Analyzing Health Care Incidents:

Weapon Use

Perpetrator Behavior

Geographic Patterns

1. This Notebook provides an in-depth analysis of a dataset containing incidents related to attacks on health care facilities and personnel.
2. The primary objective is to offer insights into patterns of weapon usage, perpetrator behavior, and the geographical distribution of these incidents, with a focus on aiding decision-making for upper management.

Objectives

1. Support Strategic Decision-Making:

The visualizations and analyses aim to help upper management identify key patterns in perpetrator behavior, weapon usage, and the geographic impact of attacks.

2. Understand Risks and Threats:

By recognizing hotspots and common weapons, management can develop targeted responses to mitigate future incidents.

3. Assess Human Impact:

The analysis of health worker casualties offers a clear picture of the human toll, prompting potential adjustments in policy or security measures.

Step-1: Importing Necessary Dependencies

In [249…

```
# Step 1: Import the necessary libraries
import pandas as pd
import matplotlib.pyplot as plt
```

Step -2: Loading The Data

In [250…

```
# Step 2: Load the dataset
file_path = 'C:/Users/faraz/Downloads/Niksun/ml_datasets/War_21st Century_Is
data = pd.read_excel(file_path)
```

```
data.head()
```

Out[250…

	Date	Event Description	Country	Country ISO	Admin 1	Reported Perpetrator	Reported Perpetrator Name	Car
0	2024-05-20	20 May 2024: The vicinity of a hospital was hi...	OPT	PSE	Gaza Strip	Host Government: Military	Israeli Defence Forces	A
1	2024-05-20	20 May 2024: In Jabalia Refugee Camp, medical ...	OPT	PSE	Gaza Strip	Host Government: Military	Israeli Defence Forces	
2	2024-05-19	19 May 2024: A hospital was damaged by Israeli...	OPT	PSE	Gaza Strip	Host Government: Military	Israeli Defence Forces	A
3	2024-05-19	19 May 2024: An NGO hospital was hit with shel...	OPT	PSE	Gaza Strip	Host Government: Military	Israeli Defence Forces	
4	2024-05-18	18 May 2024: In Jabalia Refugee Camp, an Israe...	OPT	PSE	Gaza Strip	Host Government: Military	Israeli Defence Forces	A

5 rows × 33 columns

Step 3: Preprocess the data

We will check for missing values, handle them, and make sure the 'Date' column is in datetime format.

In [251…

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1219 entries, 0 to 1218
Data columns (total 33 columns):
 #   Column                                                        Non-Null 
Count  Dtype         
---  ------                                                        ---------
-----  -----         
 0   Date                                                          1219 non-
null   datetime64[ns]
 1   Event Description                                             1219 non-
null   object        
 2   Country                                                       1219 non-
null   object        
 3   Country ISO                                                   1219 non-
null   object        
 4   Admin 1                                                       1219 non-
null   object        
 5   Reported Perpetrator                                          1219 non-
null   object        
 6   Reported Perpetrator Name                                     1219 non-
null   object        
 7   Weapon Carried/Used                                           1219 non-
null   object        
 8   Location of Incident                                          1219 non-
null   object        
 9   Number of Attacks on Health Facilities Reporting Destruction  1219 non-
null   int64         
 10  Number of Attacks on Health Facilities Reporting Damaged      1219 non-
null   int64         
 11  Forceful Entry into Health Facility                           1219 non-
null   int64         
 12  Occupation of Health Facility                                 1219 non-
null   int64         
 13  Vicinity of Health Facility Affected                          1219 non-
null   int64         
 14  Health Transportation Destroyed                               1219 non-
null   int64         
 15  Health Transportation Damaged                                 1219 non-
null   int64         
 16  Health Transportation Stolen/Hijacked                         1219 non-
null   int64         
 17  Looting/Theft/Robbery/Burglary of Health Supplies             1219 non-
null   int64         
 18  Access Denied or Obstructed                                   1219 non-
null   bool          
 19  Health Workers Killed                                         1219 non-
null   int64         
 20  Health Workers Injured                                        1219 non-
null   int64         
 21  Health Workers Kidnapped                                      1219 non-
null   int64         
 22  Health Workers Arrested                                       1219 non-
null   int64         
 23  Known Kidnapping or Arrest Outcome                            93 non-nu
ll     object        
 24  Health Workers Threatened                                     1219 non-
```

```
null   int64
 25  Health Workers Assaulted                              1219 non-
null   int64
 26  Health Workers Sexually Assaulted                     1219 non-
null   int64
 27  Conflict-Related Violence                             1219 non-
null   object
 28  Political-Related Violence                            1219 non-
null   object
 29  COVID-19-Related Violence                             1219 non-
null   object
 30  Ebola-Related Violence                                1219 non-
null   object
 31  Vaccination-Related Violence                          1219 non-
null   object
 32  SiND Event ID                                         1219 non-
null   int64
dtypes: bool(1), datetime64[ns](1), int64(17), object(14)
memory usage: 306.1+ KB
```

In [252…

```python
## Checking for all the missing Values in the Dataset
data.isnull().sum()
```

Out[252…

```
Date                                                               0
Event Description                                                  0
Country                                                            0
Country ISO                                                        0
Admin 1                                                            0
Reported Perpetrator                                               0
Reported Perpetrator Name                                          0
Weapon Carried/Used                                                0
Location of Incident                                               0
Number of Attacks on Health Facilities Reporting Destruction       0
Number of Attacks on Health Facilities Reporting Damaged           0
Forceful Entry into Health Facility                                0
Occupation of Health Facility                                      0
Vicinity of Health Facility Affected                               0
Health Transportation Destroyed                                    0
Health Transportation Damaged                                      0
Health Transportation Stolen/Hijacked                              0
Looting/Theft/Robbery/Burglary of Health Supplies                  0
Access Denied or Obstructed                                        0
Health Workers Killed                                              0
Health Workers Injured                                             0
Health Workers Kidnapped                                           0
Health Workers Arrested                                            0
Known Kidnapping or Arrest Outcome                              1126
Health Workers Threatened                                          0
Health Workers Assaulted                                           0
Health Workers Sexually Assaulted                                  0
Conflict-Related Violence                                          0
Political-Related Violence                                         0
COVID-19-Related Violence                                          0
Ebola-Related Violence                                             0
Vaccination-Related Violence                                       0
SiND Event ID                                                      0
dtype: int64
```

In [253…

```
data_cleaned = data.dropna(axis=1)
data_cleaned.info()
df = data_cleaned
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1219 entries, 0 to 1218
Data columns (total 32 columns):
 #   Column                                                        Non-Null 
Count  Dtype         
---  ------                                                        ---------
-----  -----         
 0   Date                                                          1219 non-
null   datetime64[ns]
 1   Event Description                                             1219 non-
null   object        
 2   Country                                                       1219 non-
null   object        
 3   Country ISO                                                   1219 non-
null   object        
 4   Admin 1                                                       1219 non-
null   object        
 5   Reported Perpetrator                                          1219 non-
null   object        
 6   Reported Perpetrator Name                                     1219 non-
null   object        
 7   Weapon Carried/Used                                           1219 non-
null   object        
 8   Location of Incident                                          1219 non-
null   object        
 9   Number of Attacks on Health Facilities Reporting Destruction  1219 non-
null   int64         
 10  Number of Attacks on Health Facilities Reporting Damaged      1219 non-
null   int64         
 11  Forceful Entry into Health Facility                           1219 non-
null   int64         
 12  Occupation of Health Facility                                 1219 non-
null   int64         
 13  Vicinity of Health Facility Affected                          1219 non-
null   int64         
 14  Health Transportation Destroyed                               1219 non-
null   int64         
 15  Health Transportation Damaged                                 1219 non-
null   int64         
 16  Health Transportation Stolen/Hijacked                         1219 non-
null   int64         
 17  Looting/Theft/Robbery/Burglary of Health Supplies             1219 non-
null   int64         
 18  Access Denied or Obstructed                                   1219 non-
null   bool          
 19  Health Workers Killed                                         1219 non-
null   int64         
 20  Health Workers Injured                                        1219 non-
null   int64         
 21  Health Workers Kidnapped                                      1219 non-
null   int64         
 22  Health Workers Arrested                                       1219 non-
null   int64         
 23  Health Workers Threatened                                     1219 non-
null   int64         
 24  Health Workers Assaulted                                      1219 non-
```

```
null   int64
 25  Health Workers Sexually Assaulted                                     1219 non-
null   int64
 26  Conflict-Related Violence                                             1219 non-
null   object
 27  Political-Related Violence                                            1219 non-
null   object
 28  COVID-19-Related Violence                                             1219 non-
null   object
 29  Ebola-Related Violence                                                1219 non-
null   object
 30  Vaccination-Related Violence                                          1219 non-
null   object
 31  SiND Event ID                                                         1219 non-
null   int64
dtypes: bool(1), datetime64[ns](1), int64(17), object(13)
memory usage: 296.5+ KB
```

Step-4: Visualizations

1. Weapon Use by Perpetrator:

```
A horizontal stacked bar chart representing the distribution
of weapons used by the top perpetrators in percentage terms.
This visualization helps management understand which weapons
are most commonly associated with specific groups, aiding in
threat assessment.
```

2. Geographical Distribution of Incidents:

```
Visualizes the number of incidents in the top countries,
identifying geographical hotspots.
Provides a regional view of the most frequent perpetrators
and weapon usage in different countries.
```

3. Impact on Health Workers:

```
A pie chart showcasing the proportion of health workers
killed, injured, or kidnapped, highlighting the human cost of
these
attacks
```

4. Perpetrator Behavior and Trends:

```
Explores trends in perpetrator activity over time, showing
shifts in the frequency of incidents linked to different
groups.
```

Based on the dataset structure, key features that could be relevant for decision-making in a management context include:

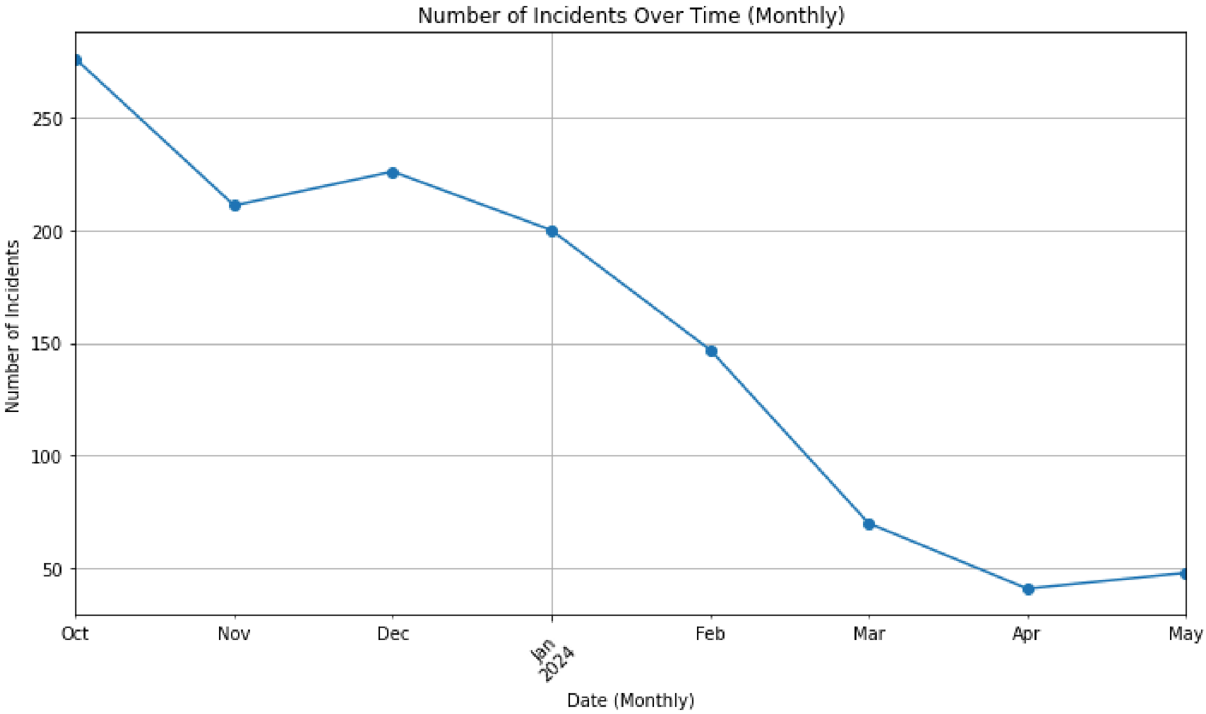
```
Date: Temporal analysis of incidents.
Country: To understand geographic distribution.
Reported Perpetrator & Perpetrator Name: Helps in identifying
the actors behind incidents.
Weapon Used: Type of weapon can indicate severity and
potential responses.
Health Facilities Affected: Damage or destruction of health
facilities.
Health Workers Impacted: Including workers killed, injured,
kidnapped, etc.
```

Time Series of Incidents

In [254…

```python
# Ensure 'Date' is properly formatted as datetime
df['Date'] = pd.to_datetime(df['Date'], errors='coerce')

# Group incidents by month
df_time_series = df.groupby(df['Date'].dt.to_period('M')).size()

# Plot: Time Series - Number of Incidents Over Time
plt.figure(figsize=(10, 6))
df_time_series.plot(kind='line', marker='o', linestyle='-', title='Number of
plt.ylabel('Number of Incidents')
plt.xlabel('Date (Monthly)')
plt.xticks(rotation=45)
plt.grid(True)
plt.tight_layout()
plt.show()
```

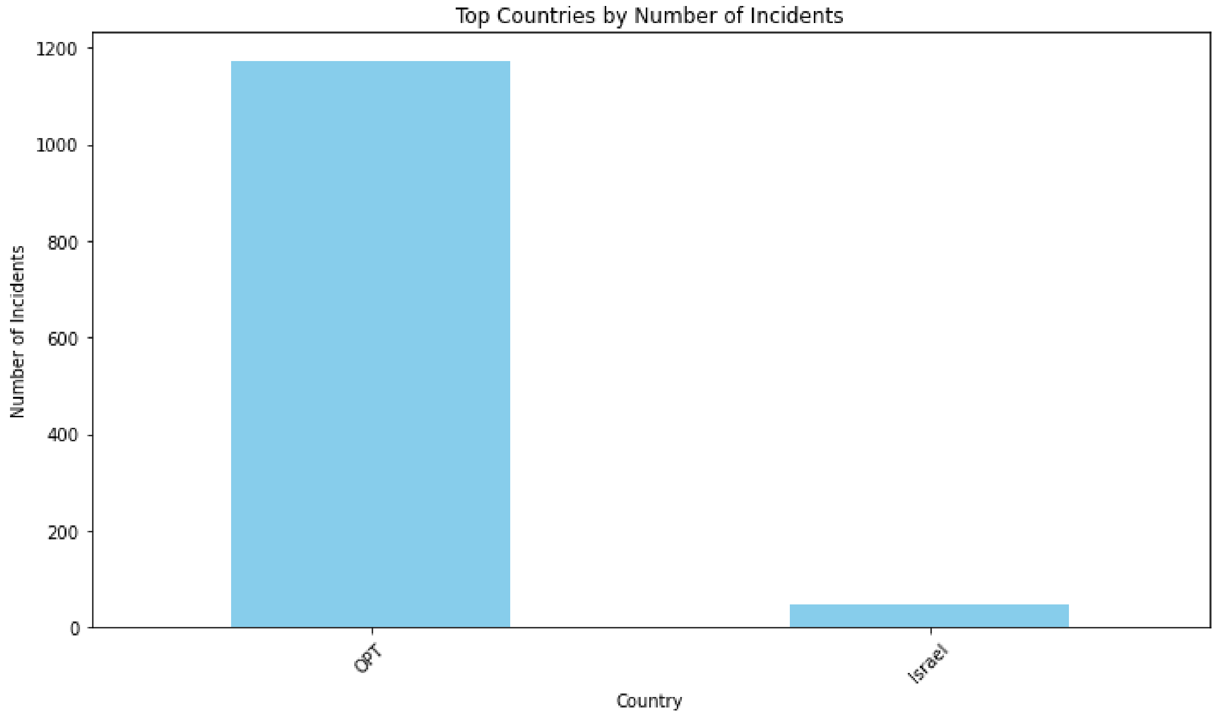
```
C:\Users\faraz\AppData\Local\Temp/ipykernel_9004/1091490575.py:2: SettingWit
hCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/
stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['Date'] = pd.to_datetime(df['Date'], errors='coerce')
```



Bar Chart of Incidents by Country

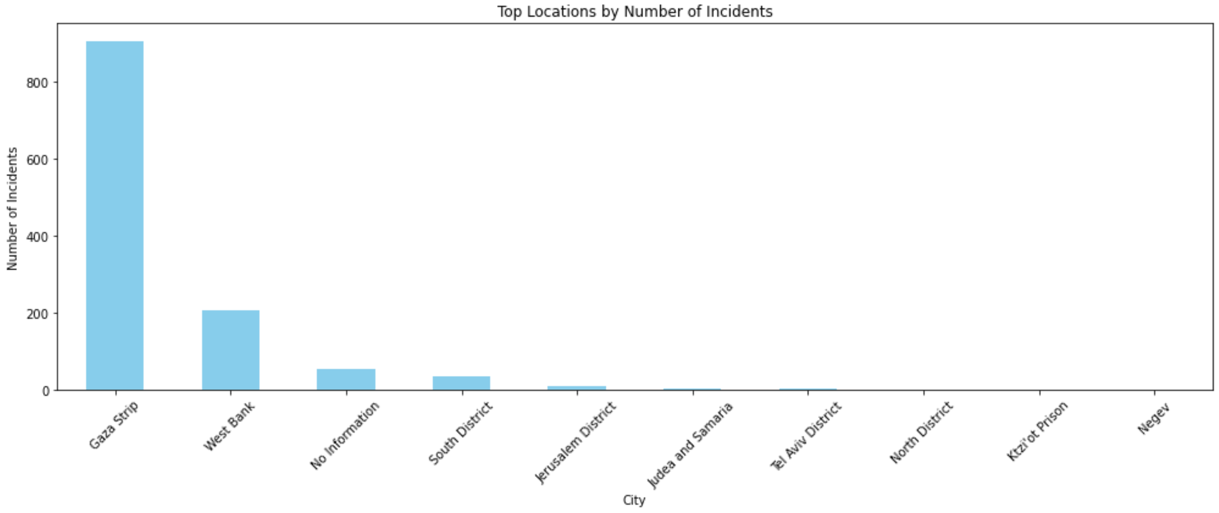
In [255…

```
# Get top 10 countries by number of incidents
df_country = df['Country'].value_counts().head(10)

# Plot: Incidents by Country
plt.figure(figsize=(10, 6))
df_country.plot(kind='bar', color='skyblue', title='Top Countries by Number
plt.ylabel('Number of Incidents')
plt.xlabel('Country')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [256…

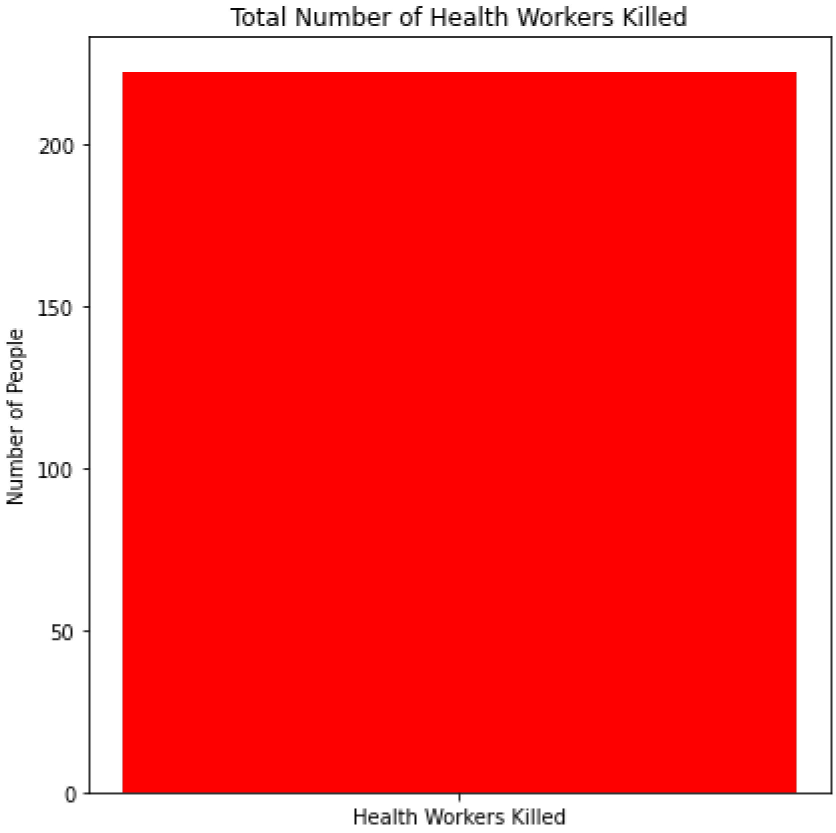
```
# Get top 10 countries by number of incidents
df_country = df['Admin 1'].value_counts().head(10)

# Plot: Incidents by Country
plt.figure(figsize=(14, 6))
df_country.plot(kind='bar', color='skyblue', title='Top Locations by Number
plt.ylabel('Number of Incidents')
plt.xlabel('City')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



Health Workers Killed', 'Health Workers Injured', 'Health Workers Kidnapped'

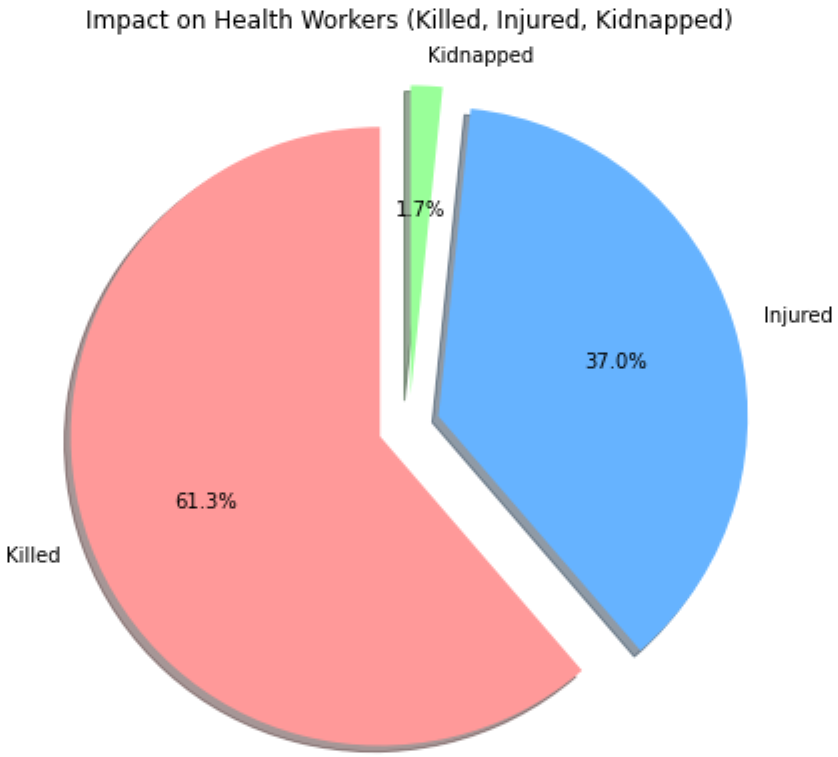
In [257…

```
# Summing the total number of health workers killed
total_killed = pd.to_numeric(df['Health Workers Killed'], errors='coerce').s

# Plotting a simple bar chart to visualize the total number of people killed
plt.figure(figsize=(6, 6))
plt.bar('Health Workers Killed', total_killed, color='red')

# Adding title and labels
plt.title('Total Number of Health Workers Killed')
plt.ylabel('Number of People')
plt.tight_layout()
plt.show()
```



In [258…

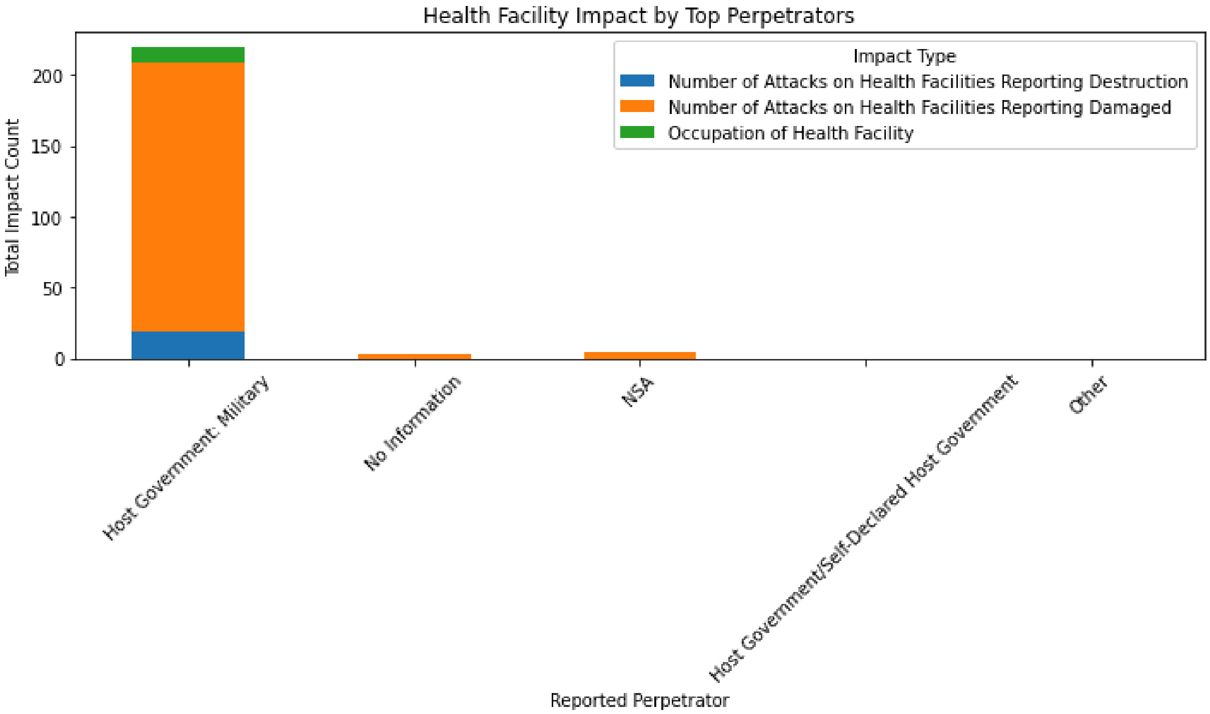
```
df_workers_impacted = df[['Health Workers Killed', 'Health Workers Injured',

# Sum of each impact category
impact_totals = df_workers_impacted.sum()

# Define labels and colors for the pie chart
labels = ['Killed', 'Injured', 'Kidnapped']
colors = ['#ff9999','#66b3ff','#99ff99']
explode = (0.1, 0.1, 0.1)  # 'explode' the slices to make them stand out

# Plot: Enhanced Pie Chart for Health Workers Impacted
plt.figure(figsize=(6, 6))
plt.pie(impact_totals, labels=labels, autopct='%1.1f%%', startangle=90, expl
plt.title('Impact on Health Workers (Killed, Injured, Kidnapped)')
plt.tight_layout()
plt.show()
```



Health Facility Impact by Perpetrator

In [259…

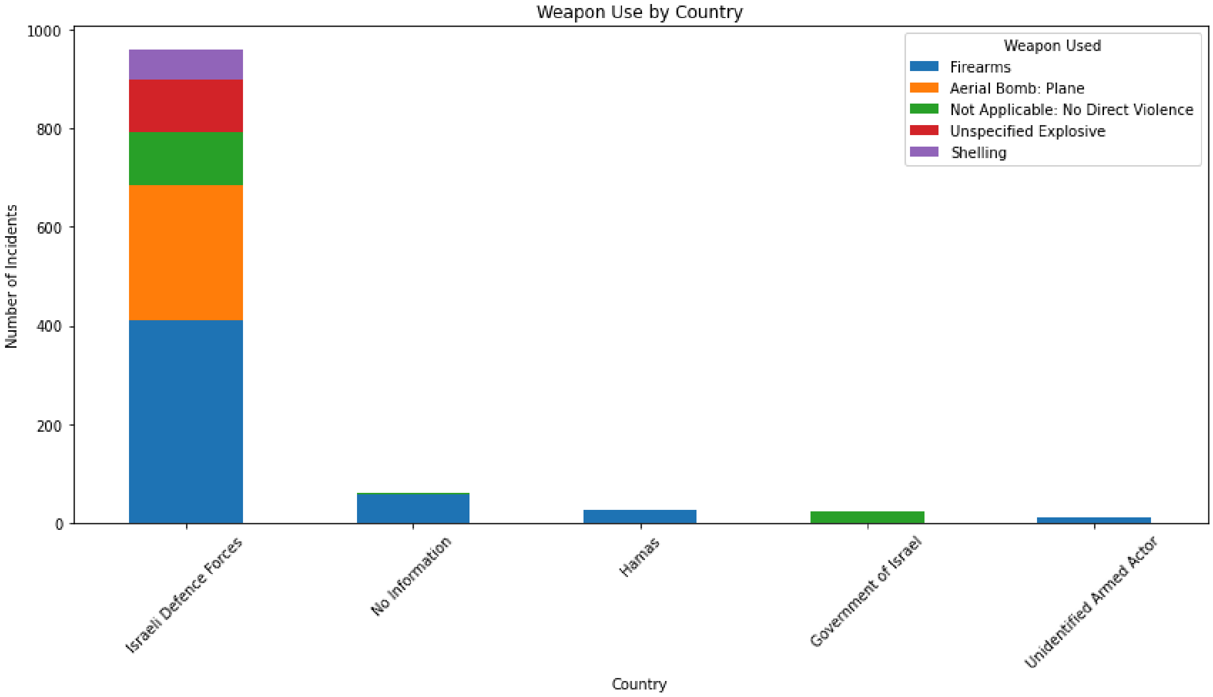
```
# Let's consider three key columns for health facility impact
df_health_impact = df[['Reported Perpetrator', 'Number of Attacks on Health
df_health_impact = df_health_impact.groupby('Reported Perpetrator').sum()

# Plot: Health Facility Impact by Perpetrator
df_health_impact.loc[top_perpetrators].plot(kind='bar', stacked=True, figsiz
plt.ylabel('Total Impact Count')
plt.xlabel('Reported Perpetrator')
plt.xticks(rotation=45)
plt.legend(title='Impact Type')
plt.tight_layout()
plt.show()
```



Weapon Usage by Perpetrators

In [260…

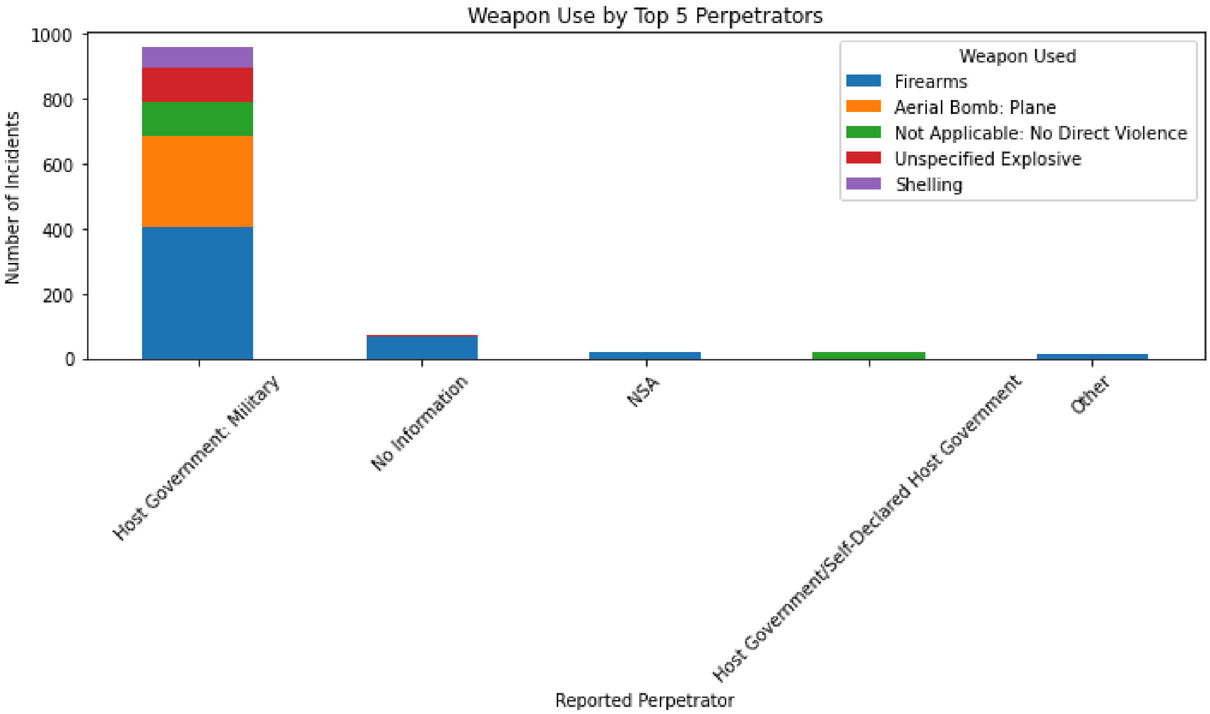
```
# ---------- Weapon Usage by Country ----------
# Cross-tab of Country and Weapon Used
df_weapon_country = pd.crosstab(df['Reported Perpetrator Name'], df['Weapon

# Plot: Weapon Use in Top Countries
top_countries = df['Reported Perpetrator Name'].value_counts().head(5).index

df_weapon_country.loc[top_countries, top_weapons].plot(kind='bar', stacked=T
plt.ylabel('Number of Incidents')
plt.xlabel('Country')
plt.xticks(rotation=45)
plt.legend(title='Weapon Used')
plt.tight_layout()
plt.show()
```



Trends in Weapon Usage Over Time

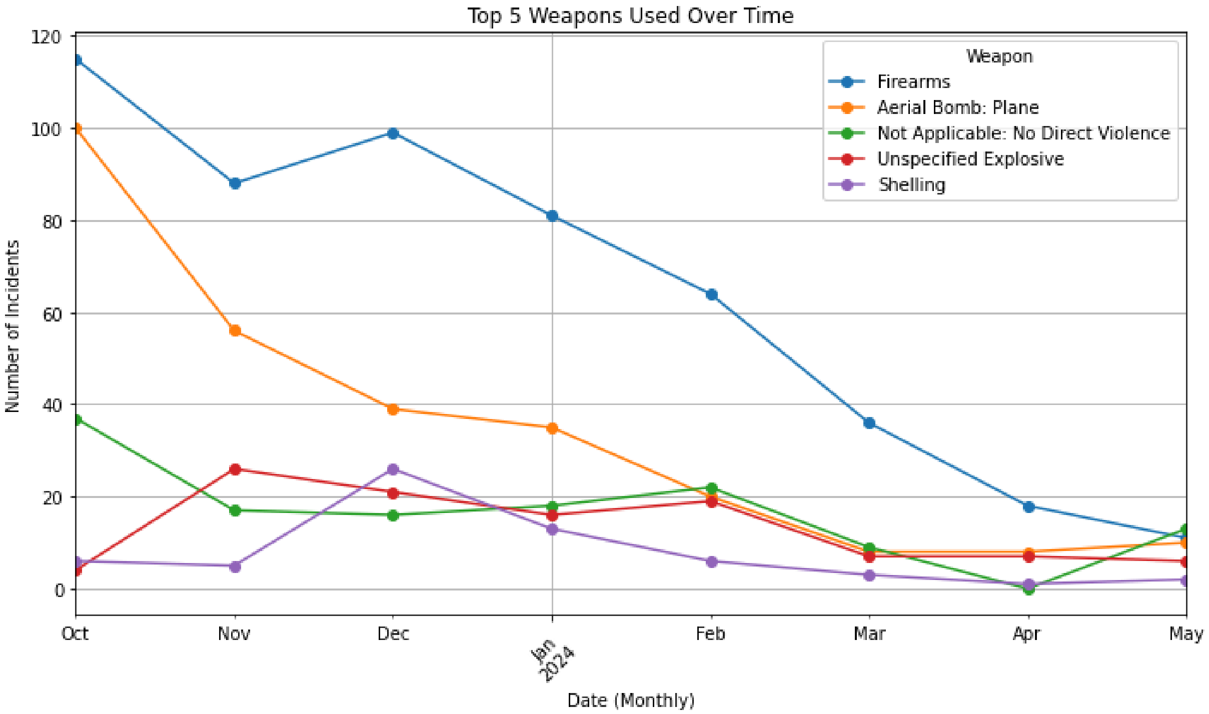
In [261…

```
# Cross-tab of Perpetrator and Weapon Used
df_weapon_perp = pd.crosstab(df['Reported Perpetrator'], df['Weapon Carried/

# Plot: Weapon Use by Top 5 Perpetrators
top_perpetrators = df['Reported Perpetrator'].value_counts().head(5).index
df_weapon_perp.loc[top_perpetrators, top_weapons].plot(kind='bar', stacked=T
plt.ylabel('Number of Incidents')
plt.xlabel('Reported Perpetrator')
plt.xticks(rotation=45)
plt.legend(title='Weapon Used')
plt.tight_layout()
plt.show()
```



In [262…

```
# Group by weapon and time (monthly) to see trends
df_weapon_time = df.groupby([df['Date'].dt.to_period('M'), 'Weapon Carried/U

# Plot: Top 5 Weapons Used Over Time
top_weapons = df['Weapon Carried/Used'].value_counts().head(5).index
df_weapon_time[top_weapons].plot(kind='line', marker='o', figsize=(10,6), ti
plt.ylabel('Number of Incidents')
plt.xlabel('Date (Monthly)')
plt.xticks(rotation=45)
plt.legend(title='Weapon')
plt.grid(True)
plt.tight_layout()
plt.show()
```



Frequency of Weapon Use

In [263…

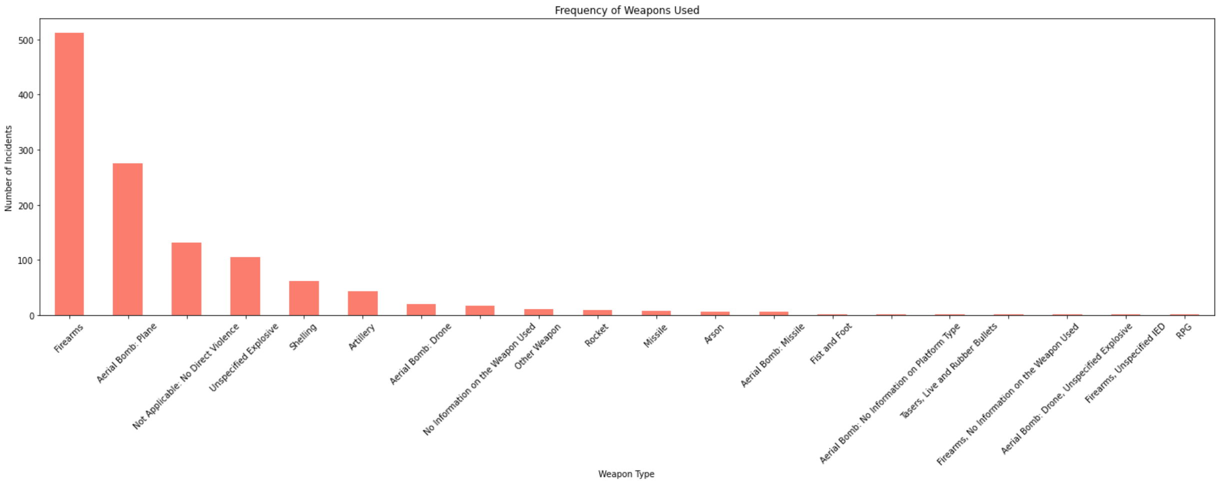
```
# Create a table of weapon types and their counts
weapon_table = pd.DataFrame({'Weapon Type': weapon_counts.index, 'Weapon Cou

# Display the table in the notebook
weapon_table
```

Out[263…

	Weapon Type	Weapon Count
0	Firearms	512
1	Aerial Bomb: Plane	276
2	Not Applicable: No Direct Violence	132
3	Unspecified Explosive	106
4	Shelling	62
5	Artillery	43
6	Aerial Bomb: Drone	21
7	No Information on the Weapon Used	17
8	Other Weapon	11
9	Rocket	9
10	Missile	8
11	Arson	7
12	Aerial Bomb: Missile	6
13	Fist and Foot	2
14	Aerial Bomb: No Information on Platform Type	2
15	Tasers, Live and Rubber Bullets	1
16	Firearms, No Information on the Weapon Used	1
17	Aerial Bomb: Drone, Unspecified Explosive	1
18	Firearms, Unspecified IED	1
19	RPG	1

In [264…

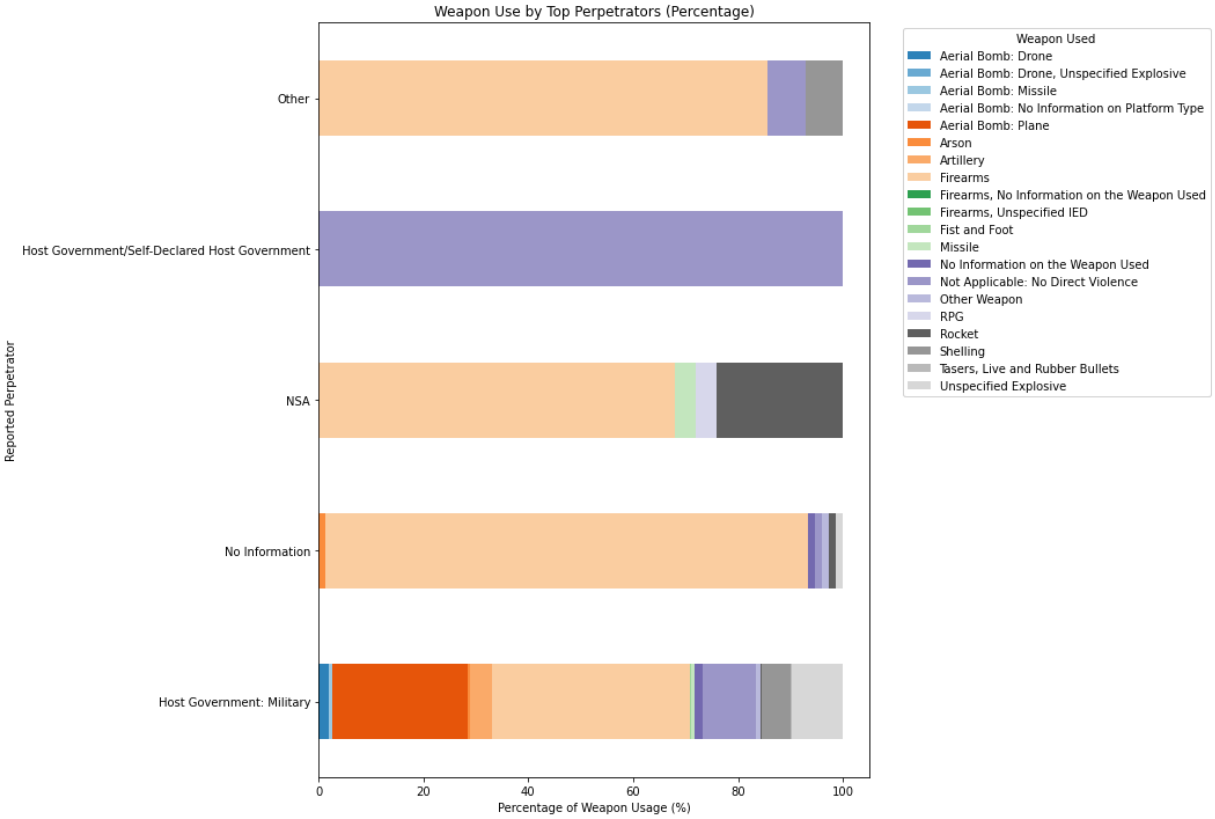
```
# ---------- Frequency of Weapons Used ----------
# Count the occurrences of each weapon
weapon_counts = df['Weapon Carried/Used'].value_counts()

# Plot: Frequency of Weapons Used
plt.figure(figsize=(20, 8))
weapon_counts.plot(kind='bar', color='salmon', title='Frequency of Weapons U
plt.ylabel('Number of Incidents')
plt.xlabel('Weapon Type')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [265…

```
# Cross-tab of Perpetrator and Weapon Used
df_weapon_perp = pd.crosstab(df['Reported Perpetrator'], df['Weapon Carried/

# Calculate the percentage of weapon use per perpetrator
df_weapon_perp_percentage = df_weapon_perp.div(df_weapon_perp.sum(axis=1), a

# Plot: Weapon Use by Top Perpetrators as a Horizontal Stacked Bar Chart wit
plt.figure(figsize=(15, 10))
df_weapon_perp_percentage.loc[top_perpetrators].plot(kind='barh', stacked=Tr

# Move the legend outside of the plot for clarity
plt.legend(title='Weapon Used', bbox_to_anchor=(1.05, 1), loc='upper left')
plt.xlabel('Percentage of Weapon Usage (%)')
plt.ylabel('Reported Perpetrator')
plt.tight_layout()
plt.show()
```

```
<Figure size 1080x720 with 0 Axes>
```


Weapon Use by Top Perpetrators (Percentage)
Reported Perpetrator
Other
Host Government/Self-Declared Host Government
NSA
No Information
Host Government: Military
0
20
40
60
80
100
Percentage of Weapon Usage (%)
Weapon Used
Aerial Bomb: Drone
Aerial Bomb: Drone, Unspecified Explosive
Aerial Bomb: Missile
Aerial Bomb: No Information on Platform Type
Aerial Bomb: Plane
Arson
Artillery
Firearms
Firearms, No Information on the Weapon Used
Firearms, Unspecified IED
Fist and Foot
Missile
No Information on the Weapon Used
Not Applicable: No Direct Violence
Other Weapon
RPG
Rocket
Shelling
Tasers, Live and Rubber Bullets
Unspecified Explosive