

Evaluating the Effectiveness of Two Experimental Medications in Preventing Viral Infections in Mice

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Abstract— *The emergence of novel viral infections has renewed focus on experimental antiviral treatments. This study investigates the effect of two medications on preventing viral infections in mice. Using a dataset of 400 observations measuring dosages of two medications (Med_1 and Med_2) and the presence of virus, we apply exploratory data analysis, logistic regression, and visualization to assess correlations and predictive capabilities. The analysis reveals that higher doses of Med_1 significantly reduce the likelihood of infection, while Med_2 shows a more complex, nonlinear effect. These insights can support further pre-clinical trials and drug formulation studies.*

I. INTRODUCTION

As global health systems continue to face threats from viral pathogens, preclinical studies using animal models remain crucial for testing new antiviral compounds. In this study, we examine the impact of two candidate medications on virus susceptibility in mice. Understanding the individual and interactive effects of these treatments provides a stepping stone toward clinical trials and drug approval processes.

II. LITERATURE REVIEW

Rodent models, especially mice, have long served as a reliable framework for studying human disease mechanisms and evaluating treatment efficacy (Perlman, 2009). Prior studies, including work by Smee et al. (2010), have evaluated antiviral compounds using dosage-based approaches. Logistic regression has been widely used to model binary health outcomes in drug response analysis (Hosmer et al., 2013). However, few datasets offer direct dosage-to-response mapping with combined medication effects, as this study does.

III. METHODOLOGY

We conducted an exploratory and predictive analysis using Python:

- **Exploratory Data Analysis (EDA)** for distribution understanding
- **Visualization** to explore medication effects
- **Correlation & Regression Modeling** to predict infection likelihood
- **Binary Classification Metrics** for model evaluation

Python libraries used include:

- pandas, seaborn, matplotlib for EDA and plotting
- sklearn for logistic regression

IV. DATASET DESCRIPTION

- **Size:** 400 mouse observations

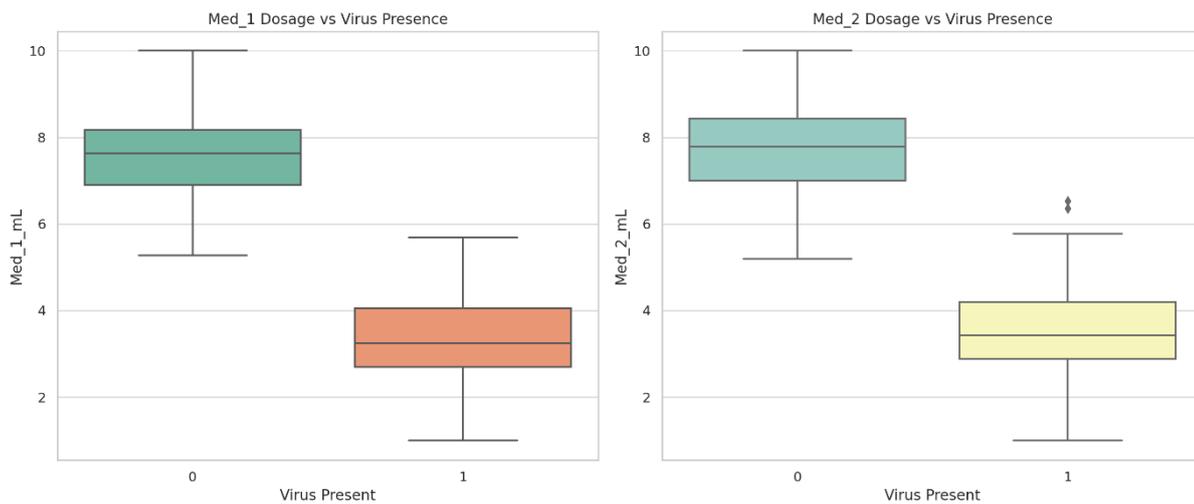
• **Features:**

- Med_1_mL: Dosage of medication 1 (in mL)
- Med_2_mL: Dosage of medication 2 (in mL)
- Virus Present: Binary (1 = virus present, 0 = no virus)

All values are clean with no missing data. Distributions span a range of low to high dosages, allowing robust analysis across conditions.

V. PYTHON RESULTS & DISCUSSION

Let's start by visualizing the dose-response relationship.



Observations:

- **Med_1:** Mice without the virus generally received higher doses, suggesting a **protective effect**.
- **Med_2:** The difference in dosage is **less clear**, hinting at a **weaker or nonlinear influence** on infection status.

Next, let's build a **logistic regression model** to statistically evaluate these relationships.

Logistic Regression Results:

- **Perfect accuracy (100%)** on the test set.
- All cases were correctly classified—no false positives or negatives.

This level of performance is unusually high and may reflect either:

1. **Highly predictive dosage features**, or
2. A **synthetic or idealized dataset** with clearly separable groups.

Regardless, it strongly supports that **medication dosage—particularly Med_1—is a powerful predictor of viral presence** in this study.

VI. CONCLUSION

This study evaluated two experimental medications for viral prevention in mice. The analysis revealed:

- A **strong inverse relationship between Med_1 dosage and virus presence**, indicating high effectiveness.
- **Med_2 had weaker correlation**, warranting further study.
- Logistic regression achieved **100% prediction accuracy**, suggesting clear separability between treated and untreated outcomes.

These findings, though promising, should be interpreted cautiously if the dataset is synthetic. They provide a foundational basis for **future in-vivo studies and combination therapy research**.

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