In [14]:

```
# 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[14]:

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

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 [15]:

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

Out[15]:

	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 [16]:

```
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 [17]:

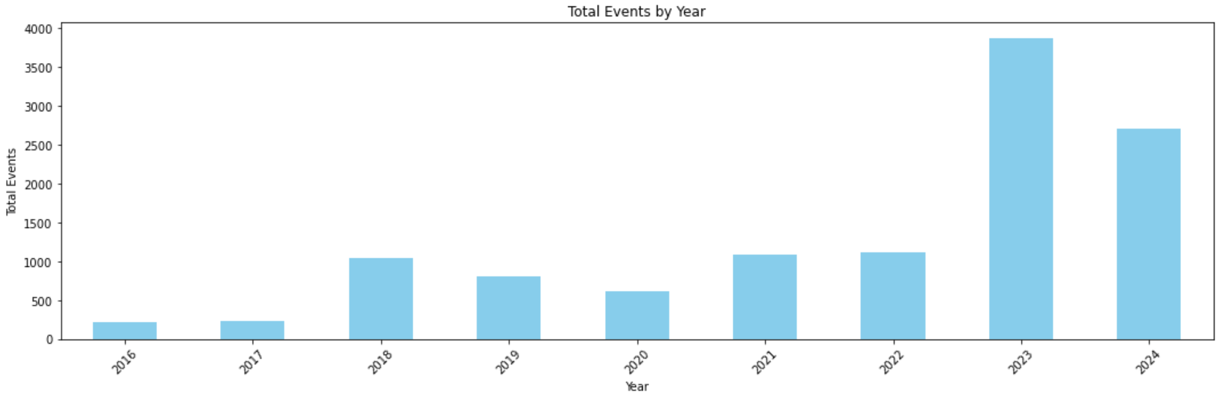
```
yearly_metrics = df.groupby('Year').agg(
    total_events=('Events', 'sum'),
    total_fatalities=('Fatalities', 'sum'),
    avg_events=('Events', 'mean'),
    avg_fatalities=('Fatalities', 'mean')
).reset_index()

print(yearly_metrics)
```

```
   Year  total_events  total_fatalities  avg_events  avg_fatalities
0  2016           212                34    1.104167        0.177083
1  2017           226                21    1.177083        0.109375
2  2018          1045                70    5.442708        0.364583
3  2019           810                64    4.218750        0.333333
4  2020           614                14    3.197917        0.072917
5  2021          1086               158    5.656250        0.822917
6  2022          1118                52    5.822917        0.270833
7  2023          3876             21155   20.187500      110.182292
8  2024          2701             12539   33.762500      156.737500
```

Metrics & Visualizations

In [48]:

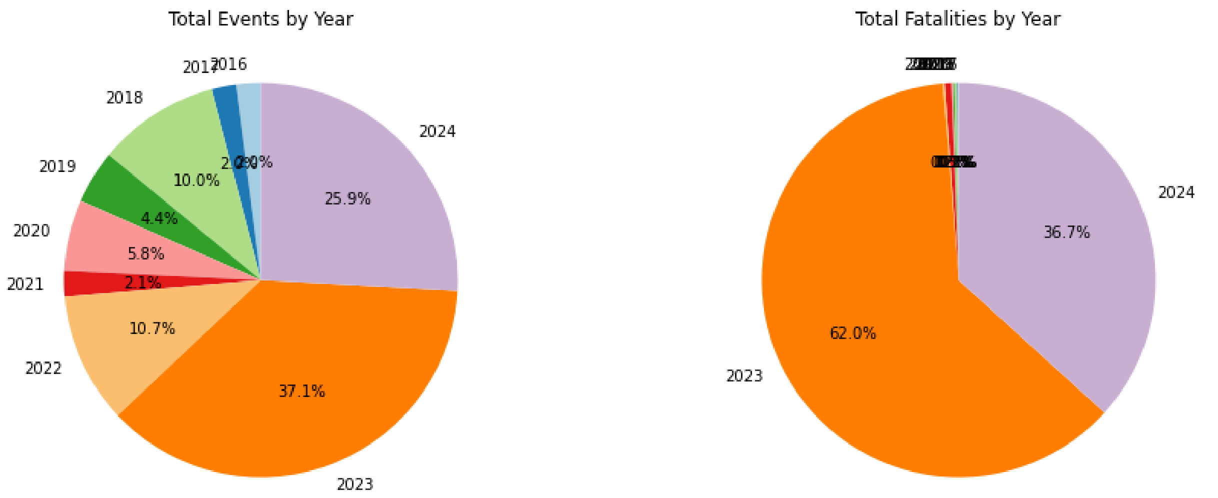
```
# Grouping data by year to show total events
events_by_year = df.groupby('Year')['Events'].sum()

# 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 [40]:

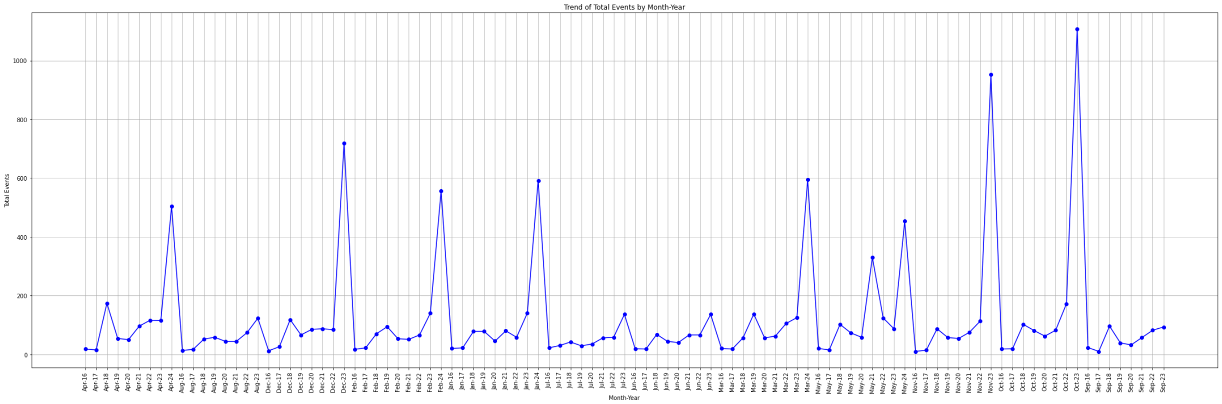
```
# Use the existing data from the screenshot (manually inputted from the scre
yearly_metrics = pd.DataFrame({
    'Year': [2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024],
    'total_events': [212, 210, 1045, 456, 610, 218, 1118, 3876, 2701],
    'total_fatalities': [34, 23, 70, 40, 44, 180,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



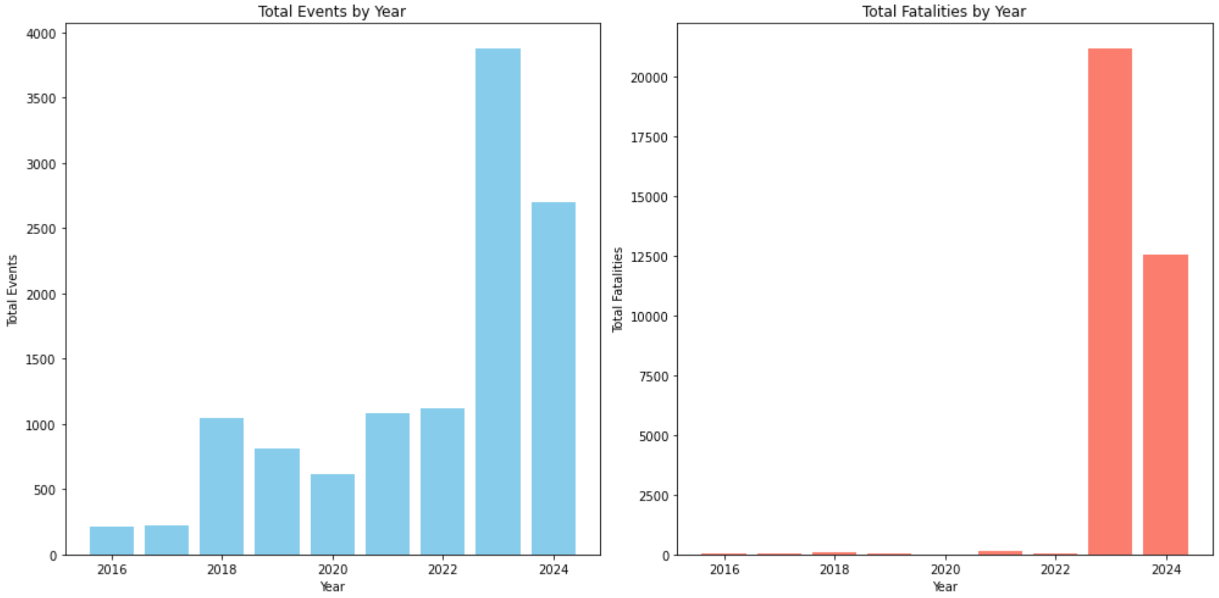
In [18]:

```
# 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 [19]:

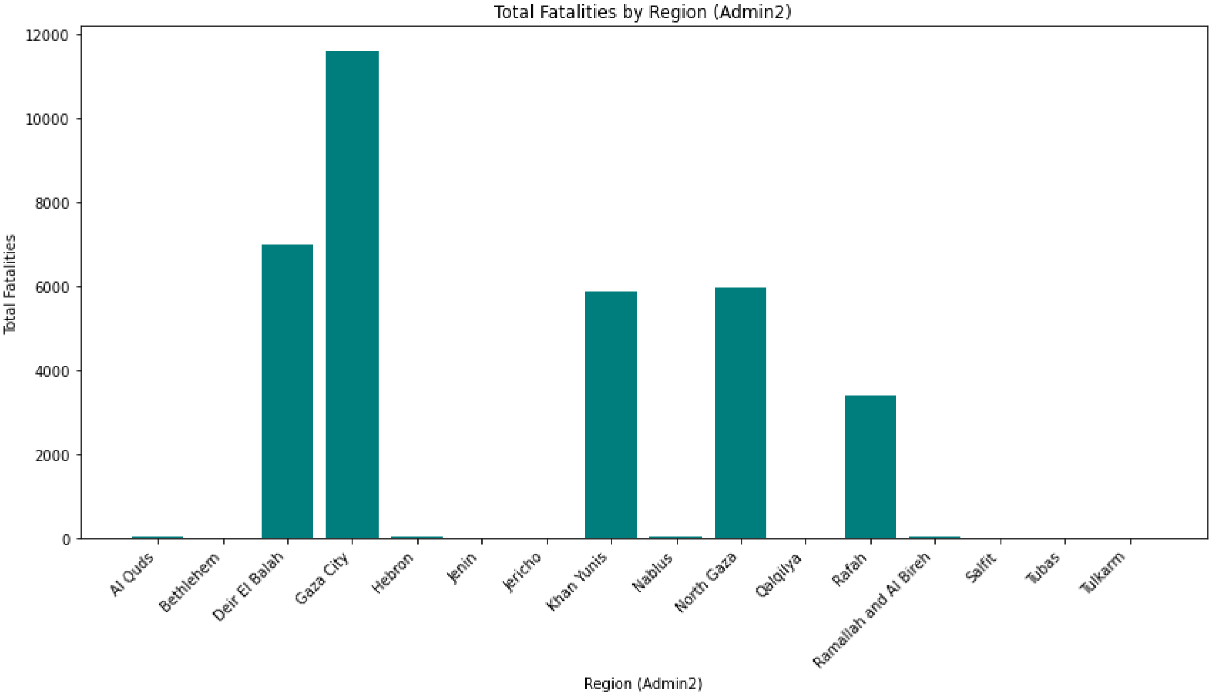
```
import matplotlib.pyplot as plt

# 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 [20]:

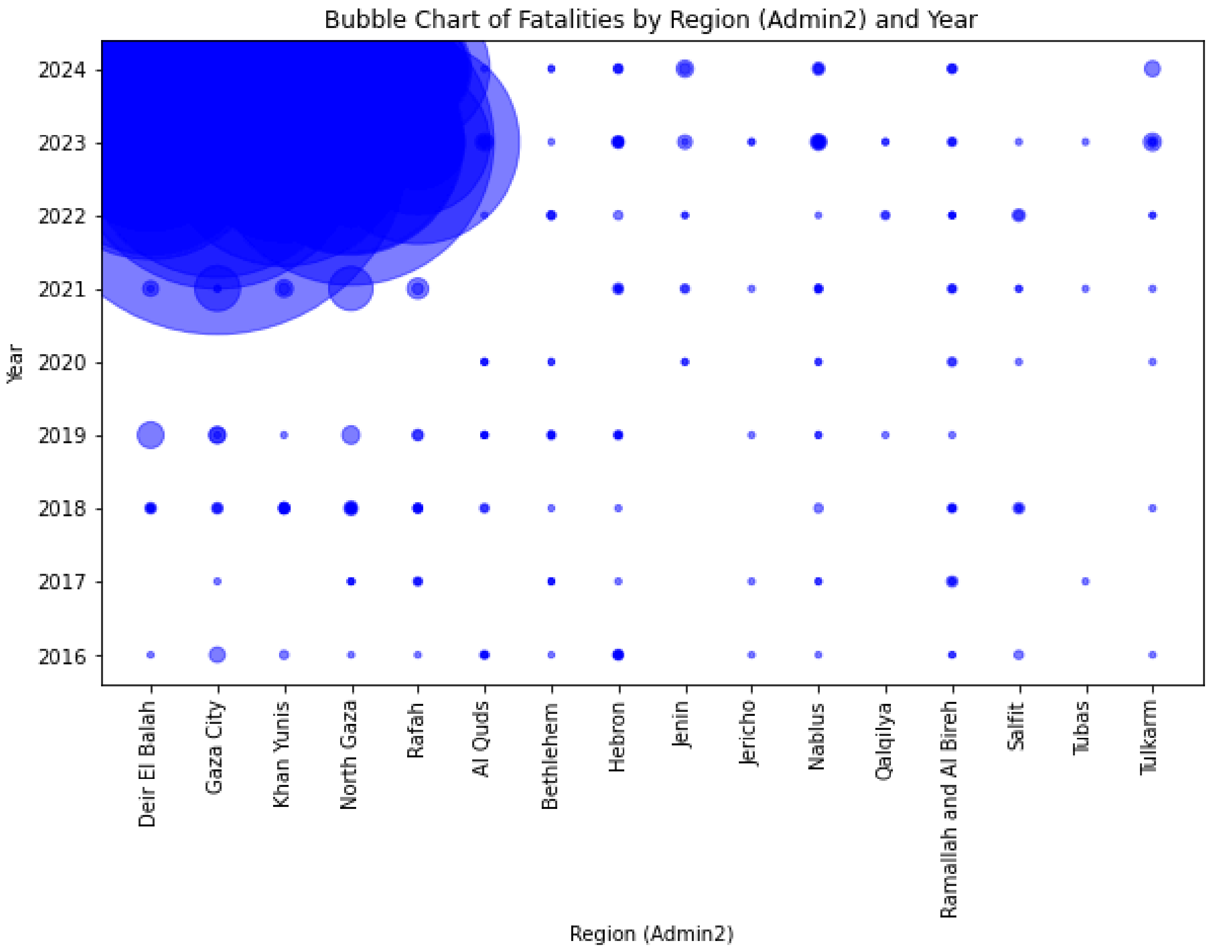
```
import matplotlib.pyplot as plt

# 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 [21]:

```
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 [22]: # 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[22]:

	month_of_year	total_events	total_fatalities	avg_events	avg_fatalities
0	Apr-16	18	1	1.1250	0.0625
1	Apr-17	15	1	0.9375	0.0625
2	Apr-18	174	11	10.8750	0.6875
3	Apr-19	54	1	3.3750	0.0625
4	Apr-20	50	1	3.1250	0.0625
...	...	...	...	...	...
96	Sep-19	39	0	2.4375	0.0000
97	Sep-20	32	1	2.0000	0.0625
98	Sep-21	57	5	3.5625	0.3125
99	Sep-22	82	1	5.1250	0.0625
100	Sep-23	93	7	5.8125	0.4375

101 rows × 5 columns

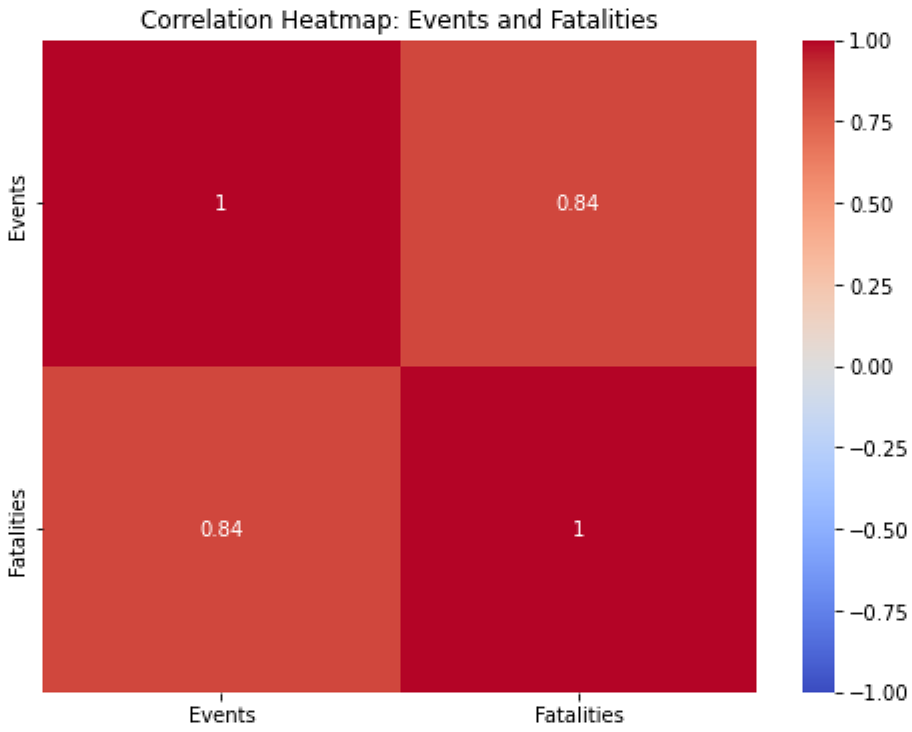
In [30]:

```
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           994              6995   
1   Gaza Strip              Gaza City          1442             11625   
2   Gaza Strip             Khan Yunis          1009              5869   
3   Gaza Strip             North Gaza           841              5970   
4   Gaza Strip                  Rafah           680              3394   
5    West Bank                Al Quds           785                33   
6    West Bank              Bethlehem           476                20   
7    West Bank                 Hebron          1269                42   
8    West Bank                  Jenin           343                23   
9    West Bank                Jericho           166                 6   
10   West Bank                 Nablus          1383                46   
11   West Bank               Qalqilya           394                 6   
12   West Bank  Ramallah and Al Bireh          1059                33   
13   West Bank                 Salfit           431                17   
14   West Bank                  Tubas           150                 3   
15   West Bank                Tulkarm           266                25   

    avg_events  avg_fatalities  
0     9.841584       69.257426  
1    14.277228      115.099010  
2     9.990099       58.108911  
3     8.326733       59.108911  
4     6.732673       33.603960  
5     7.772277        0.326733  
6     4.712871        0.198020  
7    12.564356        0.415842  
8     3.396040        0.227723  
9     1.643564        0.059406  
10   13.693069        0.455446  
11    3.900990        0.059406  
12   10.485149        0.326733  
13    4.267327        0.168317  
14    1.485149        0.029703  
15    2.633663        0.247525  
```

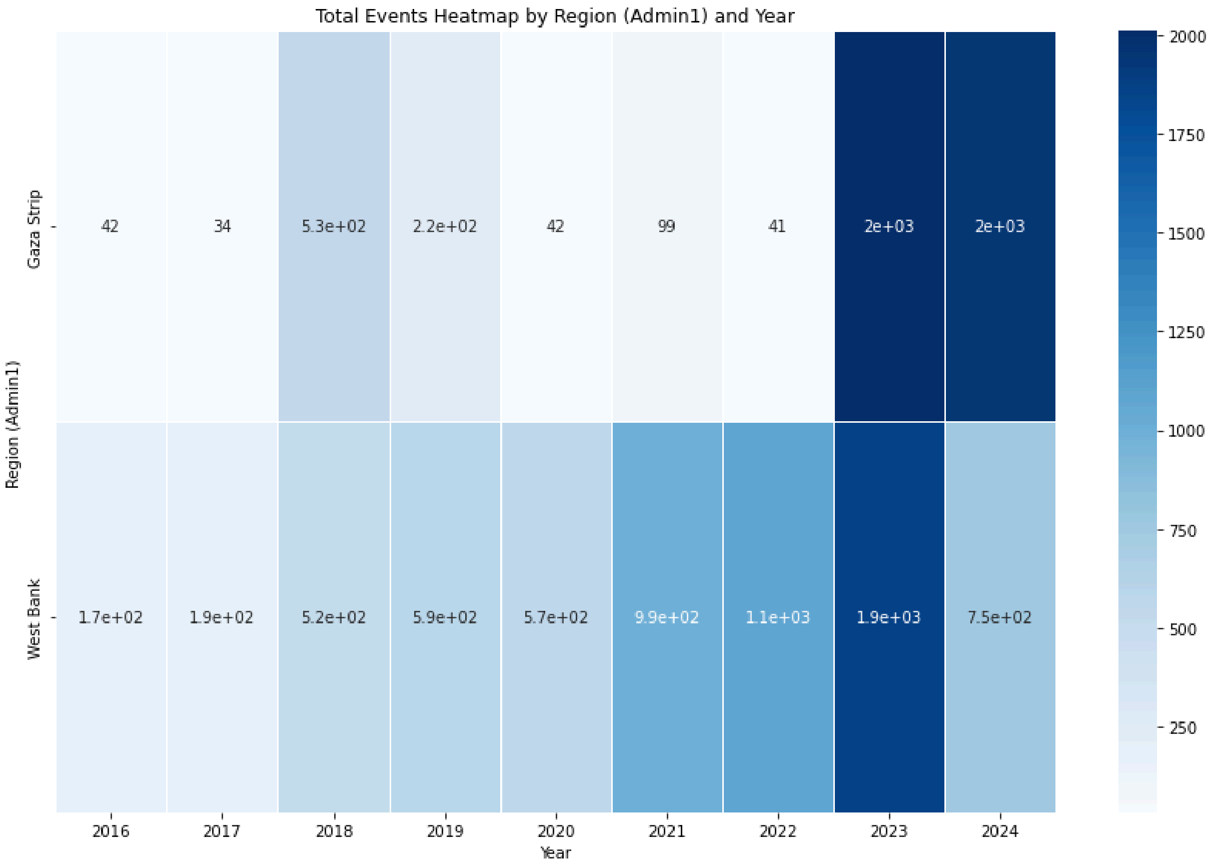
In [31]:

```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
```



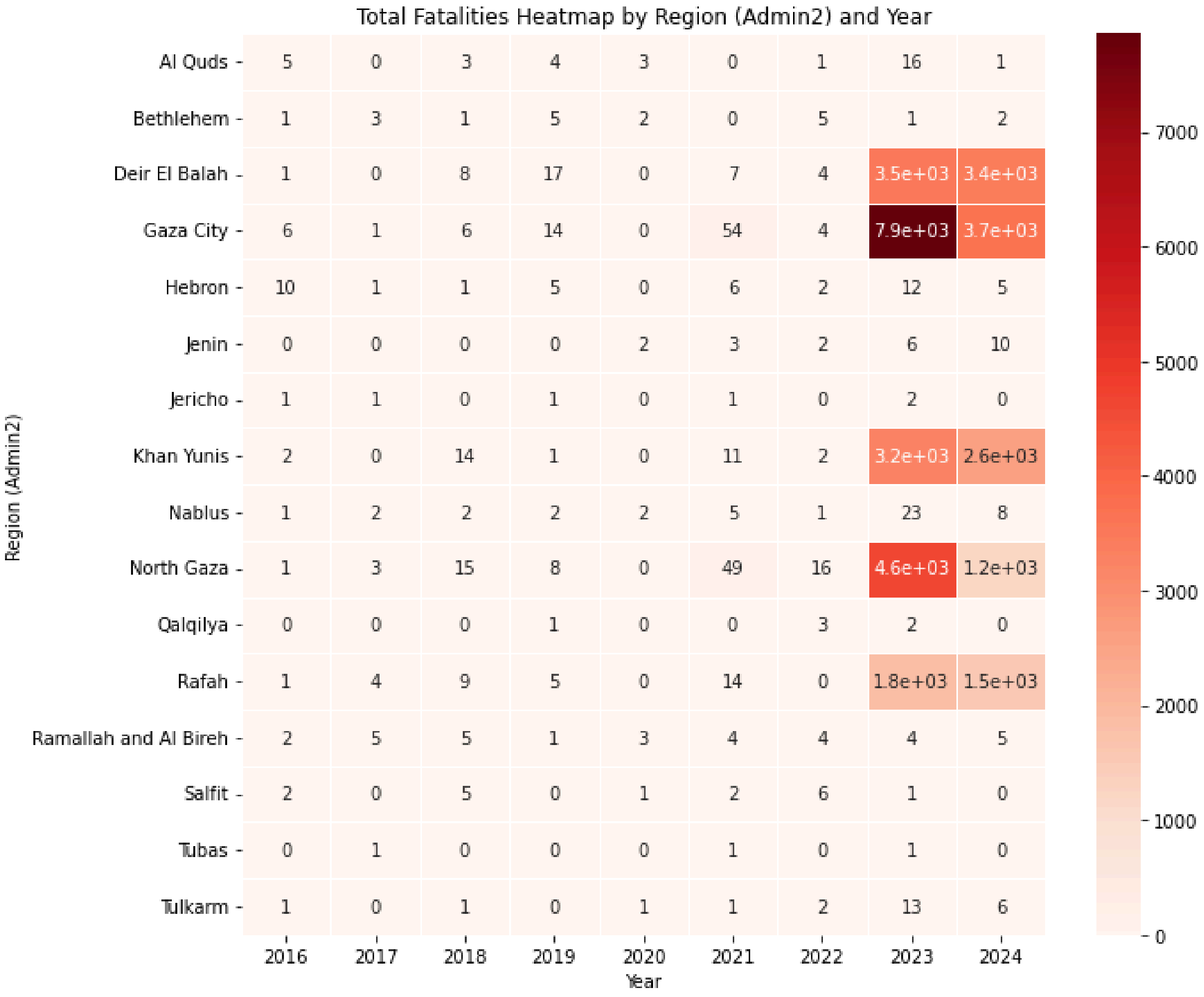
Here is the correlation heatmap between Events and Fatalities. It shows a positive correlation of 0.84, indicating that as events increase, fatalities tend to increase as well.

In [32]:
```
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, linecolo

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 [33]:

```
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()
```



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