

Measuring the Mission: Visualizing Officer Recruitment Progress and Performance

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Author Note: Elise Bell, Ben Char, Brett Pearson and Vanessa Turner are first-class cadets at the U.S. Air Force Academy (USFA) majoring in Operations Research and Gerry Gonzalez, Taylor Leonard, and Benjamin Kallemyn are faculty advisors. The views expressed herein are those of the authors and do not reflect the official positions of the United States Air Force Academy, the Department of the Air Force, or the Department of War.

Abstract: The 348th Recruiting Squadron, responsible for officer accessions across the Western United States, seeks to optimize its recruiting infrastructure through enhanced data visualization and predictive analytics. Using fiscal year 2025 data from the Defense Recruiting Activity Report and Health Professions database, we develop a unified Power BI platform that enables efficient tracking of recruiting progress against Air Force accession goals. Analysis of the current system reveals significant inefficiencies, with recruiters manually tracking numerous variables across disconnected spreadsheets, limiting timely decision-making and actionable insight. To address these challenges, we implement an interactive Power BI dashboard that centralizes data and automates reporting, alongside statistical modeling in RStudio to estimate pipeline transition probabilities and apply Monte Carlo simulation for forecasting selection outcomes under varying applicant flows. This integrated approach provides real-time visibility and predictive insight, enabling leadership to proactively adjust recruiting strategies, reduce workload, and improve attainment of officer accession targets.

Keywords: Recruitment, Microsoft Power BI, Visualization, RStudio

1. Introduction

The Air Force officer recruiting process is complex and multilayered, involving multiple pathways to commission. The 348th Recruiting Squadron (RCS), headquartered in Clearfield, Utah, oversees the Western United States and Pacific Rim and is responsible for transforming qualified applicants into officer candidates. Officers are assigned Air Force Specialty Codes (AFSCs) which represent an assigned career field. The squadron's current system relies on multiple Excel spreadsheets, manual data entry, and limited visualization capabilities, creating inefficiencies in tracking and decision-making. This project addresses these challenges by reducing recruiter workload, introducing predictive analytics, and enabling real-time, dynamic visualizations to improve recruiting efficiency and support the broader mission of building the Air Force officer corps.

1.1 Project Background

The 348th RCS currently tracks data across two Excel files: the Defense Recruiting Activity Report (DRAR), which monitors applicant progression and squadron goals, and the Health Professions (HP) Database, which specifically tracks medical applicants. While these spreadsheets are familiar and user-friendly, their disjointed structure makes compiling real-time reports and generating effective visualizations challenging. To address this, the squadron requested an automated visualization tool that preserves existing data entry processes. In response, this project adopts a visualization-first approach using Microsoft Power BI, integrating data sources into a centralized dashboard. This solution enhances data accessibility, improves interpretability, and expands analytical capability while maintaining the squadron's preferred workflows.

1.2 Problem Statement

Overall, our team aims to improve how the 348th RCS interprets and acts upon data by developing real-time, interactive visualizations that integrate existing recruiting data sources without requiring structural changes to current Excel

workflows. Additionally, we seek to explore predictive metrics based on historical recruiting performance that can inform more realistic, program-specific recruitment targets and improve long-term planning.

2. Related Work

The literature most relevant to this project focuses on dashboard design, user-centered adaptability, and recruitment-specific predictive analytics. Kandel (2025) demonstrates how Microsoft Power BI can transform structured datasets, such as Excel files, into meaningful analytical models. For our project, this validates our platform selection and provides a blueprint for migrating the squadron's legacy DRAR data into a dynamic environment. Building on this, Sarikaya et al. (2019) establishes a framework for dashboard design categorized by strategic, tactical, and operational purposes. This framework directly informs our visual hierarchy, ensuring the dashboard accommodates both the daily monitoring needs of individual recruiters and the strategic decision-making required by squadron leadership. Furthermore, Alhamadi et al. (2022) highlight that dashboards frequently fail due to gaps in user data literacy and shifting stakeholder requirements. To address this, we apply their recommendation of role-based, adaptive features, ensuring our final product remains intuitive and sustainable for the 348th RCS long after our capstone concludes.

Beyond foundational design, we leverage literature specific to recruitment analytics and forecasting. Yokoyama, Okada, and Taniguchi (2021) examine dynamic visualization techniques for heterogeneous recruitment data, demonstrating how time-varying graphs can expose long-term trends. Their approach to tracking applicant attributes guides how we structure our Power BI visuals to help the squadron identify the most effective recruiting strategies. Finally, Korniienko and Barchi (2025) explore Monte Carlo simulations to model recruitment pipelines under uncertainty. Because military recruiting faces significant real-world variability, integrating these probabilistic methods allows our system to move beyond historical tracking and enables us to identify pipeline bottlenecks to provide commanders with realistic, data-driven forecasts that meet officer accession targets.

3. Data and Methodology

3.1 Data Description

This project utilizes several existing data sources maintained by the 348th RCS to track officer recruiting activity. The primary datasets include the DRAR and the HP Database. Collectively, these files contain detailed information on applicant progression, recruiter performance, and organizational recruiting targets.

The DRAR serves as the squadron's primary operational dataset and consists of eighteen worksheets tracking rated (jobs that require aeronautical training) and non-rated applicant entries, recruiting goals, and performance summaries. The DRAR tracks between 2000 and 3000 applicants per year. For each applicant, the dataset contains up to fifty variables, including demographic information, and recruitment status updates throughout the accession pipeline. This project focuses on the fiscal year 2025 DRAR to capture the most recent Excel formatting and most current variables. Targeting the most recent dataset assures our product is optimized for the squadron's current operational structure and reporting formats.

The HP database focuses specifically on applicants pursuing medical career fields through programs such as the Health Professions Scholarship Program (HPSP). This dataset contains detailed information related to academic performance, standardized test scores, interview outcomes, and program-specific application milestones.

3.2 Methodology

Although these datasets require substantial manual data entry, the 348th RCS has elected to retain the existing Excel-based system. As a result, the analysis and proposed solution are constrained to operate within this environment, with implications for data consistency and standardization.

The methodology for this project follows a structured, end-to-end approach to improve recruiting analytics, beginning with stakeholder engagement and concluding with the deployment of an integrated analytical platform. We first conduct informal stakeholder analysis with squadron personnel to identify key limitations in the existing Excel-based recruiting process, including inconsistent data formatting, and time-intensive manual reporting. Given this constraint, we choose to build a project architecture that places the analytical layer on top of the existing data infrastructure rather than replacing it. We begin by preparing and standardizing data using Power BI's Power Query environment. This includes cleaning column names, aligning

data types, and resolving inconsistencies in categorical variables across datasets such as the DRAR and HP database . We also create derived variables using DAX Queries to add depth to the visualizations when applicable. These cleaned datasets and predictive outputs are then integrated into a Power BI dashboard, which serves as the primary user-facing platform. The dashboard provides real-time visualization of recruiting performance, including pipeline progression, goal attainment, and forecasted outcomes. To ensure usability, we emphasize in the dashboard design clarity, interactivity, and alignment with stakeholder decision-making needs identified during initial engagement.

In parallel, we conduct statistical analysis in R Studio to develop predictive metrics that extend beyond descriptive reporting. Using historical recruiting data, we estimate conversion probabilities between key pipeline stages and apply logistic regression models to quantify selection likelihood across programs. We further incorporate Monte Carlo simulation to model uncertainty in recruiting outcomes and estimate the number of applicants required to meet accession targets under varying conditions.

Finally, we validate the platform through iterative feedback with intended users and refine visualizations and metrics accordingly. We design the completed system for continuous use, with automatic updates as underlying Excel files are refreshed. This approach enables the squadron to transition from manual, time-intensive reporting to a centralized, data-driven decision-making environment without disrupting existing operational processes.

4. Visualization and Analysis

4.1 Data Visualization

We develop a variety of visual outputs to communicate recruiting performance effectively, including funnel charts to illustrate applicant pipeline progression, bar charts and scorecards to summarize program performance, and trend visualizations to highlight changes across flights and programs. The selection and structure of these visualizations are informed by prior literature on dashboard design. In particular, Sarikaya et al. (2019) emphasize the importance of aligning dashboards with strategic, tactical, and operational decision-making, which guides our use of high-level summary metrics for leadership alongside more detailed, filterable views for recruiters.

Our design of the dashboard also reflects a user-centered approach consistent with Alhamadi et al. (2022), who identify usability and adaptability as critical factors in successful dashboard implementation. Throughout the development, we incorporate feedback from squadron stakeholders to ensure the visualizations align with existing workflows while improving interpretability. Rather than simply replicating static reports previously created in Excel, the dashboard introduces new analytical capabilities, including full pipeline visibility through funnel charts, dynamic cross-filtering across organizational levels, and the integration of predictive metrics. These features enable users to identify bottlenecks in the recruiting process, compare performance across units, and assess progress toward accession targets in ways that were not previously possible.

Because all measures are calculated dynamically, users can filter the dashboard by squadron, recruiter, program, or time period, allowing them to examine recruiting performance at multiple levels of detail without modifying the underlying data. Users can apply slicers and cross-filters directly within the dashboard to isolate specific programs, recruiting flights, or squadrons. This functionality allows leadership to interact with data to answer operational questions in real time.

To ensure long-term usability for the 348th RCS, we design the dashboard with continuous updates in mind. The Power BI model connects directly to the squadron's Excel-based recruiting data sources, allowing the dashboard to reflect current recruiting progress as source files are updated. The completed dashboard is shared via DoD SAFE, enabling authorized users to access the report through a secure web interface. By integrating data cleaning, modeling, and visualization within a single platform, the Power BI solution eliminates many inefficiencies associated with the squadron's previous reporting process. Recruiters no longer need to manually reconcile multiple spreadsheets or recreate charts for leadership briefings. Instead, the dashboard provides a centralized and continuously updated analytical tool that supports both operational decision-making and strategic recruiting planning. Figures 1 and 2 display the final dashboard visualizations.

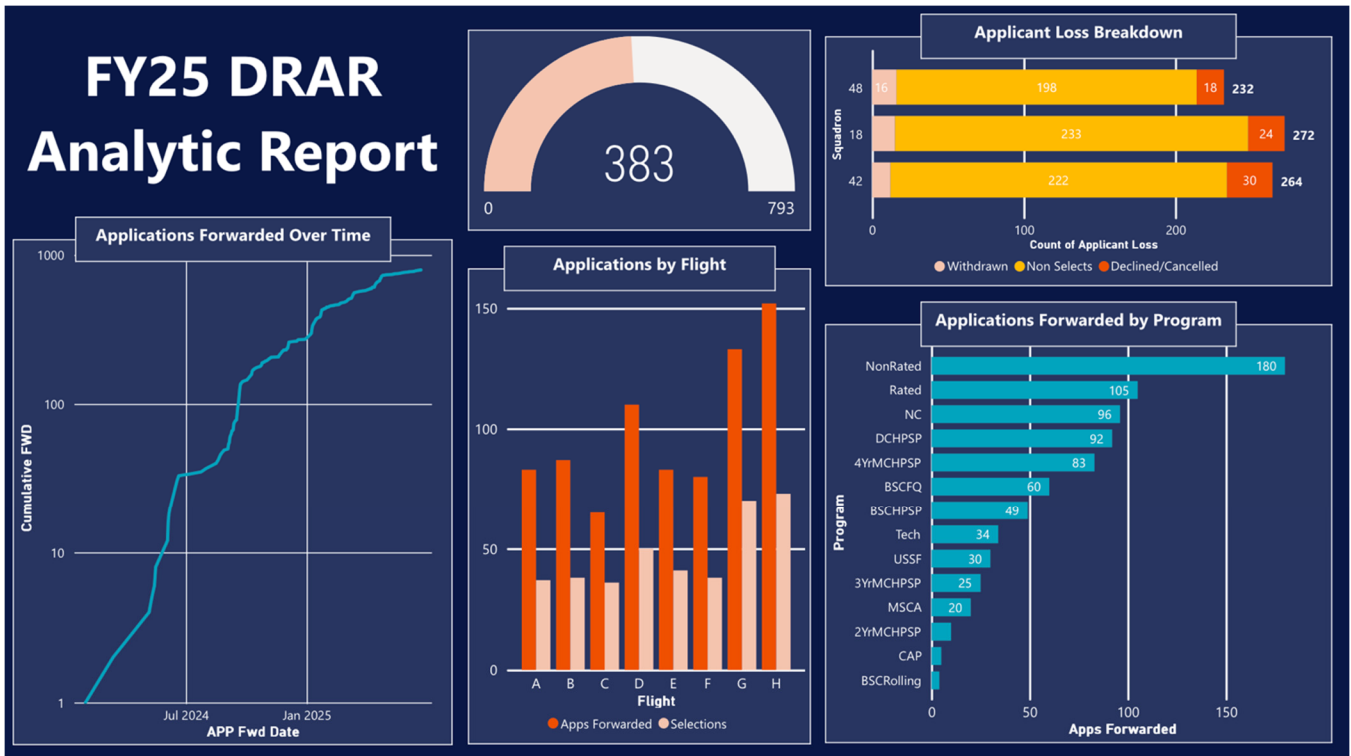


Figure 1. FY25 DRAR Power BI report

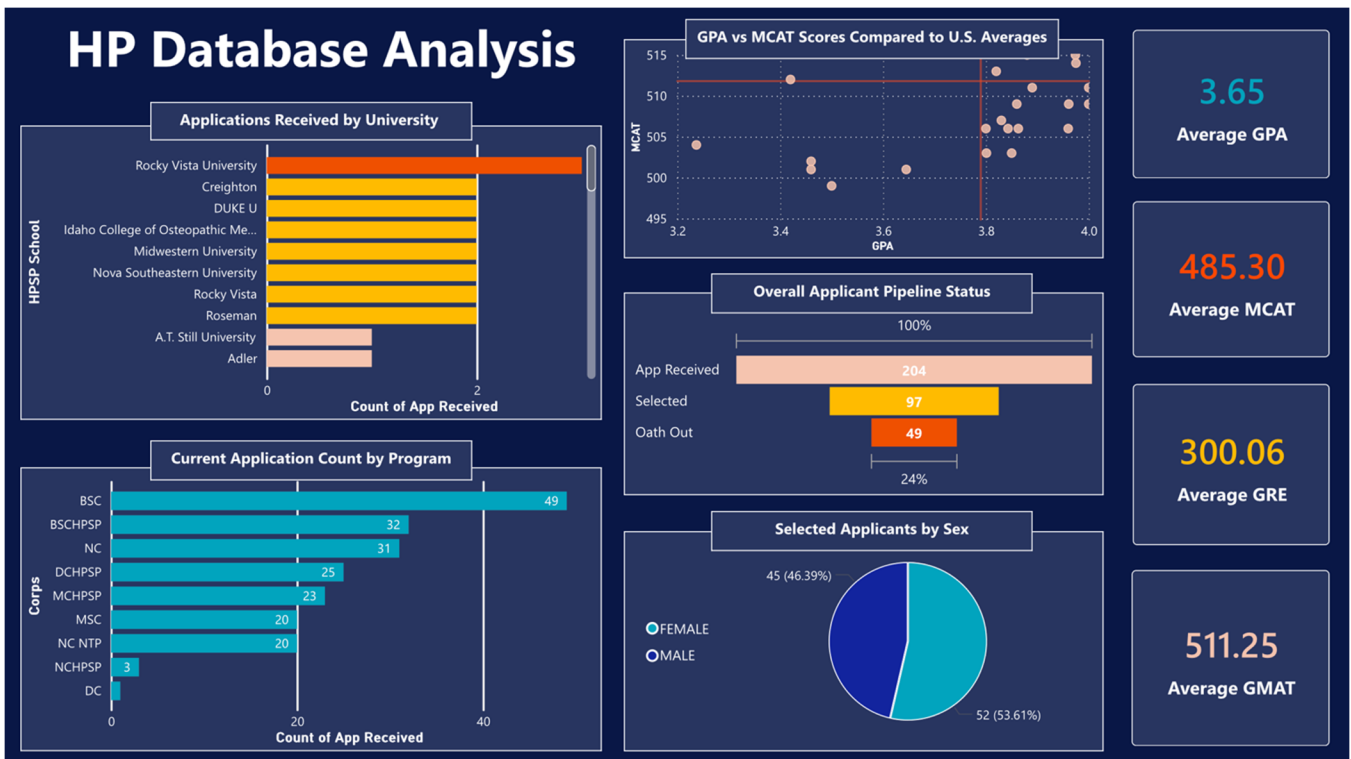


Figure 2. HP Database Power BI report

4.2 Analysis

We apply predictive analytics to estimate pipeline conversion rates, forecast selection outcomes, and evaluate recruiting target feasibility. Using R studio, we model applicant progression through key stages and translate historical data into actionable planning metrics

We first estimate transition probabilities across the recruiting pipeline. While the overall selection probability from board-ready applicants is approximately 0.517, this aggregate value masks substantial variation across programs. Selection likelihood is primarily driven by program-specific competitiveness rather than recruiter performance. This was then validated after speaking with our client. For example, larger pooled fields such as non-rated accessions face lower selection rates as the program encompasses a wide range of AFSCs. On the other hand, medical programs operate within smaller and more specific pipelines for each AFSC. As a result, program choice is the dominant factor influencing selection outcomes.

To capture these differences, we estimate a logistic regression model predicting selection as a function of program, squadron, and application quarter. Results show that program is the primary driver of selection probability, while squadron and application timing have comparatively smaller and less consistent effects. Predicted selection probabilities vary widely across programs, ranging from approximately 0.20 for Non-Rated accessions to over 0.95 for medical scholarship programs. These results highlight structural differences in accession pipelines and provide a more accurate basis for planning recruiting effort.

$$P(\textit{Selection}) = f(\textit{Program}, \textit{Squadron}, \textit{Application}, \textit{Quarter}) \quad (1)$$

To incorporate uncertainty, we simulate applicant progression using a Monte Carlo framework. We model transition probabilities using beta distributions, and repeated sampling generates a range of expected outcomes rather than a single point estimate. For consistency, simulations assume a baseline of 80 forwarded applicants, allowing comparison across programs. The simulation produces expected selections along with 10th, 50th, and 90th percentile outcomes, which represent worst-case, most-likely, and best-case scenarios.

Table 1 combines results from both modeling approaches: we derive selection probabilities from the logistic regression model, while we generate outcome ranges (percentiles) from the simulation with their respective mean values. We calculate required forwards by combining these probabilities with squadron targets.

Table 1. Predictive Analysis Results

Program	Selection Probability	SE	Mean	10 th Percentile	50 th Percentile	90 th Percentile	Required Forwards
2YrMCHPSP	0.9741	0.02640	69.88705	62	71	77	18.5
4YrMCHPSP	0.8255	0.02440	60.17830	54	60	66	156.9
BSCPSP	0.2303	0.03580	26.19985	19	26	33	26.6
DCHPSP	0.1984	0.02380	25.67865	20	26	32	57.2
NC	0.8444	0.02040	65.68890	61	66	70	159
Non-Rated	0.2050	0.02140	12.38725	8	12	17	253
Rated	0.3551	0.02720	35.28410	29	35	42	72.8
Tech	0.6612	0.04370	49.93695	43	50	57	53.9
USSF	0.2831	0.04780	20.81550	14	21	27	19.5

Finally, we estimate the number of applicants required to meet accession goals. Comparing required forwards to actual recruiting activity produces a pipeline gap metric. This metric identifies programs where current applicant volume is insufficient to meet targets.

$$\textit{Required Forwards} = \frac{\textit{Target Selections}}{P(\textit{Select}|\textit{Forward})} \quad (2)$$

This framework provides direct operational value to the 348th RCS. Rather than relying on aggregate conversion rates, leadership can identify which programs require increased recruiting effort, prioritize resources toward lower-probability pipelines, and anticipate shortfalls earlier in the recruiting cycle. This enables more targeted decision-making and improves the squadron's ability to meet accession goals under uncertainty.

5. Recommendations and Conclusion

5.1 Recommendations

Based on the models and analysis generated, we propose several recommendations to successfully integrate these tools into the 348th RCS's organizational processes. First, leadership should incorporate the new predictive analytics capabilities, specifically the target achievement forecasting and pipeline gap metrics, into routine performance evaluations. For example, our target achievement forecasting reveals that programs with lower selection probabilities, such as non-rated (20.5%), require a disproportionately high volume of forwarded applicants (253 forwards) to meet their specific accession target of 118 selections. By identifying these precise pipeline constraints, commanders can strategically reallocate recruiting efforts to unsupported pathways. Second, to ensure the long-term sustainability of the system, the squadron must establish standardized data entry practices within the DRAR. Inconsistent categorical values currently require manual cleaning; standardizing these inputs will ensure seamless, automated updates to the dashboard. Third, regarding process integration, the 348th RCS should designate the interactive Power BI dashboard as the primary interface for leadership briefings. While precise time savings will depend on user proficiency, implementing this system functionally eliminates the manual effort previously required to cross-reference multiple Excel worksheets. Finally, to further mature their analytical capabilities, the squadron should begin tracking specific recruiter outreach activities (e.g., event attendance) to eventually link front-end recruiting efforts with back-end selection outcomes.

5.2 Conclusion

This project addresses the 348th RCS's need for an automated, forward-looking analytical framework. Using Microsoft Power BI, we transform manually intensive Excel databases into a centralized, real-time dashboard without disrupting existing workflows. This reduces recruiter and leadership burdens by an estimated 8–15 hours per week, or approximately \$15,000–\$25,000 annually in personnel time. In addition, statistical modeling in R establishes a baseline for predictive recruiting metrics. Logistic regression and Monte Carlo simulation enable leadership to move beyond historical tracking to probabilistic forecasting, identify pipeline shortfalls earlier, and prioritize recruiting effort across programs.

The final deliverables are fully transitioned to process owners, ensuring sustainability while avoiding an estimated \$10,000–\$30,000 in potential external development costs. Overall, these tools reduce workload, improve data accuracy, and provide real-time, actionable insights, strengthening the squadron's ability to meet accession targets and support the broader Air Force mission.

6. References

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