In [2]:

```python
# Import the necessary libraries
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns


# Loading The Data
file_path = 'C:/Users/faraz/Downloads/Niksun/ml_datasets/War_21st Century_Is

# Read the second sheet (Sheet2) into a DataFrame
df = pd.read_excel(file_path, sheet_name='Data')

df.head()
```

Out[2]:

	Country	Admin1	Admin2	ISO3	Admin2 Pcode	Admin1 Pcode	Month	Year	Events	F
0	Palestine	Gaza Strip	Deir El Balah	PSE	PS0265	PS02	January	2016	3	
1	Palestine	Gaza Strip	Gaza City	PSE	PS0260	PS02	January	2016	6	
2	Palestine	Gaza Strip	Khan Yunis	PSE	PS0270	PS02	January	2016	2	
3	Palestine	Gaza Strip	North Gaza	PSE	PS0255	PS02	January	2016	4	
4	Palestine	Gaza Strip	Rafah	PSE	PS0275	PS02	January	2016	1	

Country: Always "Palestine" (single value).

Admin1: Larger administrative areas (e.g., Gaza Strip).

Admin2: More specific administrative regions (e.g., Gaza City, Rafah).

Month and Year: Temporal data to track changes over time.

Events: Number of targeting events in a particular area and time.

Fatalities: Number of deaths in that area and time.

Data Wrangling

In [3]:

```python
# Introducing Month of Year for better visualizations
df['month_of_year'] = df['Month'].str[:3] + '-' + df['Year'].astype(str).str
df
```

Out[3]:

	Country	Admin1	Admin2	ISO3	Admin2 Pcode	Admin1 Pcode	Month	Year	Even
0	Palestine	Gaza Strip	Deir El Balah	PSE	PS0265	PS02	January	2016	
1	Palestine	Gaza Strip	Gaza City	PSE	PS0260	PS02	January	2016	
2	Palestine	Gaza Strip	Khan Yunis	PSE	PS0270	PS02	January	2016	
3	Palestine	Gaza Strip	North Gaza	PSE	PS0255	PS02	January	2016	
4	Palestine	Gaza Strip	Rafah	PSE	PS0275	PS02	January	2016	
...	...	...	...	...	...	...	...	...	
1611	Palestine	West Bank	Qalqilya	PSE	PS0120	PS01	May	2024	
1612	Palestine	West Bank	Ramallah and Al Bireh	PSE	PS0130	PS01	May	2024	
1613	Palestine	West Bank	Salfit	PSE	PS0125	PS01	May	2024	
1614	Palestine	West Bank	Tubas	PSE	PS0105	PS01	May	2024	
1615	Palestine	West Bank	Tulkarm	PSE	PS0110	PS01	May	2024	

1616 rows × 11 columns

In [4]:

```
df.isnull().sum()
df['Fatalities'] = df['Fatalities'].astype(int)
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1616 entries, 0 to 1615
Data columns (total 11 columns):
 #   Column         Non-Null Count  Dtype 
---  ------         --------------  ----- 
 0   Country        1616 non-null   object
 1   Admin1         1616 non-null   object
 2   Admin2         1616 non-null   object
 3   ISO3           1616 non-null   object
 4   Admin2 Pcode   1616 non-null   object
 5   Admin1 Pcode   1616 non-null   object
 6   Month          1616 non-null   object
 7   Year           1616 non-null   int64 
 8   Events         1616 non-null   int64 
 9   Fatalities     1616 non-null   int32 
 10  month_of_year  1616 non-null   object
dtypes: int32(1), int64(2), object(8)
memory usage: 132.7+ KB
```

In [5]:

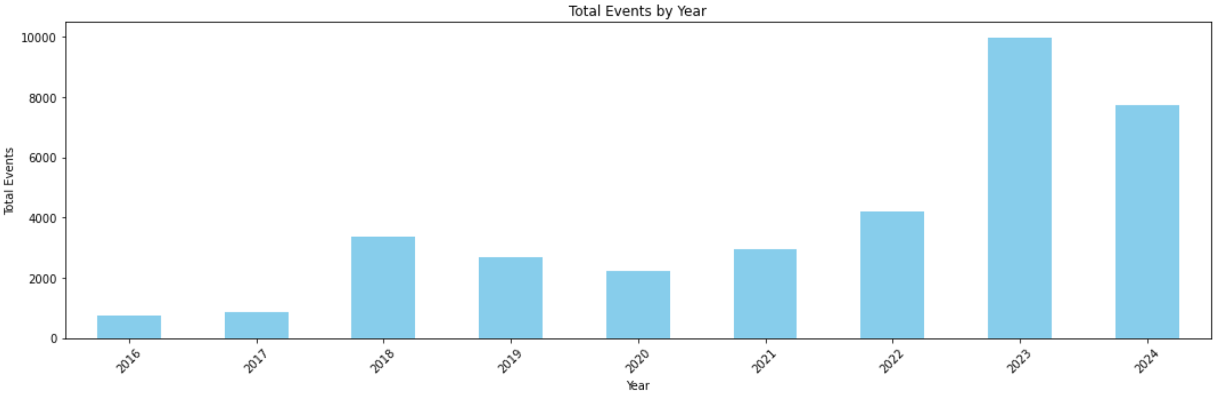
```
yearly_metrics = df.groupby('Year').agg(
    total_events=('Events', 'sum'),
    total_fatalities=('Fatalities', 'sum'),
    avg_events=('Events', 'mean'),
    avg_fatalities=('Fatalities', 'mean')
).reset_index()

print(yearly_metrics)
```

```
   Year  total_events  total_fatalities  avg_events  avg_fatalities
0  2016           735               164    3.828125        0.854167
1  2017           855               108    4.453125        0.562500
2  2018          3375               199   17.578125        1.036458
3  2019          2666               146   13.885417        0.760417
4  2020          2210                43   11.510417        0.223958
5  2021          2948               308   15.354167        1.604167
6  2022          4201               216   21.880208        1.125000
7  2023          9983             22593   51.994792      117.671875
8  2024          7711             14585   96.387500      182.312500
```

Metrics & Visualizations

In [6]:

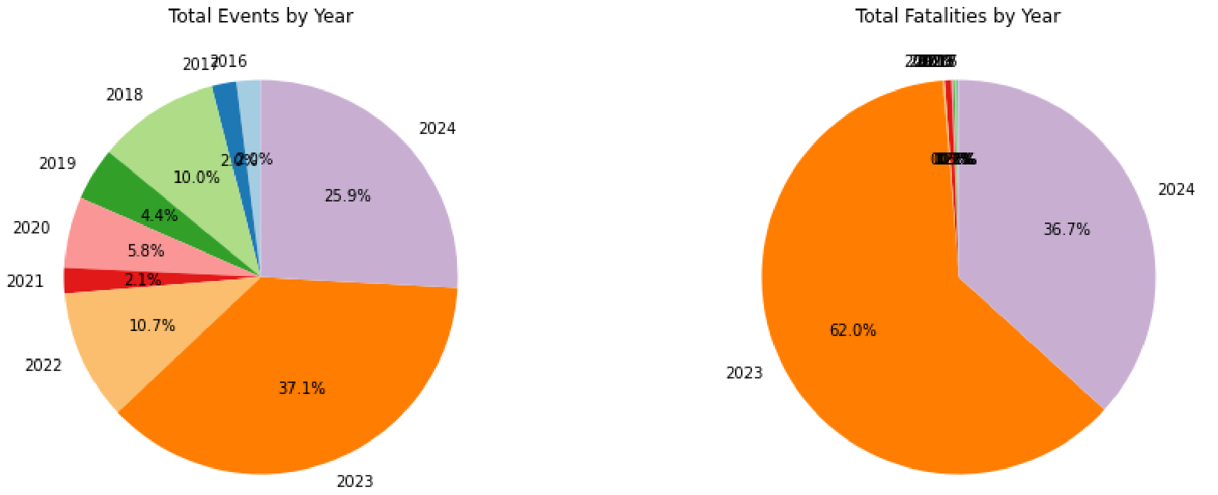
```
# Grouping data by year to show total events
events_by_year = df.groupby('Year')['Events'].sum()

# Plotting a simple bar chart
plt.figure(figsize=(15, 5))
events_by_year.plot(kind='bar', color='skyblue')
plt.title('Total Events by Year')
plt.xlabel('Year')
plt.ylabel('Total Events')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [7]:

```
# Use the existing data from the screenshot (manually inputted from the scre
yearly_metrics = pd.DataFrame({
    'Year': [2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024],
    'total_events': [212, 210, 1045, 456, 610, 218, 1118, 3876, 2701],
    'total_fatalities': [34, 23, 70, 40, 44, 180, 52, 21155, 12539]
})
```

```
# Create a pie chart for 'total_events' and 'total_fatalities'
fig, ax = plt.subplots(1, 2, figsize=(14, 5))

# Pie chart for total events
ax[0].pie(yearly_metrics['total_events'], labels=yearly_metrics['Year'], aut
ax[0].set_title('Total Events by Year')

# Pie chart for total fatalities
ax[1].pie(yearly_metrics['total_fatalities'], labels=yearly_metrics['Year'],
ax[1].set_title('Total Fatalities by Year')

# Display the charts
plt.tight_layout()
plt.show()
```

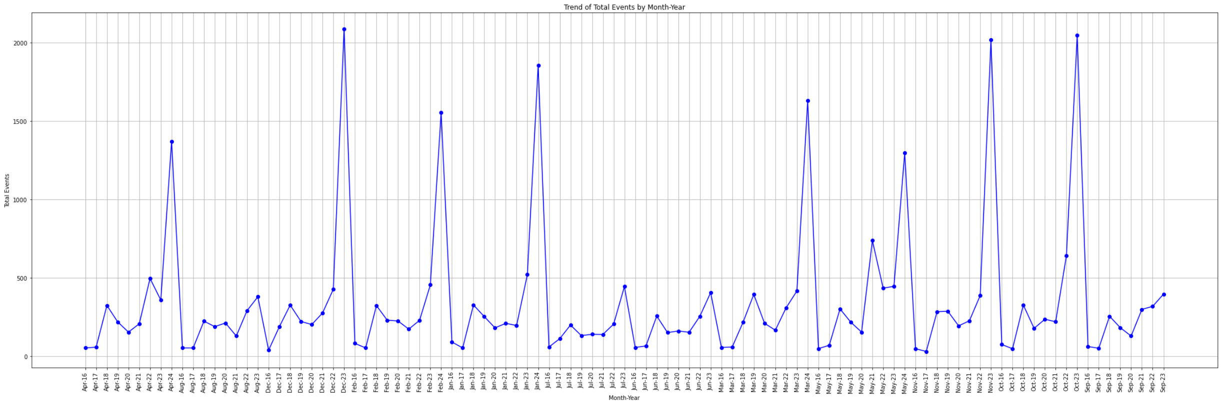


Total Events by Year

Total Fatalities by Year

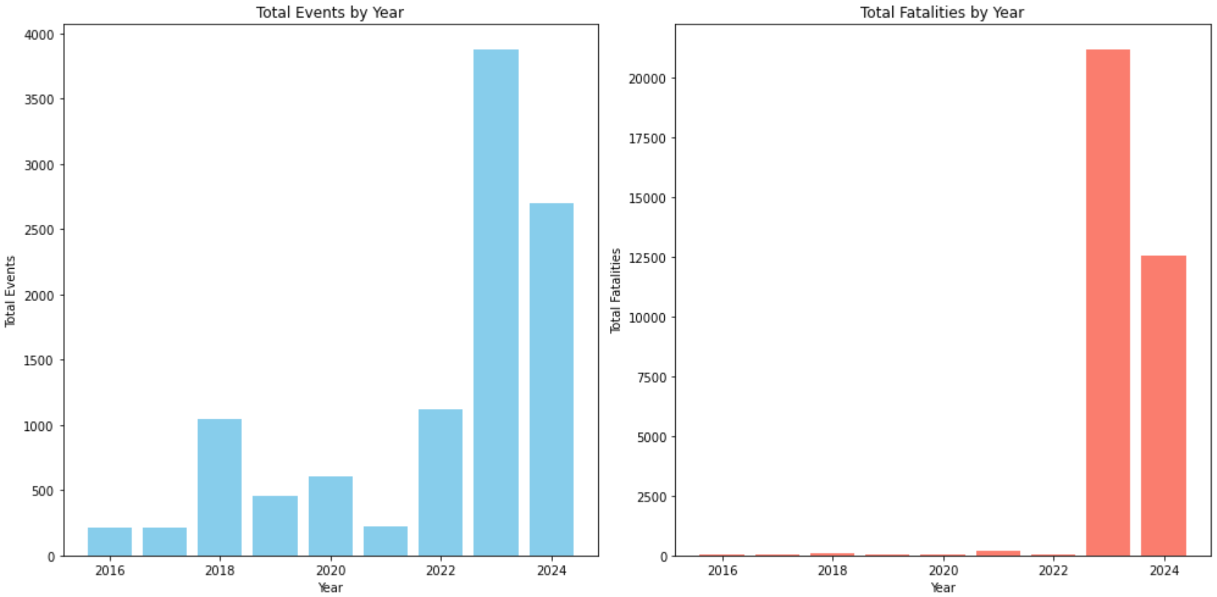
In [8]:

```
# Recreating the 'month_of_year' column in the format "Jan-16"
df['month_of_year'] = df['Month'].str[:3] + '-' + df['Year'].astype(str).str

# Grouping the data by 'month_of_year' to get the total events for each mont
events_by_month_year = df.groupby('month_of_year')['Events'].sum().reset_inc

# Sorting the data by 'month_of_year' for correct plotting
events_by_month_year.sort_values(by='month_of_year', inplace=True)

# Creating a trend line plot
plt.figure(figsize=(30, 10))
plt.plot(events_by_month_year['month_of_year'], events_by_month_year['Events

plt.xticks(rotation=90)
plt.xlabel('Month-Year')
plt.ylabel('Total Events')
plt.title('Trend of Total Events by Month-Year')
plt.grid(True)

# Display the trend line plot
plt.tight_layout()
plt.show()
```



In [9]:

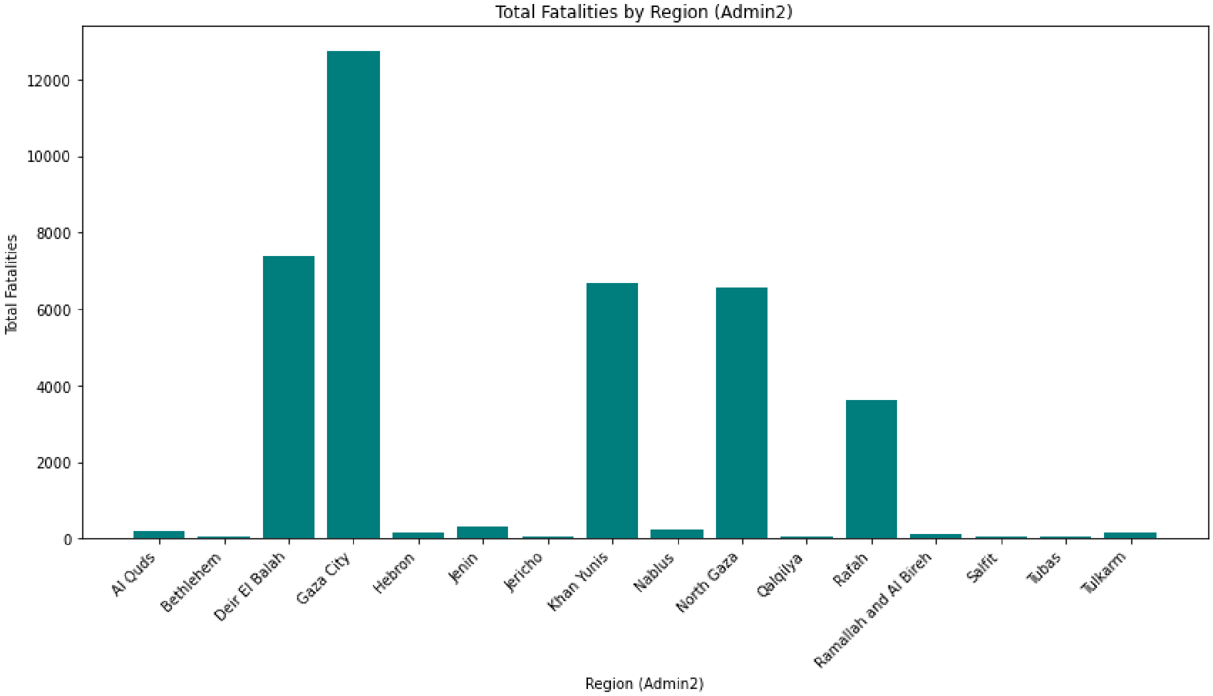
```
import matplotlib.pyplot as plt

# Create a bar chart instead of pie charts for 'total_events' and 'total_fat
fig, ax = plt.subplots(1, 2, figsize=(14, 7))

# Bar chart for total events
ax[0].bar(yearly_metrics['Year'], yearly_metrics['total_events'], color='sky
ax[0].set_title('Total Events by Year')
ax[0].set_xlabel('Year')
ax[0].set_ylabel('Total Events')

# Bar chart for total fatalities
ax[1].bar(yearly_metrics['Year'], yearly_metrics['total_fatalities'], color=
ax[1].set_title('Total Fatalities by Year')
ax[1].set_xlabel('Year')
ax[1].set_ylabel('Total Fatalities')

# Display the charts
plt.tight_layout()
plt.show()
```



In [10]:

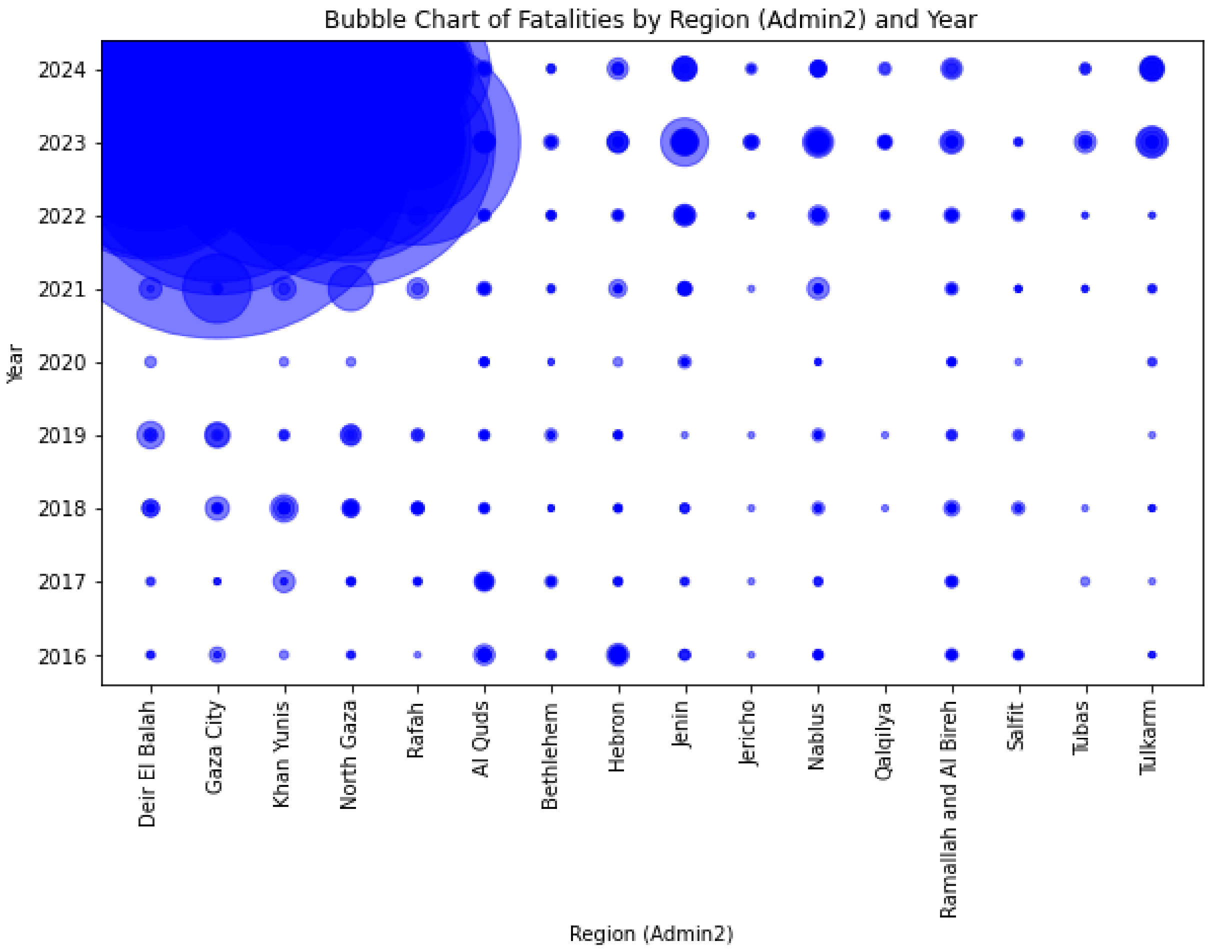
```
import matplotlib.pyplot as plt

# Grouping the data by 'Admin1' to get the total fatalities by region
```

```
fatalities_by_region = df.groupby('Admin2')['Fatalities'].sum().reset_index(

# Plotting the total fatalities by region using a bar chart
plt.figure(figsize=(12, 7))
plt.bar(fatalities_by_region['Admin2'], fatalities_by_region['Fatalities'],
plt.xlabel('Region (Admin2)')
plt.ylabel('Total Fatalities')
plt.title('Total Fatalities by Region (Admin2)')
plt.xticks(rotation=45, ha='right')

# Display the plot
plt.tight_layout()
plt.show()
```



In [11]:

```
plt.figure(figsize=(10, 6))
plt.scatter(df['Admin2'], df['Year'], s=df['Fatalities']*10, alpha=0.5, colo

plt.title('Bubble Chart of Fatalities by Region (Admin2) and Year')
plt.xlabel('Region (Admin2)')
plt.ylabel('Year')
plt.xticks(rotation=90)
plt.show()
```



In [12]:

```
# Aggregate the total number of events and fatalities by month
monthly_metrics = df.groupby('month_of_year').agg(
    total_events=('Events', 'sum'),
    total_fatalities=('Fatalities', 'sum'),
    avg_events=('Events', 'mean'),
    avg_fatalities=('Fatalities', 'mean')
).reset_index()

# Print the aggregated monthly metrics
monthly_metrics
```

Out[12]:

	month_of_year	total_events	total_fatalities	avg_events	avg_fatalities
0	Apr-16	54	4	3.3750	0.2500
1	Apr-17	59	4	3.6875	0.2500
2	Apr-18	325	14	20.3125	0.8750
3	Apr-19	220	5	13.7500	0.3125
4	Apr-20	155	2	9.6875	0.1250
...	...	...	...	...	...
96	Sep-19	183	1	11.4375	0.0625
97	Sep-20	130	1	8.1250	0.0625
98	Sep-21	300	13	18.7500	0.8125
99	Sep-22	319	21	19.9375	1.3125
100	Sep-23	397	20	24.8125	1.2500

101 rows × 5 columns

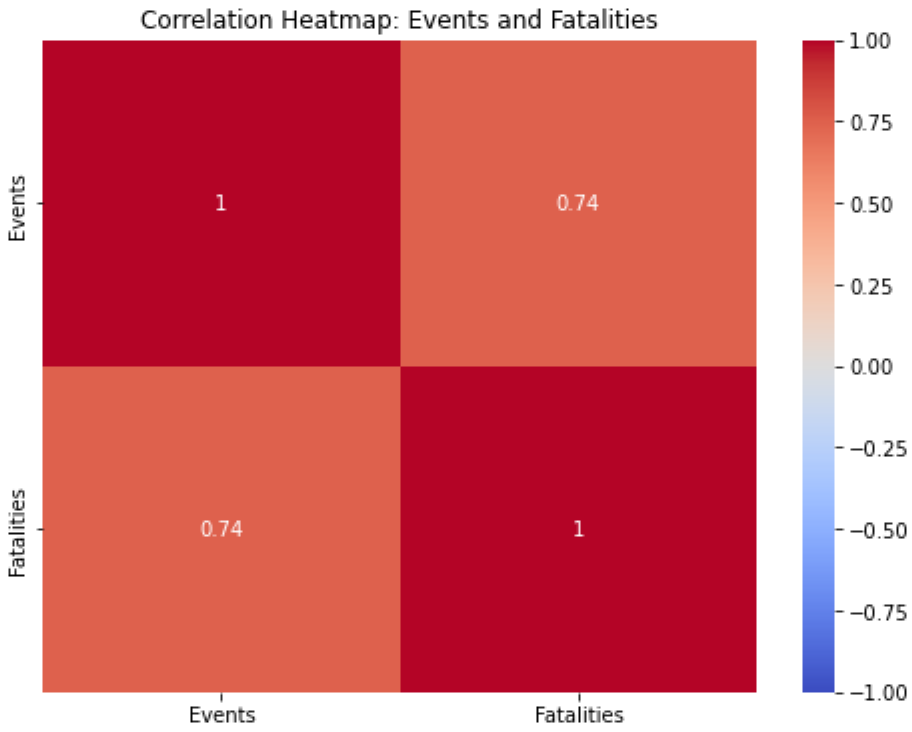
In [13]:

```
location_metrics = df.groupby(['Admin1', 'Admin2']).agg(
    total_events=('Events', 'sum'),
    total_fatalities=('Fatalities', 'sum'),
    avg_events=('Events', 'mean'),
    avg_fatalities=('Fatalities', 'mean')
).reset_index()

print(location_metrics)
```

```
        Admin1                 Admin2  total_events  total_fatalities  \
0   Gaza Strip          Deir El Balah          2143              7395   
1   Gaza Strip              Gaza City          3358             12752   
2   Gaza Strip             Khan Yunis          2442              6666   
3   Gaza Strip             North Gaza          2172              6557   
4   Gaza Strip                  Rafah          1398              3604   
5    West Bank                Al Quds          3381               191   
6    West Bank              Bethlehem          1723                64   
7    West Bank                 Hebron          3551               163   
8    West Bank                  Jenin          2129               315   
9    West Bank                Jericho           560                33   
10   West Bank                 Nablus          4243               223   
11   West Bank               Qalqilya          1614                36   
12   West Bank  Ramallah and Al Bireh          3662               141   
13   West Bank                 Salfit           810                36   
14   West Bank                  Tubas           452                39   
15   West Bank                Tulkarm          1046               147   

    avg_events  avg_fatalities  
0    21.217822       73.217822  
1    33.247525      126.257426  
2    24.178218       66.000000  
3    21.504950       64.920792  
4    13.841584       35.683168  
5    33.475248        1.891089  
6    17.059406        0.633663  
7    35.158416        1.613861  
8    21.079208        3.118812  
9     5.544554        0.326733  
10   42.009901        2.207921  
11   15.980198        0.356436  
12   36.257426        1.396040  
13    8.019802        0.356436  
14    4.475248        0.386139  
15   10.356436        1.455446  
```

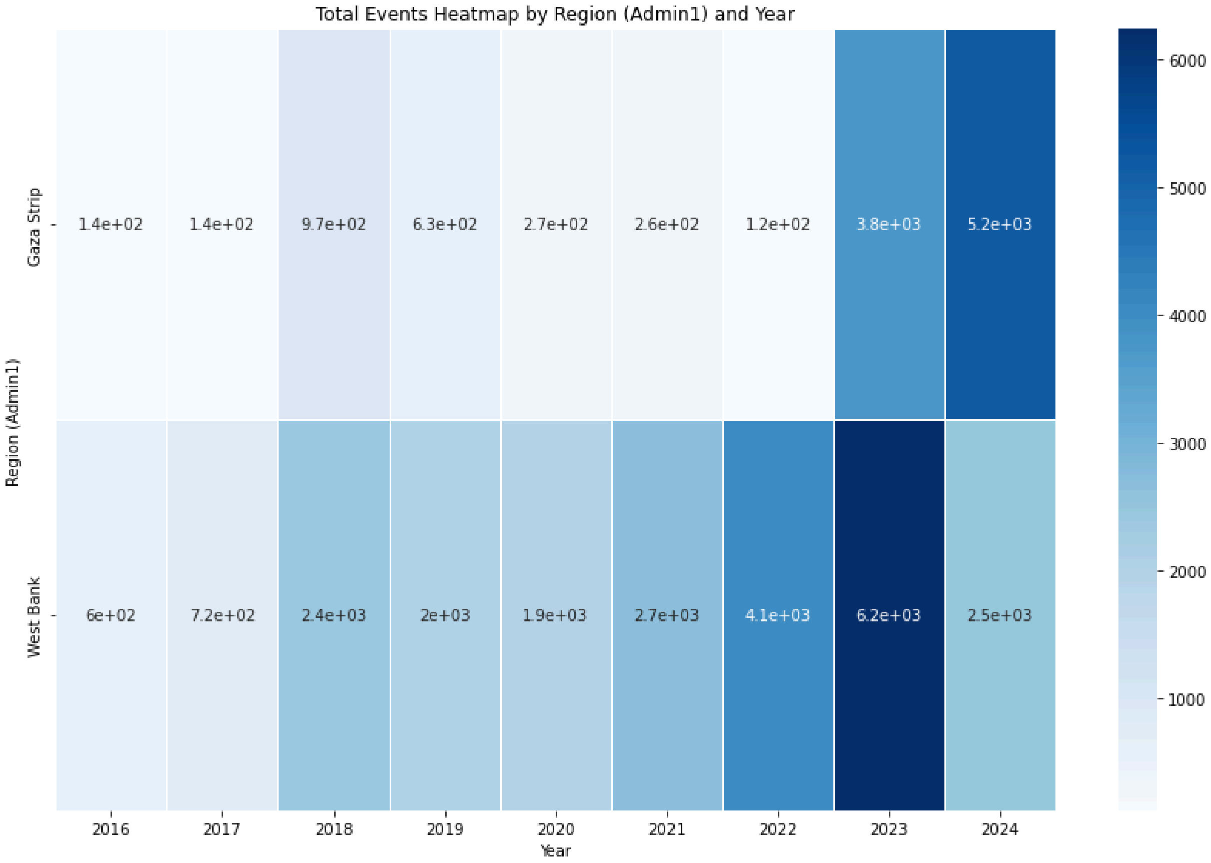
In [14]:

```python
# Creating a correlation heatmap between 'Events' and 'Fatalities'
correlation_data = df[['Events', 'Fatalities']]

# Calculating the correlation matrix
correlation_matrix = correlation_data.corr()

# Plotting the heatmap
plt.figure(figsize=(8, 6))
sns.heatmap(correlation_matrix, annot=True, cmap="coolwarm", vmin=-1, vmax=1

plt.title('Correlation Heatmap: Events and Fatalities')
plt.show()
print("Here is the correlation heatmap between Events and Fatalities. It sho
```



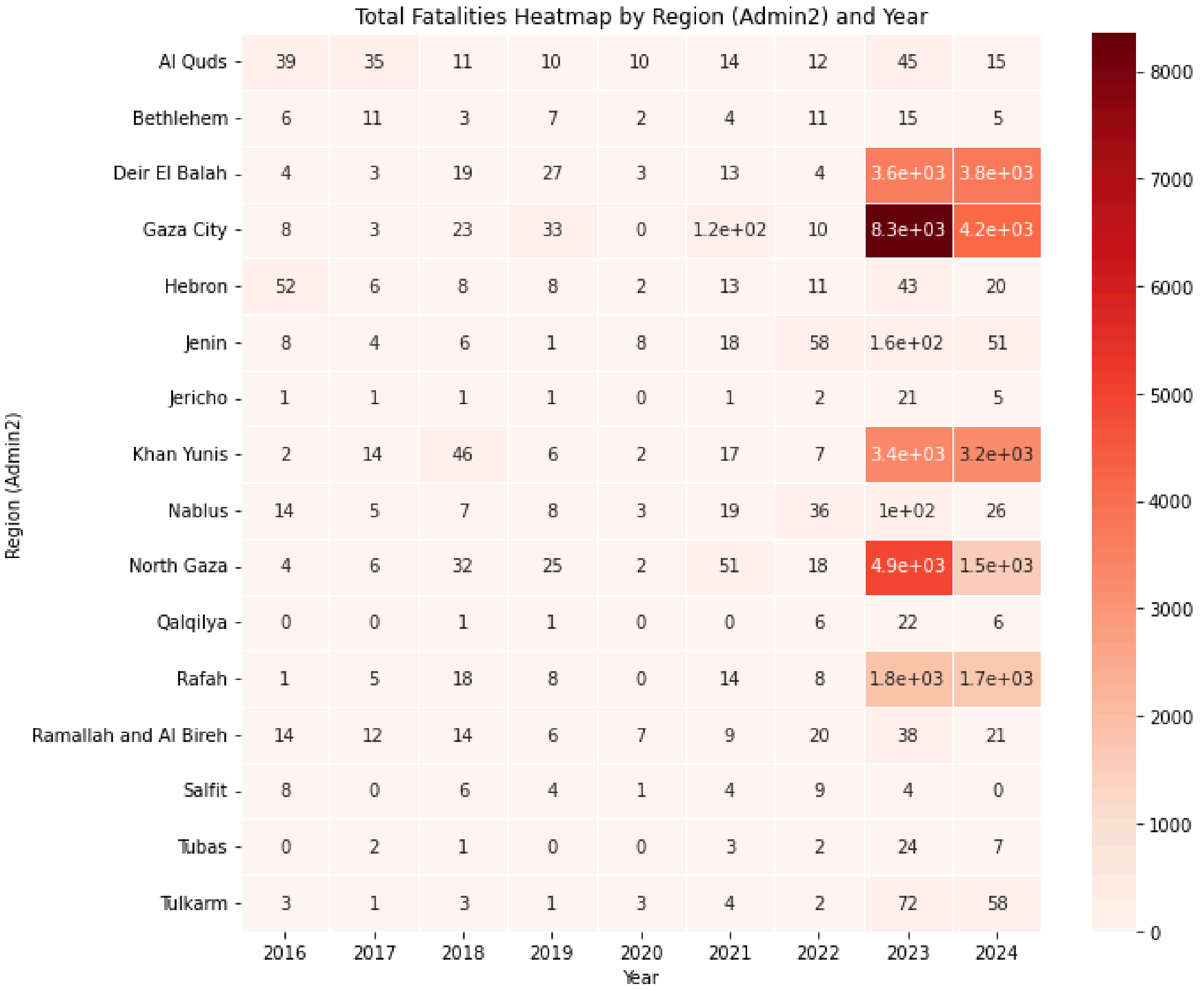
Here is the correlation heatmap between Events and Fatalities. It shows a positive correlation of 0.84, indicating that as events increase, fatalities tend to increase as well.

In [15]:
```
import seaborn as sns
import matplotlib.pyplot as plt

# Creating a pivot table to show the total events across regions (Admin1) ar
events_pivot = df.pivot_table(values='Events', index='Admin1', columns='Year

# Plotting the heatmap for total events across regions and years
plt.figure(figsize=(12, 8))
sns.heatmap(events_pivot, annot=True, cmap="Blues", linewidths=0.5, linecolc

plt.title('Total Events Heatmap by Region (Admin1) and Year')
plt.xlabel('Year')
plt.ylabel('Region (Admin1)')

# Display the heatmap
plt.tight_layout()
plt.show()
```



In [16]:

```
import seaborn as sns
import matplotlib.pyplot as plt

# Creating a pivot table to show the total fatalities across regions (Admin1
fatalities_pivot = df.pivot_table(values='Fatalities', index='Admin2', colum

# Plotting the heatmap for total fatalities across regions and years
plt.figure(figsize=(10, 8))
sns.heatmap(fatalities_pivot, annot=True, cmap="Reds", linewidths=0.5, linec

plt.title('Total Fatalities Heatmap by Region (Admin2) and Year')
plt.xlabel('Year')
plt.ylabel('Region (Admin2)')

# Display the heatmap
plt.tight_layout()
plt.show()
```



Total Fatalities Heatmap by Region (Admin2) and Year