentage of users who made a purchase, either on the day they joined the experiment or at a later date.
2. **Average Purchase Amount:** The average amount spent by users who made a purchase.
3. **User Engagement:** Number of purchases made by users.

Handling Missing Values

Impact: Missing data can introduce bias, reduce sample size, and misrepresent key metrics, potentially compromising the validity of A/B testing results.
Solution: We performed Exploratory Data Analysis (EDA) and Chi-Square tests to identify patterns and mitigate biases associated with missing data. Only the missing gender values underwent further statistical testing due to their potentially significant impact on the analysis

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Hypothesis Testing Overview

For the statistical tests conducted during this analysis, the following hypotheses were established:

1. T-Test for Average Spend & Z-Test for Conversion Rate
    - **Null Hypothesis (H_0):** There is no difference in average spend between the control and treatment groups.
    - **Alternative Hypothesis (H_1):** There is a difference in average spend between the groups.
2. Chi-Square Test for Missing Gender Data:
    - **Null Hypothesis (H_0):** Missing gender values are independent of other variables.
    - **Alternative Hypothesis (H_1):** There is a relationship between missing gender values and other variables.

Results

Missing Value Analysis

In the course of analyzing missing data, the following insights were identified:

- Total Records: 49,082
- Gender Records: 42,200 | Missing Gender Records: 6,882 (14.02%)
- Country Records: 48,435 | Missing Country Records: 647 (1.32%)
- Device Records: 48,787 | Missing Device Records: 295 (0.60%)

Breakdown

- **Gender Data**
  Missing gender values range from 0.15% to 2.2% across countries, accounting for approximately 17% of users on each experiment day. The total existing number of male users is 20,289, while female users is 20,130.
- **Country and Device Data**
  The missing country and device values represent 1.32% and 0.60% of the total records, respectively. These percentages are not insignificant and do not warrant further statistical testing.

Chi-Square Analysis

A Chi-Square test was conducted specifically on the gender data to determine if the missing values were randomly distributed or associated with other variables. The Chi-Square test is appropriate for assessing the independence between categorical variables and the missing data.

Chi-Square test:

- **Chi-Square Statistic**: 0.0015 (|chi| > 3.841,), failed to reject the null hypothesis.
- **Result:** The missing gender values are **not statistically significant**, suggesting that they do not introduce bias into the analysis.

Impact on Analysis

Given that the calculation of conversion rate and average spend does not depend on gender, country, or device values, the entire dataset was used for these KPIs. Missing country and device values were excluded only from their respective analyses

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KPIs

Conversion rate & average purchase

	Conversion Rate	Average Purchase	Sample Size
Control (A)	3.92%	$3.37	24343
Treatment (B)	4.63%	$3.39	24600

Overall Conversion Rate: 4.28%

Detailed Gender-Based Results

		Conversion Rate	Average Purchase
A	F	5.14%	$4.46
	M	2.63%	$2.25
	O	3.22%	$2.77
B	F	5.44%	$4.13
	M	3.79%	$2.60
	O	3.02%	$2.77

Insight: While the overall average purchase amount did not show a significant difference, the average spend of women in the Treatment Group decreased compared to the Control Group.

User Engagement

Group/Items	0	1	2
A	82.7% | 20123 users	3.1% | 757 users	0.2% | 51 users
B	82.1% | 20196 users	3.7% | 900 users	0.2% | 61 users

User Engagement Breakdown by Gender

Group/Items		0	1	2
A	F	82.2% | 9551 users	4.2% | 483 users	0.3% | 35 users
	M	83.4% | 9790 users	2.5% | 249 users	0.1% | 15 users
	O	83.9% | 782 users	2.7% | 249 users	0.1% | 15 users
B	F	82.0% | 9514 users	4.5% | 512 users	0.3% | 35 users
	M	82.8% | 9847 users	3.7% | 365 users	0.2% | 23 users
	O	82.9% | 782 users	2.8% | 249 users	0.4% | 15 users

Time-to-Purchase Analysis

- **First Purchase Timing**:
  The majority of purchases (78%) were made on the same day as the user's first visit. After the first purchase, subsequent purchases sharply declined.

- **Second Purchase Timing:**
  The majority of second purchases (40%) were made one day after the first purchase.
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- **Purchase Distribution:**
  Control Group: **Majority Spent:** $40-$50
  Treatment Group: **Majority Spent:** $30-$40

Insights by Country

Negative Reaction: 50% of the top 10 countries showed a decrease in average purchase value, with Turkey being a standout case. In Turkey, the conversion rate dropped from 3.89% to 3.36%, and the average purchase values for women declined significantly from $6.33 to $2.93, further highlighting the negative impact of the banner on women's spending. Notably, there was no clear pattern by region for this negative reaction, indicating that the banner's impact varied widely across different countries

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Device Insights

	Conversion Rate	Average Purchase	Number Devices
Android	3.15%	$2.39	30289
iOS	6.16%	$5.00	18360

Insight: iOS users were more responsive to the banner across both KPIs , suggesting a need to investigate the banner's effectiveness on Android devices.

Statistical Testing

T-Test for Average Spend: **T-statistic:** -0.070 (|t| < 1.96), failed to reject the null hypothesis.
Result: No significant difference in average spend between the groups

Z-Test for Conversion Rate: **Z-statistic:** -4.19 (|z| > 1.96), rejected the null hypothesis.
Result: Significant difference in conversion rates between the groups.

Summary

The A/B test conducted on GloBox's promotional banner revealed mixed results. While the banner effectively increased conversion rates, it did not significantly impact the average purchase amount. Notably, there was a decline in spending among key user segments, particularly women in the Treatment Group and Android users. Given that women represent the primary customer base, this decline is concerning. The banner's limited effectiveness, especially among Android users and in certain regions, underscores the need for further analysis and refinement.

Recommendations

1. **Enhance Android Experience**:
   Given the lower conversion rates and average purchase amounts observed among Android users, it is imperative to evaluate and refine the banner's design and functionality specifically for Android devices. Conduct targeted A/B tests with various configurations to identify the most effective design elements for improving user engagement and conversion rates on this platform.

2. **Implement Localized Marketing Strategies**
   Adapt Regional Approaches: Considering the negative impact of the banner in certain countries, notably Turkey, it is essential to develop and deploy localized marketing strategies. Customize promotional content and methods to align with regional preferences and market conditions to enhance relevance and effectiveness in these areas.

3. **Conduct In-Depth User Journey Analysis**:
   Analyse and Refine User Pathways: Utilize advanced analytics tools to map user journeys on the website, identifying critical drop-off points. This analysis will provide insights into where users disengage, allowing for targeted improvements to the user experience and potentially reducing churn rates.

4. **Leverage Gender-Based Insights**:
   Focus on Female User Engagement: The data indicates that female users exhibited higher purchasing rates across all devices. Develop targeted marketing initiatives or personalized offers specifically for female users to capitalize on this trend and further increase conversion rates.

5. **Enhance iOS Experience**
   Build on Positive iOS Response: Given the higher conversion rates and greater average spend observed among iOS users, explore opportunities to further enhance their experience. Consider additional incentives or exclusive offers for iOS users to maintain high engagement levels and capitalize on this segment's responsiveness.