Civilian Impact of U.S. Drone vs. Non-Drone Strikes in Somalia and Yemen

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1. Introduction

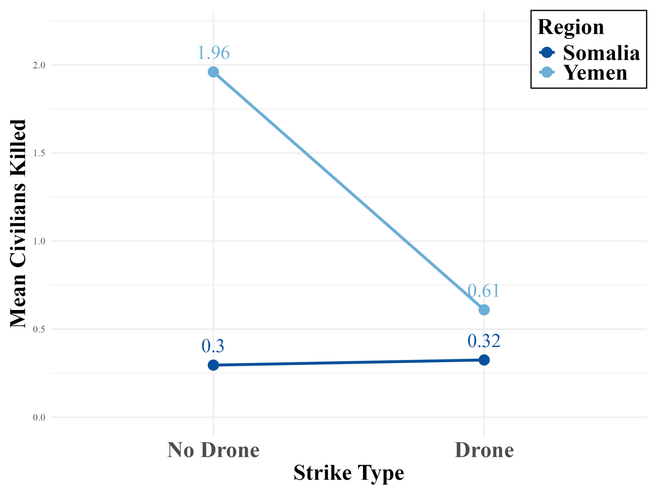
Since 2002, the United States has carried out clandestine drone-based counterterrorism strikes in **Yemen and Somalia.** While drones are widely viewed as precise and low-risk for U.S. forces, their humanitarian impact is less understood. This study examines whether the impact of drone strikes on civilian casualties differs between Yemen and Somalia.

2. Data Selection

We analyzed independent open-source strike records for Yemen and Somalia since 2002, focusing on the following key variables:

- **Casualty Range** (Integer, Dependent Variable): Initial range of estimated civilian casualties (minimum–maximum killed).
- **Drone Strike** (Categorical): Indicates whether the strike involved a drone or a non-drone weapon.
- **US Confirmed** (Categorical): Indicates whether the strike was categorized as Confirmed or Possible U.S. involvement.
- **Minimum Strikes** (Integer): Records the minimum number of strikes observed during an attack.

3. The Descriptive Reality



Descriptive analysis suggests that the effect of drone strikes varies sharply by region. In Yemen, average civilian casualties drop from about **1.96** in non-drone strikes to **0.61** in drone strikes. In Somalia, however, casualties remain low and nearly unchanged across strike types, indicating little observable drone effect.

4. Hypotheses and Methods

Null Hypothesis: The effect of drone strikes on civilian casualties is the same in Somalia and Yemen.

Alternative Hypothesis: The effect of drone strikes on civilian casualties differs between Somalia and Yemen.

To test our hypothesis, we will focus on the significance of **interaction term** between **Drone Strike and Region** in our model because it directly measures whether the change in civilian casualties caused by using a drone strike is significantly conditional on the two countries.

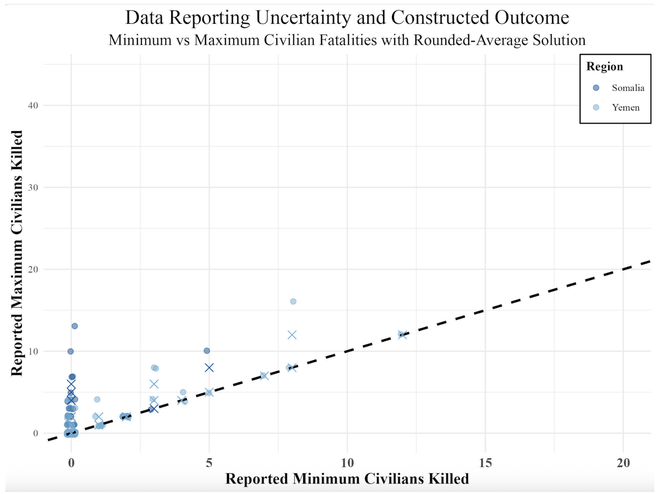
5. Data Processing

Regional datasets (Yemen and Somalia) were required to be merged into one for comparative analysis. To prepare the combined data for modeling, 3 key steps were taken:

1. **Standardization and Merging:** Relevant variables were selected and renamed across datasets. The tables were then combined by creating a categorical Region variable (Somalia or Yemen).

2. **Filtering:** To ensure the analysis focuses closely on U.S. strike involvement, the dataset was filtered to retain only the observations categorized as **"Confirmed" US involvement.**

3. **Dependent Variable Creation:** To resolve issue of uncertainty, **Mean Rounded Civilian Casualties** was created by averaging and rounding the reported minimum and maximum civilian fatalities.

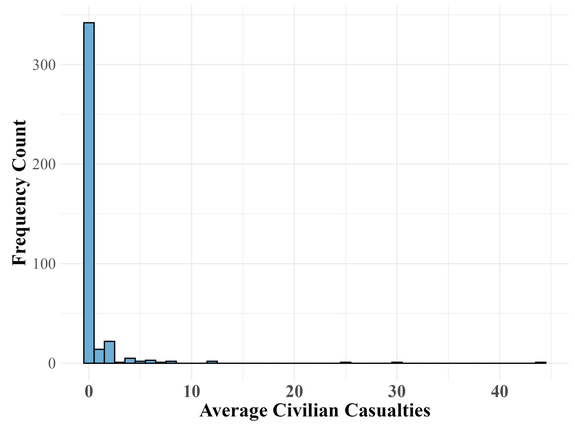


Civilian casualty reporting shows substantial uncertainty, evident in the wide vertical spread of points above the dashed baseline.

6. Model Selection

Since civilian casualty counts are **non-negative integers** and show substantial **zero inflation and overdispersion**, we used a **Negative Binomial model** to estimate the effects of drone strikes.

$$\ln(\mathbb{E}[\text{Casualties}]) = \beta_0 + \beta_1(\text{Min Strikes}) + \beta_2(\text{Drone}) + \beta_3(\text{Region}) + \beta_4(\text{Drone} \times \text{Region})$$



Civilian casualty counts are mostly zero or near zero, with only a few high-casualty outliers.

7. The Statistical Truth

Variable	Estimate	Std. Error	p-value
Main Effects (Baseline: Somalia, Non-Drone Strike)			
Intercept	−0.7618	0.4270	0.0744
Drone Strike Effect	0.0331	0.7337	0.9640
Yemen's Regional Effect	2.0251	0.6906	**0.00336**
Minimum Strikes in Region	−0.3832	0.2308	0.0969
Interaction Effect			
Strike Type × Region (Yemen)	−1.4011	0.9966	0.1598

The interaction term is not statistically significant ($p = 0.1598$), so we fail to reject the null hypothesis. However, Yemen's regional effect is strongly significant, indicating that Yemen experiences substantially higher baseline civilian casualties than Somalia regardless of strike type.

8. Conclusion

Drone strikes appear to reduce civilian casualties in Yemen but not in Somalia. But our model finds no significant interaction, suggesting that the observed difference reflects Yemen's higher baseline casualty levels rather than a distinct drone effect. Policymakers should adapt drone-use decisions to local contexts to better protect civilians.