Instacart Shopper Hiring Funnel: A/B Test Detailed Report

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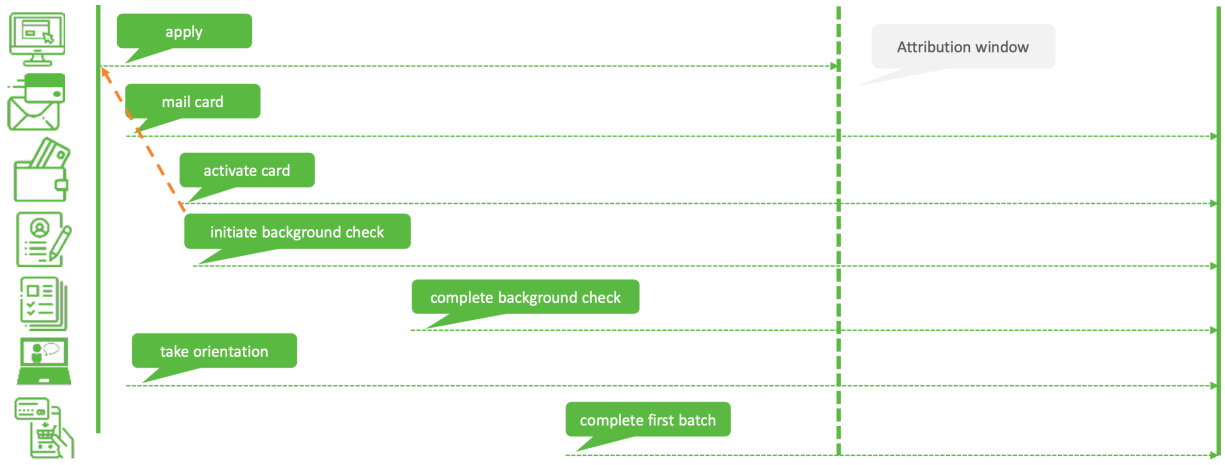
GitHub Link

Introduction

Background

Instacart aims to optimize its shopper hiring funnel and, as part of this initiative, conducted an A/B test. The experiment evaluated whether an earlier initiation of the mandatory background check would affect the conversion rates at different stages of the funnel. This report provides a comprehensive analysis of the A/B test data to inform future strategies.

The dataset includes 108328 entries for users who registered for various events at different times. The conventional process for hiring a shopper is depicted on the left graph, while the treatment group follows an alternative process that involves initiating a background check earlier in the process.



Methodology

Data Collection and Preprocessing

The dataset, application.csv, contains event data for applicants and includes identifiers, event types, and timestamps. It has been preprocessed to ensure data quality and consistency.

Analytical Approach

The analysis followed a structured approach to ensure robust and actionable insights:

- Descriptive Statistics: An initial overview of the dataset was performed to understand its structure and composition. This included computing mean, median, and other statistical measures for key variables.
- Sample Size Analysis: The dataset was examined to identify the unique sample sizes for both the control and treatment groups. This is essential for understanding the representativeness of the test results.
- Conversion Funnel Analysis: A step-by-step breakdown of conversion rates at each stage of the hiring funnel was conducted for both groups. This included both graphical and statistical comparisons.
- Duration Analysis: The average and median time durations between key steps in the hiring funnel were computed and compared between the two groups.

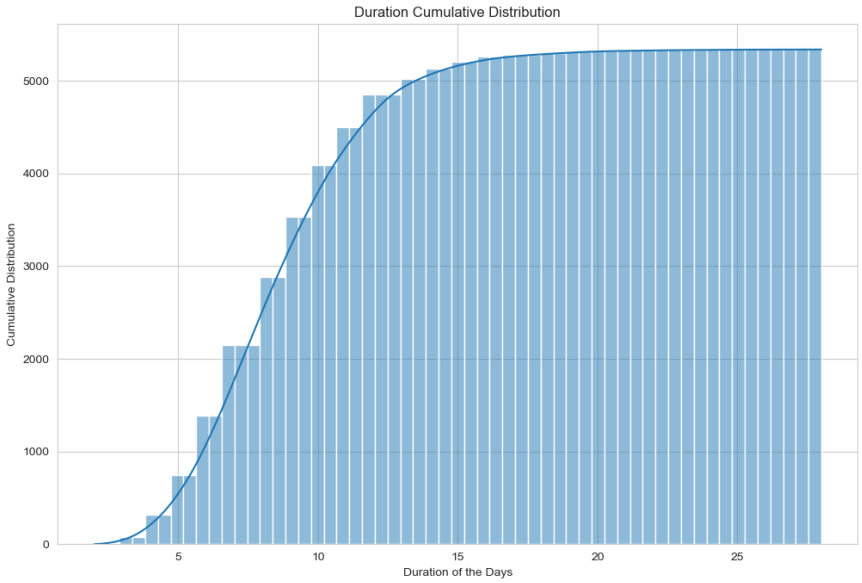
Findings

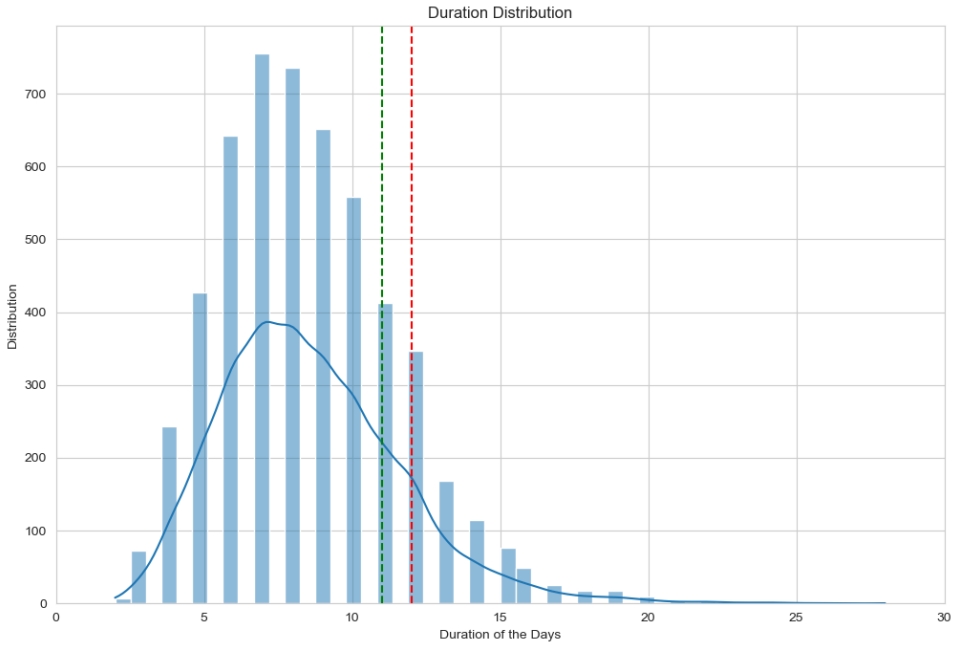
Data Exploration

The dataset captures applicant data for the month of October 2018. During this period, the control group comprised 14501 unique applicants while the treatment group had 7197 unique applicants. Initial data exploration also revealed that the treatment group had a higher rate of initial applications but a lower rate of background check completions.

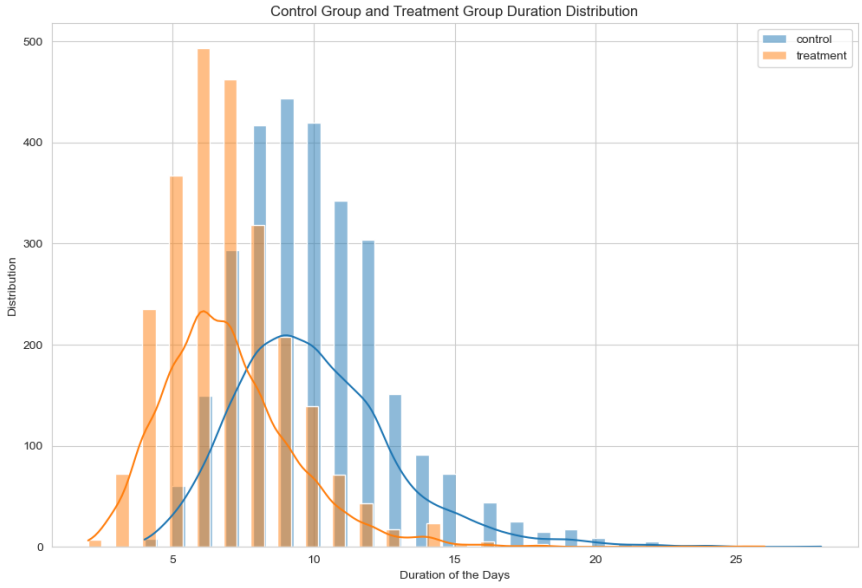
Duration Analysis

The average time taken from application to the first batch completion varies between the groups. The treatment group generally takes longer to reach the final stage of the funnel.





Based on the cumulative distribution, it appears that the majority (90%) of applications will be finished within approximately 12 days.



After dividing them into two groups, it is clear from the chart that the treatment group had a shorter duration distribution.

Based on the results of the statistical significance test, it is evident that there is a substantial difference in the performance of the two groups. Hence, we can conclude that the performance of the group receiving treatment for a longer duration is better.

Conversion Funnel

The experiment spanned 41 days, commencing on October 1, 2018, and concluding on November 11, 2018.

Based on the distribution of durations, it appears that 80% of users complete the entire process within 11 days. To determine a more precise and thorough application time frame, we established a conversion window spanning from October 1st, 2018, at 12:00 AM to October 31st, 2018, at 12:00 AM, which is 11 days prior to the end date.

The conversion funnel analysis provided several noteworthy insights:

- The treatment group had higher conversion rates at the initial stages of the funnel, such as application and background check initiation.
- However, the treatment group lagged behind the control group in terms of completing the first batch of orders, which is a critical metric for Instacart.

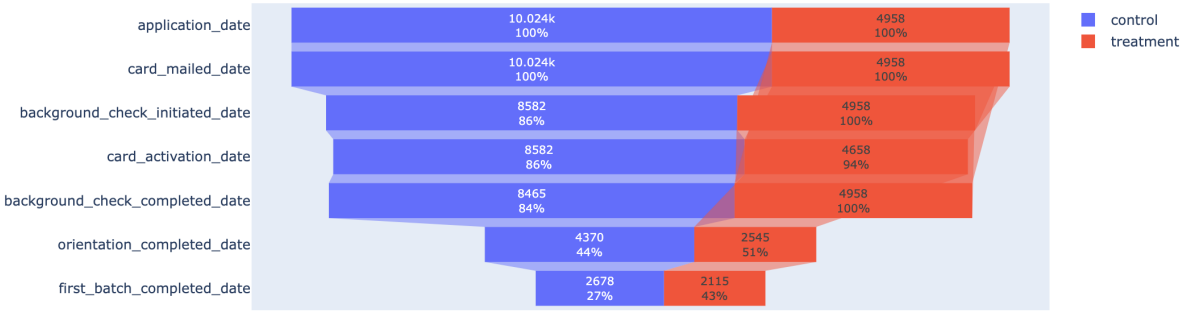
And If initiating background check earlier...

- Increases first batch completion rate.
- Reduces the entire hiring process time (processes optimization).
- Evidence does not show shoppers will start quickly if they complete card activation and background check (we cannot include the duration of background check into shopper momentum calculation, because it is a passive waiting) .

group	#applicant (sample size)	#completed first batch	❶ conversion rate	❷ #days from application to first batch completion	❸ #days from both completion (card activation, background check) to first batch completion
control	10,024	2,678	26.7%	10.2 days	1.95 days
treatment	4,958	2,115	**42.7%**	**7.1 days**	2.00 days
conclusion			conversion rate significantly increased (z score 19.2; significant at 90%)	accelerated the hiring process significantly	stimulate shopper to start more quickly insignificantly

improve improve

* Appendix: z test and sample size



The analysis reveals varying conversion rates at different stages for both groups. The treatment group, which underwent the earlier background check, shows promising but variable conversion rates across the funnel stages.

Cost-effective Analysis

To evaluate cost-effectiveness, we are using the card activation rate and the average cost per first batch completion. The card activation event is the closest to the initialing background event in the hiring funnel, and the average cost per first batch completion is the most effective metric to evaluate dollar efficiency. We want to determine if the activation funnel is expanding by initiating background checks earlier. The conversion rate may be impacted by the orientation event, so evaluating the bottom of the funnel is not ideal. To become a successful shopper in the hiring process, a potential shopper must activate a card and pass a background check. Therefore, we are focusing on both the card activation rate and dollar efficiency.

card activation rate						
group	**overall**	job site search	shopper referral bonus	social media	web search engine	**Dollar efficiency**
control	**86%**	67%	96%	96%	83%	**$96**
treatment	**94%**	87%	97%	98%		**$70**
z score At 90%	**17.1 significant**	12.35 significant	0.54 insignificant	3.4 significant	significant	

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Yes cost effective

Yes cost effective

Channel Analysis

job site search channel:
- **lowest conversion** rate in the control group
- **conversion rate significantly improved**, if initiating background check
- **orientation completion rate is the lowest** in the test

social media channel:
- generates **ineffective leads** in the test
- **conversion rate insignificantly improved**, if initiating background check
- **lowest orientation completion rate**

shopper referral bonus channel:
- **highest conversion rate** in the control group;
- generates **effective leads**
- **highest orientation rate**

web search engine channel:
- **lowest conversion rate** in the control group;
- **conversion rate significantly improved**, if initiating background check

Control

	conversion rate	card activation rate	orientation rate	background check completed rate	#days from application to first batch completion	#days from both completion (card activation, background check)
job site search	16%	67%	69%	100%	9.5	2.1
shopper-referral-bonus	34%	96%	82%	99%	9.5	1.8
social-media	17%	96%	24%	98%	11.3	2.0
web-search-engine	25%	83%	65%	99%	9.6	1.9
Overall	27%	86%	47%	100%	10.2	2.0

Treatment

job site search	38%	87%	58%	100%	6.3	1.9
shopper-referral-bonus	50%	97%	83%	100%	6.9	2.1
social-media	20%	98%	20%	100%	8.0	2.0
web-search-engine	45%	94%	54%	100%	6.8	2.0
Overall	43%	94%	58%	100%	7.1	2.0

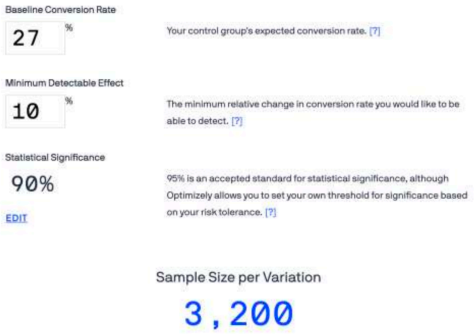
Recommendations

- Extended A/B Test: Given the variability in conversion rates at different stages, it would be advisable to extend the A/B test for a longer period to gather more data.
- Cost-Effectiveness Analysis: A detailed cost-benefit analysis should be conducted to determine if the $30 background check fee results in a positive ROI. The conversion rate in social media channels is much lower than average.
- If this channel is paid to advertise, we should evaluate the ROI, which cost is channel acquisition cost + $30 background fee, etc. to check if the social media channel is an effective way to attract potential shoppers.
- Funnel Optimization: Based on the duration analysis, it might be beneficial to revisit the design of the hiring funnel to identify and rectify bottlenecks.
- To perform A/B Test to evaluate if accelerating the duration of background checks would make shoppers start to shop quickly.
- To perform A/B Test to evaluate if mandatory orientation would improve the conversion rate.

Evaluate cleaned dataset for A/B test

Result	Check List
Yes	control / treatment group split completely
Yes	all the event occurrence date are followed by application/test window (application date is before 10/31/2018)
Yes	sample size (baseline 26.7% , minimum detectable 10%, significance:90%; size size in each group: 3200)
Yes	all the event occurrence date are followed by the conversion funnel order
Yes	The other features are equally distribution across the test, such as background check duration, card mail duration, etc

Sample size check



Evaluate ab test

	Visitors	Conversions
Control	10024	2678
Treatment	4958	2115

Conversion Rate	Standard Error
26.7%	0.44%
42.7%	0.70%

Significant At	
90% confidence:	YES
95% confidence:	YES
99% confidence:	YES
Z-score	-19.21083
P-value	1.5E-82

* https://www.optimizely.com/sample-size-calculator#/?conversion=3&effect=20&significance=95

Conclusion

The A/B test conducted by Instacart has provided invaluable insights into the shopper hiring process. While the treatment group showed promising results in the early stages of the funnel, it faltered at the crucial final stage. These findings suggest a need for further investigation and possibly a redesign of the hiring funnel for better optimization.