1. Problem Statement

The objective of this analysis is to identify meaningful patterns, trends, and insights from Aadhaar update data provided by UIDAI. The goal is to understand how Aadhaar updates are distributed across geography, time, and demographics, and to translate these observations into actionable insights that can support informed decision-making and operational improvements.

2. Approach

A structured data analytics approach was adopted to explore Aadhaar update behaviour in the year 2025. The analysis focuses on:

- Understanding demographic distribution of updates
- Identifying regional concentration of update activity
- Detecting monthly and seasonal trends
- Examining relationships between geography, time, and age groups

The study relies on exploratory data analysis techniques, visual analytics, and aggregation-based insights rather than predictive modelling, as the dataset is descriptive in nature.

3. Datasets Used

3.1 Dataset Description

The analysis is based on the Aadhaar Update Dataset provided by UIDAI. The dataset contains records of Aadhaar updates performed across India in the year 2025.

3.2 Columns Used for Analysis

The dataset consists of the following key attributes:

Column Name	Description
Date	Date on which Aadhaar update was recorded
State	Name of the state where update occurred

Column Name	Description
District	District of update
Pin code	Location identifier
5 to 17 Years of Age	Number of updates for citizens aged 5–17
17+ Years of Age	Number of updates for citizens above 17
Total Updates	Sum of updates across both age groups
Year	Extracted year from Date
Month	Extracted month from Date
Day	Extracted day from Date

3.3 Dataset Scope

- Total records analysed: **489,682**
- Time period: Data available for selected months in 2025 (*March, April, May, June, July, and September*)
- No missing values in dataset
- Data represents Aadhaar update counts, not fresh enrolments

A systematic analytical workflow was followed to ensure clean, reproducible, and meaningful analysis.

4. Methodology

Step 1 – Data Loading

- The consolidated Aadhaar update dataset was loaded into Google Colab using Python (pandas).
- Initial inspection was performed to understand structure, data types, and size.

Step 2 – Data Understanding

- Data types and column formats were validated.
- Non-null counts were verified.
- Summary statistics were generated.

Step 3 – Data Cleaning

- Duplicate records were identified.
- A total of **10,318 duplicate rows** were removed.
- After cleaning, the dataset contained **489,682 unique records**.

Step 4 – Feature Engineering

Additional analytical fields were created:

- Year, Month, and Day extracted from Date
- A new metric **"Total Updates"** created as:

Total Updates = 5 to 17 Years of Age + 17+ Years of Age

Step 5 – Data Transformation

- Columns were renamed for clarity and readability.
- Data was aggregated at State, District, Month, and Age Group levels.

Step 6 – Exploratory Data Analysis

- Univariate, bivariate, and trivariate analysis performed.
- Visualizations created using Matplotlib and Seaborn.

5. Data Analysis & Visualization

5.1 Age Group Analysis

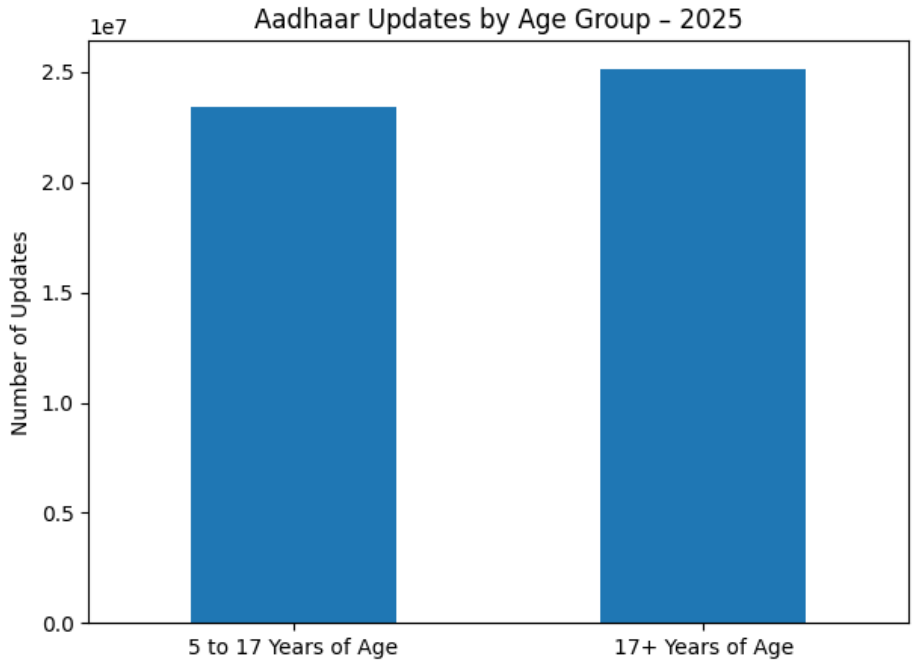
Finding

- Total updates for 5–17 age group: **23,430,272**

- Total updates for 17+ age group: **25,155,296**

Insight

- Adults contribute slightly more updates (51.8%) compared to children (48.2%).
- Indicates Aadhaar updates are almost equally important across both demographics.
- The difference between age groups is approximately 1.72 million updates, indicating nearly balanced participation.



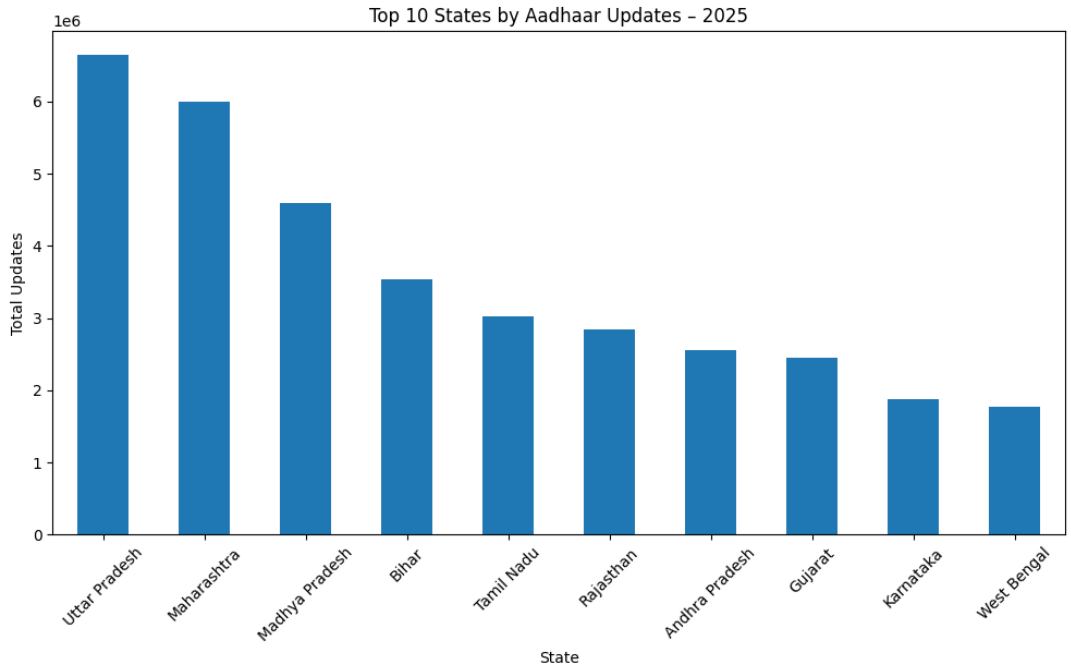
5.2 State Wise Analysis (Top 10)

State	Total Updates
Uttar Pradesh	6,643,629
Maharashtra	6,002,738
Madhya Pradesh	4,601,265

State	Total Updates
Bihar	3,543,433
Tamil Nadu	3,026,489
Rajasthan	2,844,034
Andhra Pradesh	2,557,498
Gujarat	2,455,187
Karnataka	1,872,814
West Bengal	1,776,798

Insights

- Aadhaar update demand is highly concentrated in large-population states.
- Uttar Pradesh and Maharashtra together account for more than one-fourth of all updates.

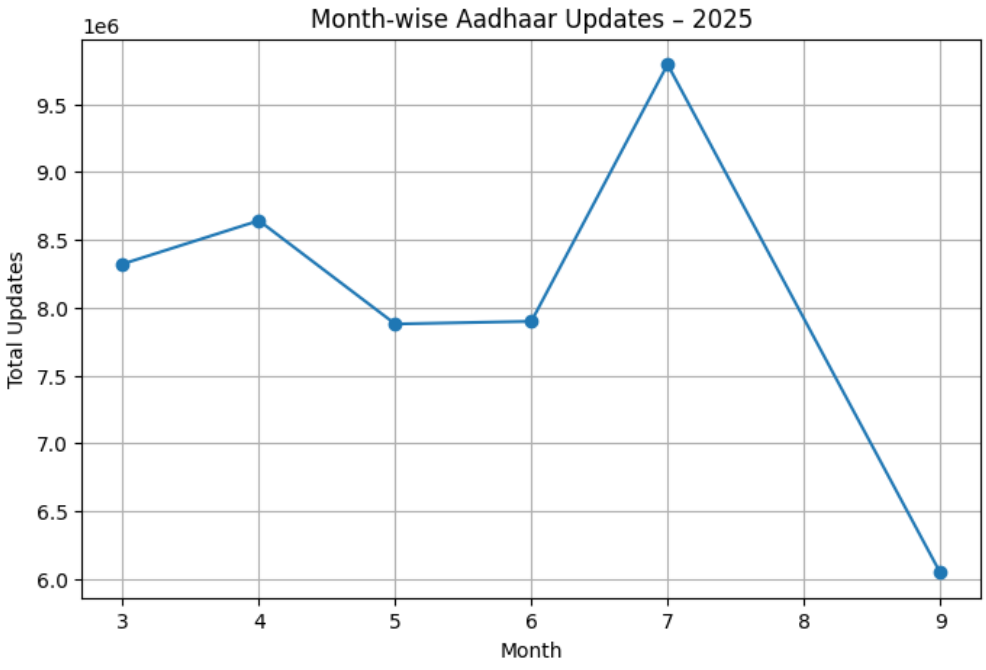


5.3 Month Wise Trend Analysis

Month	Updates
March	8,322,222
April	8,641,679
May	7,879,956
June	7,899,289
July	9,792,552
September	6,049,870

Insights

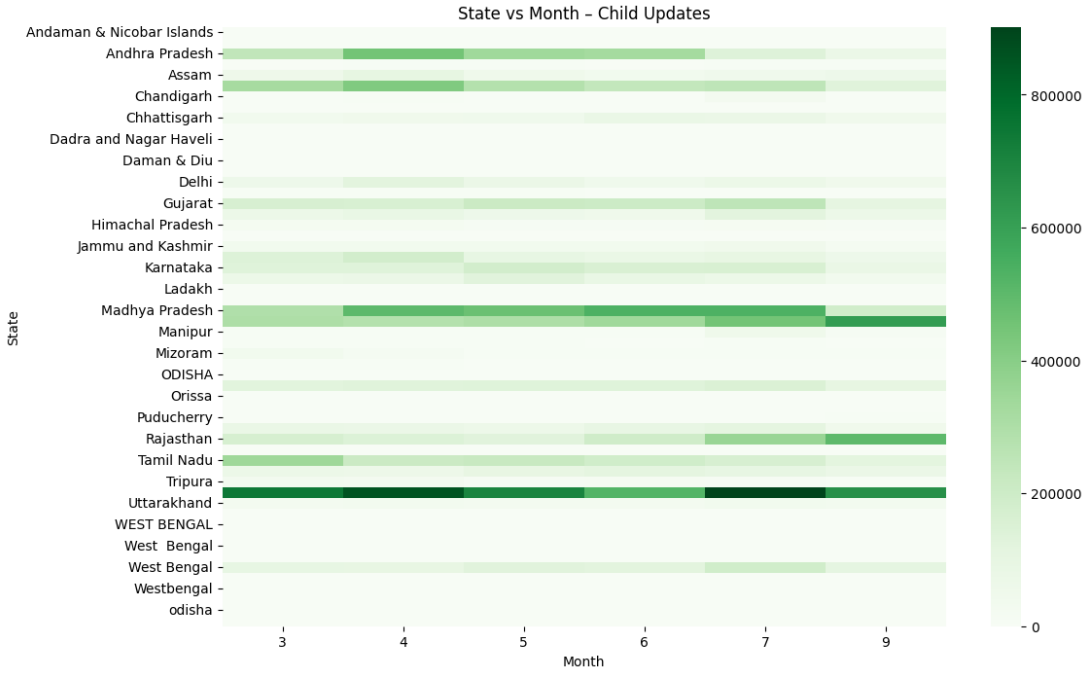
- July accounts for approximately 20% of total updates among available months.
- September records the lowest activity.
- Indicates seasonal and event-driven update behaviour.

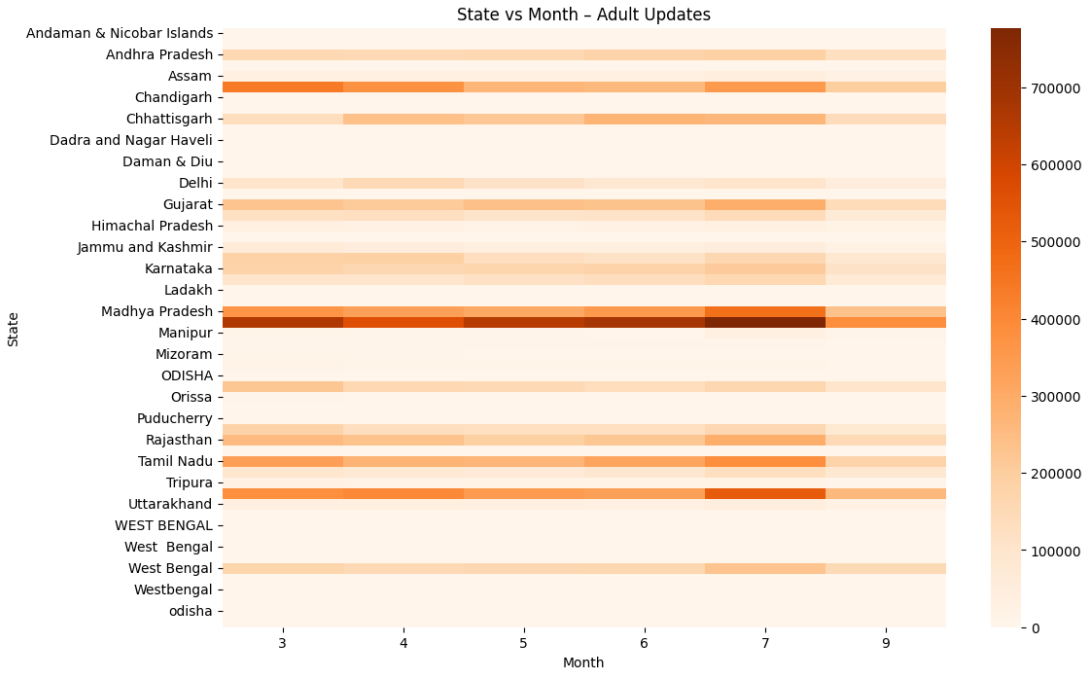


5.4 Multi-Dimensional Analysis

Heatmap analysis revealed:

- Different states show different peak months.
- Child updates peak in specific months in certain regions.
- Adult updates remain more stable across months.





6. Key Recommendations

Based on the analysis:

1. **Operational Planning**
    - Increase staffing and resources in July and April.
    - Deploy temporary update camps in high-demand months.
2. **Regional Focus**
    - Strengthen infrastructure in Uttar Pradesh and Maharashtra.
    - Conduct outreach in states with comparatively low update activity.
3. **Targeted Campaigns**
    - Plan school-focused campaigns for child updates.
    - Adult-focused awareness for address and biometric updates.

7. Limitations

- Dataset limited to the year 2025 only
- Does not include reason for updates
- Limited demographic segmentation

8. Conclusion

The analysis successfully uncovered meaningful patterns in Aadhaar update behaviour across geography, time, and age groups. These insights can help UIDAI optimize service delivery, improve citizen experience, and plan resources more effectively.

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

# Display settings
pd.set_option('display.max_columns', None)

print("Libraries imported successfully")
```

```
Libraries imported successfully
```

```
file_path = "Consolidated.xlsx"

data = pd.read_excel(file_path)

print("Dataset Loaded Successfully")
print("Rows:", data.shape[0])
print("Columns:", data.shape[1])
```

```
Dataset Loaded Successfully
Rows: 500000
Columns: 6
```

```
# View dataset structure
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 500000 entries, 0 to 499999
Data columns (total 6 columns):
 #   Column        Non-Null Count   Dtype
---  ------        --------------   -----
 0   date          500000 non-null  datetime64[ns]
 1   state         500000 non-null  object
 2   district      500000 non-null  object
 3   pincode       500000 non-null  int64
 4   bio_age_5_17  500000 non-null  int64
 5   bio_age_17_   500000 non-null  int64
dtypes: datetime64[ns](1), int64(3), object(2)
memory usage: 22.9+ MB
```

```
# Check for missing values
data.isnull().sum()
```

	0
date	0
state	0
district	0
pincode	0
bio_age_5_17	0
bio_age_17_	0

dtype: int64

```
# Check duplicate rows
print("Duplicate Rows:", data.duplicated().sum())
```

```
Duplicate Rows: 10318
```

```
# Remove duplicates
data = data.drop_duplicates()
```

```
print("Rows after removing duplicates:", data.shape[0])
```

```
Rows after removing duplicates: 489682
```

```
# Create additional time columns
data['Year'] = data['date'].dt.year
data['Month'] = data['date'].dt.month
data['Day'] = data['date'].dt.day
```

```
# Create aggregated updates column
data['Total Updates'] = data['bio_age_5_17'] + data['bio_age_17_']
```

```
# Rename columns for clarity
data = data.rename(columns={
    'date': 'Date',
    'state': 'State',
    'district': 'District',
    'pincode': 'Pincode',
    'bio_age_5_17': '5 to 17 Years of Age',
    'bio_age_17_': '17+ Years of Age'
})

print("Columns renamed successfully!")
print(data.columns)
```

```
Columns renamed successfully!
Index(['Date', 'State', 'District', 'Pincode', '5 to 17 Years of Age',
       '17+ Years of Age', 'Year', 'Month', 'Day', 'Total Updates'],
      dtype='object')
```

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 489682 entries, 0 to 499999
Data columns (total 10 columns):
 #   Column                Non-Null Count   Dtype
---  ------                --------------   -----
 0   Date                  489682 non-null  datetime64[ns]
 1   State                 489682 non-null  object
 2   District              489682 non-null  object
 3   Pincode               489682 non-null  int64
 4   5 to 17 Years of Age  489682 non-null  int64
 5   17+ Years of Age      489682 non-null  int64
 6   Year                  489682 non-null  int32
 7   Month                 489682 non-null  int32
 8   Day                   489682 non-null  int32
 9   Total Updates         489682 non-null  int64
dtypes: datetime64[ns](1), int32(3), int64(4), object(2)
memory usage: 35.5+ MB
```

```
# Basic statistical summary
data.describe()
```

	Date	Pincode	5 to 17 Years of Age	17+ Years of Age	Year	Month	Day	Total Updates
count	489682	489682.000000	489682.000000	489682.000000	489682.0	489682.000000	489682.000000	489682.000000
mean	2025-08-11 15:37:41.400663808	521908.931121	47.847934	51.370677	2025.0	8.105558	8.111162	99.218611
min	2025-03-01 00:00:00	110001.000000	0.000000	0.000000	2025.0	3.000000	1.000000	0.000000
25%	2025-09-01 00:00:00	389170.000000	1.000000	2.000000	2025.0	9.000000	1.000000	3.000000
50%	2025-09-08 00:00:00	522412.000000	5.000000	6.000000	2025.0	9.000000	8.000000	11.000000
75%	2025-09-13 00:00:00	690514.000000	26.000000	24.000000	2025.0	9.000000	13.000000	53.000000
max	2025-09-19 00:00:00	855456.000000	8002.000000	7625.000000	2025.0	9.000000	19.000000	13381.000000
std	NaN	199463.035870	157.534164	165.971424	0.0	1.794572	6.216864	305.122737

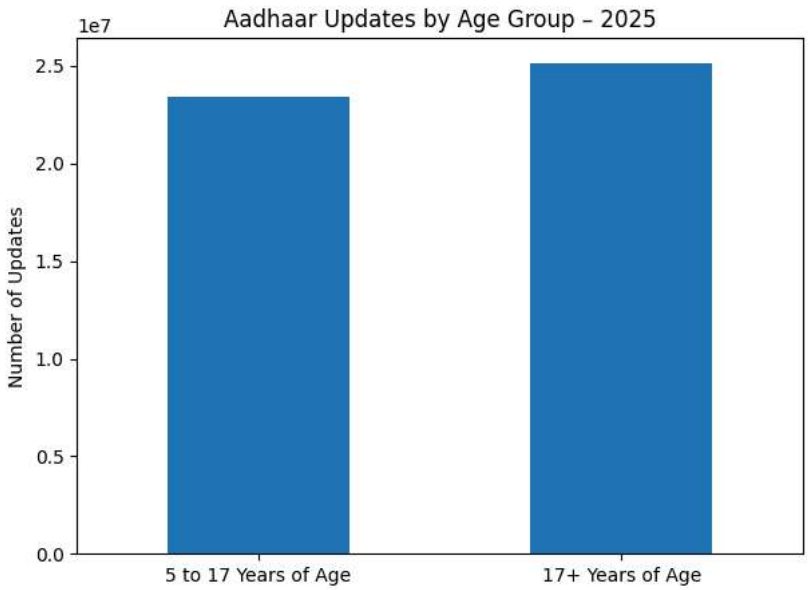
```
print("Total Aadhaar Updates Recorded in 2025:")
print(data['Total Updates'].sum())
```

```
Total Aadhaar Updates Recorded in 2025:
48585568
```

```
age_summary = data[['5 to 17 Years of Age', '17+ Years of Age']].sum()

print("Updates by Age Group:")
print(age_summary)
```

```
Updates by Age Group:
5 to 17 Years of Age    23430272
17+ Years of Age        25155296
dtype: int64
```

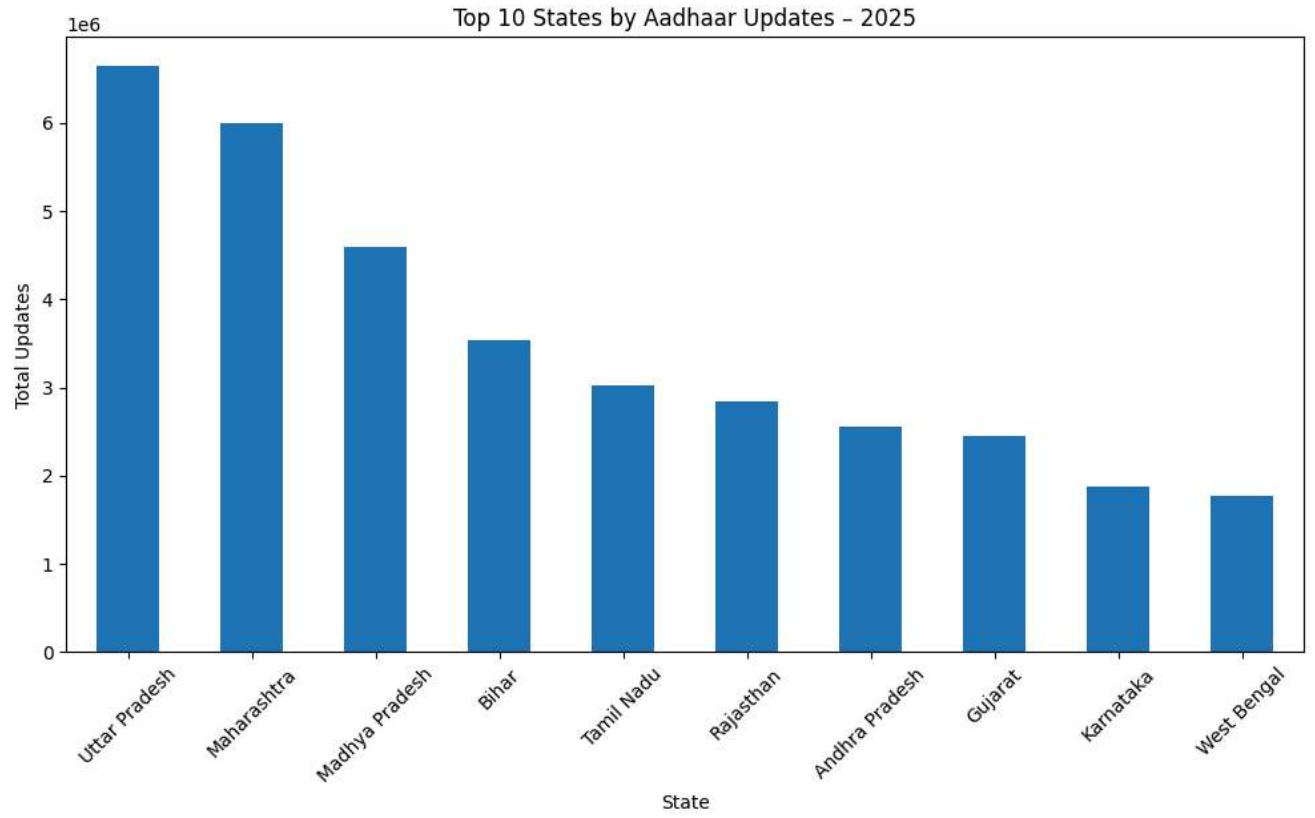
```
plt.figure(figsize=(7,5))
age_summary.plot(kind='bar')
plt.title("Aadhaar Updates by Age Group - 2025")
plt.ylabel("Number of Updates")
plt.xticks(rotation=0)
plt.show()
```




```
state_summary = data.groupby('State')['Total Updates'].sum().sort_values(ascending=False)

print("Top 10 States by Updates:")
print(state_summary.head(10))
```

```
Top 10 States by Updates:
State
Uttar Pradesh     6643629
Maharashtra       6002738
Madhya Pradesh    4601265
Bihar             3543433
Tamil Nadu        3026489
Rajasthan         2844034
Andhra Pradesh    2557498
Gujarat           2455187
Karnataka         1872814
West Bengal       1776798
Name: Total Updates, dtype: int64
```

```
plt.figure(figsize=(12,6))
state_summary.head(10).plot(kind='bar')
plt.title("Top 10 States by Aadhaar Updates - 2025")
plt.ylabel("Total Updates")
plt.xticks(rotation=45)
plt.show()
```



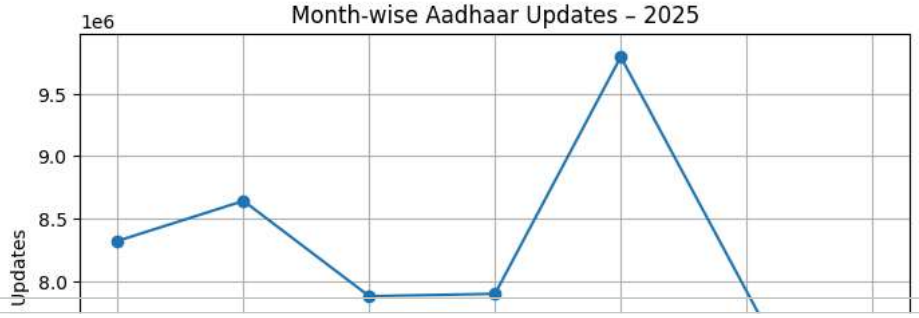

```
month_summary = data.groupby('Month')['Total Updates'].sum()

print(month_summary)
```

```
Month
3    8322222
4    8641679
5    7879956
6    7899289
7    9792552
9    6049870
Name: Total Updates, dtype: int64
```

Double-click (or enter) to edit

Double-click (or enter) to edit

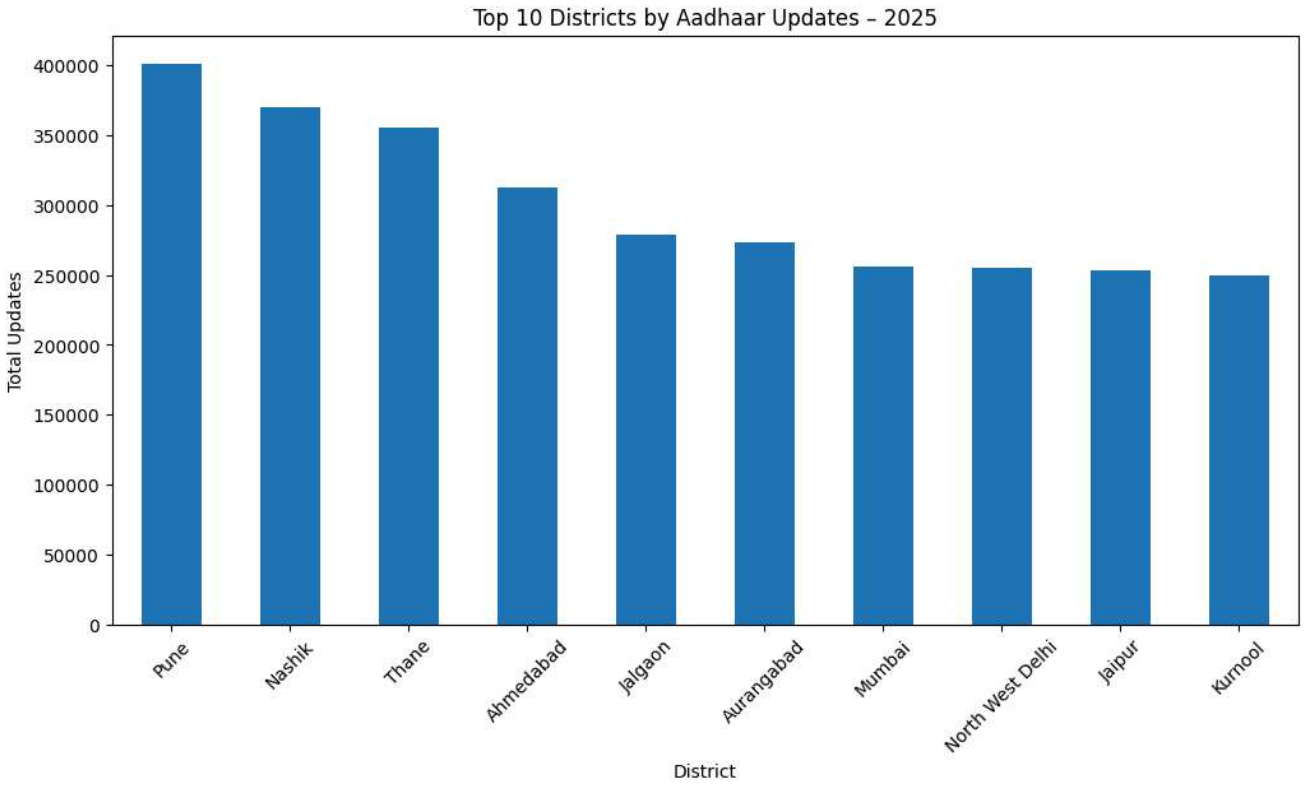
```
plt.figure(figsize=(8,5))
month_summary.plot(kind='line', marker='o')
plt.title("Month-wise Aadhaar Updates – 2025")
plt.ylabel("Total Updates")
plt.xlabel("Month")
plt.grid()
plt.show()
```




```
district_summary = data.groupby('District')['Total Updates'].sum().sort_values(ascending=False)

print("Top 10 Districts by Updates:")
print(district_summary.head(10))
```

```
Top 10 Districts by Updates:
District
Pune              401271
Nashik            370277
Thane             355678
Ahmedabad         312460
Jalgaon           278886
Aurangabad        273447
Mumbai            255617
North West Delhi  255510
Jaipur            253468
Kurnool           249235
Name: Total Updates, dtype: int64
```

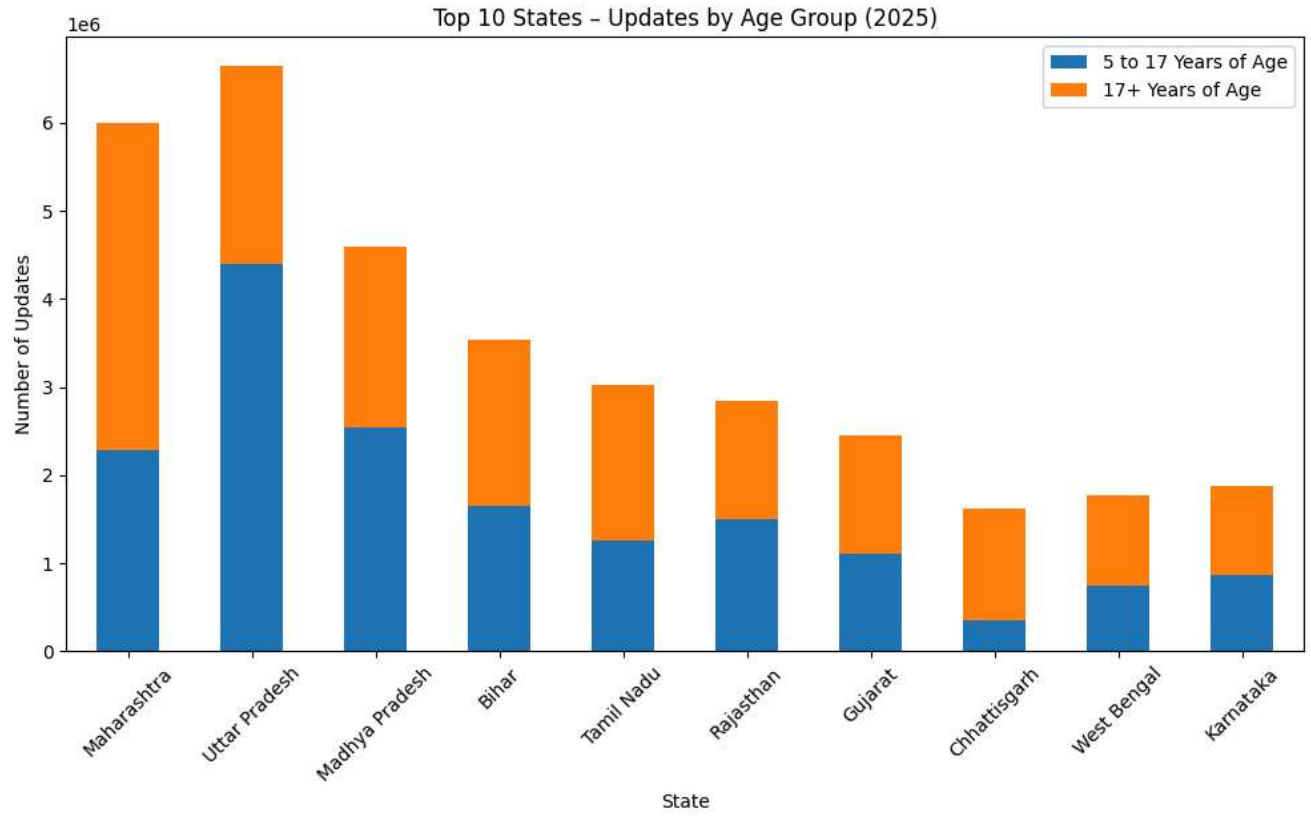
```
plt.figure(figsize=(12,6))
district_summary.head(10).plot(kind='bar')
plt.title("Top 10 Districts by Aadhaar Updates – 2025")
plt.ylabel("Total Updates")
plt.xticks(rotation=45)
plt.show()
```



```
state_age = data.groupby('State')[['5 to 17 Years of Age', '17+ Years of Age']].sum()

print("State vs Age Group Updates (Sample):")
print(state_age.head())
```

```
State vs Age Group Updates (Sample):
                            5 to 17 Years of Age  17+ Years of Age
State
Andaman & Nicobar Islands                   175              1179
Andaman and Nicobar Islands                7628              5629
Andhra Pradesh                          1580665            976833
Arunachal Pradesh                         23119             23488
Assam                                    370206            204182
```

```
state_age.sort_values(by='17+ Years of Age', ascending=False).head(10).plot(
    kind='bar', stacked=True, figsize=(12,6))

plt.title("Top 10 States - Updates by Age Group (2025)")
plt.ylabel("Number of Updates")
plt.xticks(rotation=45)
plt.show()
```

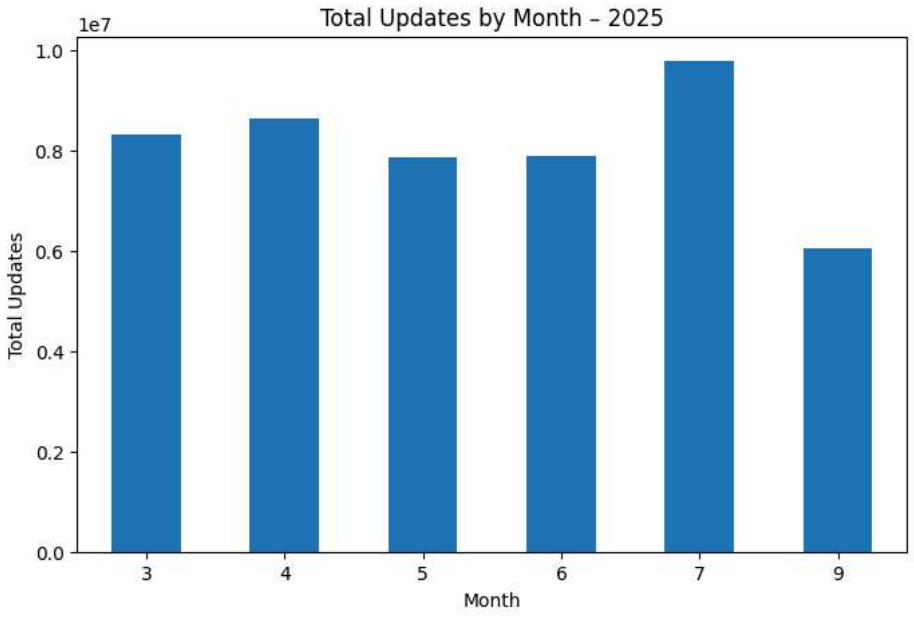



```
month_total = data.groupby('Month')['Total Updates'].sum()

print("Month-wise Total Updates:")
print(month_total)
```

```
Month-wise Total Updates:
Month
3    8322222
4    8641679
5    7879956
6    7899289
7    9792552
9    6049870
Name: Total Updates, dtype: int64
```

```
plt.figure(figsize=(8,5))
month_total.plot(kind='bar')
plt.title("Total Updates by Month - 2025")
```

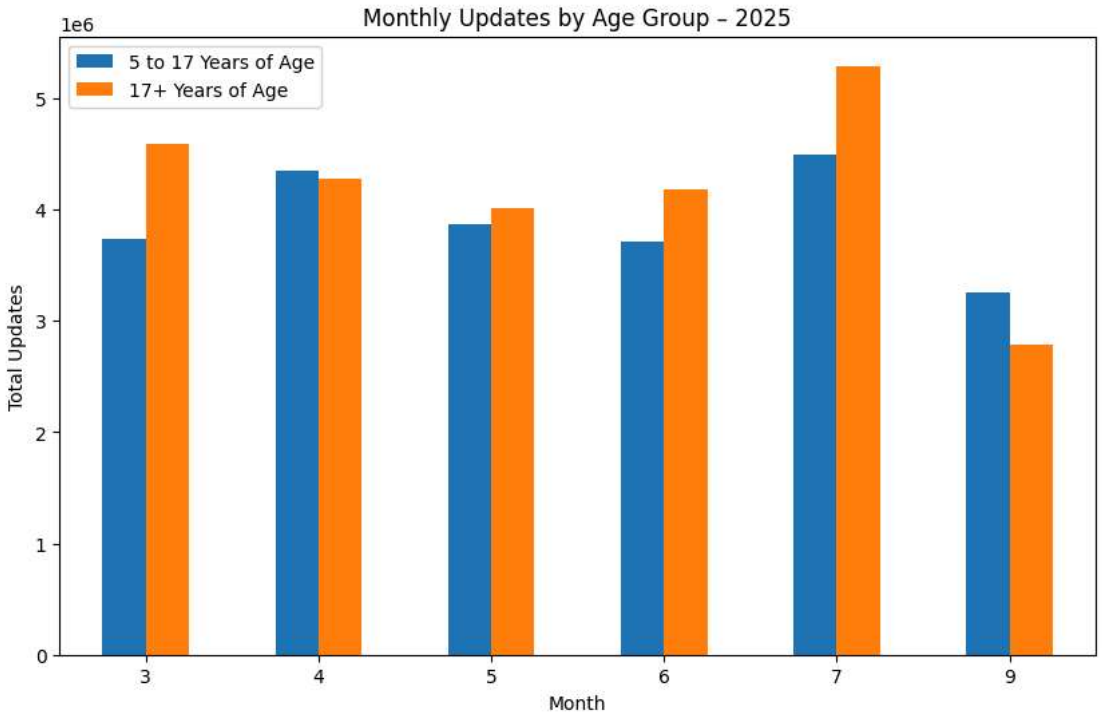
```
plt.ylabel("Total Updates")
plt.xlabel("Month")
plt.xticks(rotation=0)
plt.show()
```




```
month_age = data.groupby('Month')[['5 to 17 Years of Age', '17+ Years of Age']].sum()

print(month_age)
```

```
       5 to 17 Years of Age  17+ Years of Age
Month
3                   3733578           4588644
4                   4356896           4284783
5                   3868247           4011709
6                   3710149           4189140
7                   4499057           5293495
9                   3262345           2787525
```

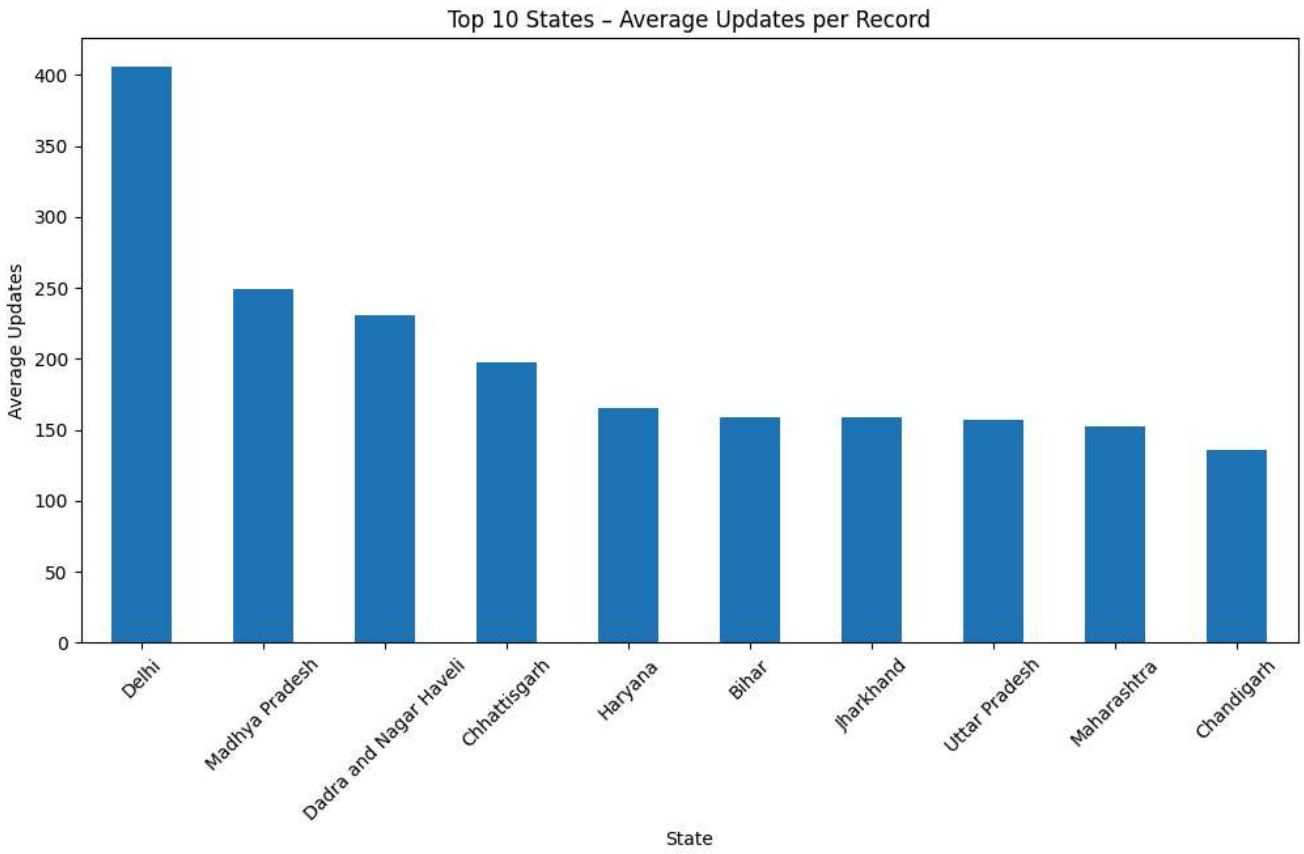
```
month_age.plot(kind='bar', figsize=(10,6))
plt.title("Monthly Updates by Age Group – 2025")
plt.ylabel("Total Updates")
plt.xticks(rotation=0)
plt.show()
```



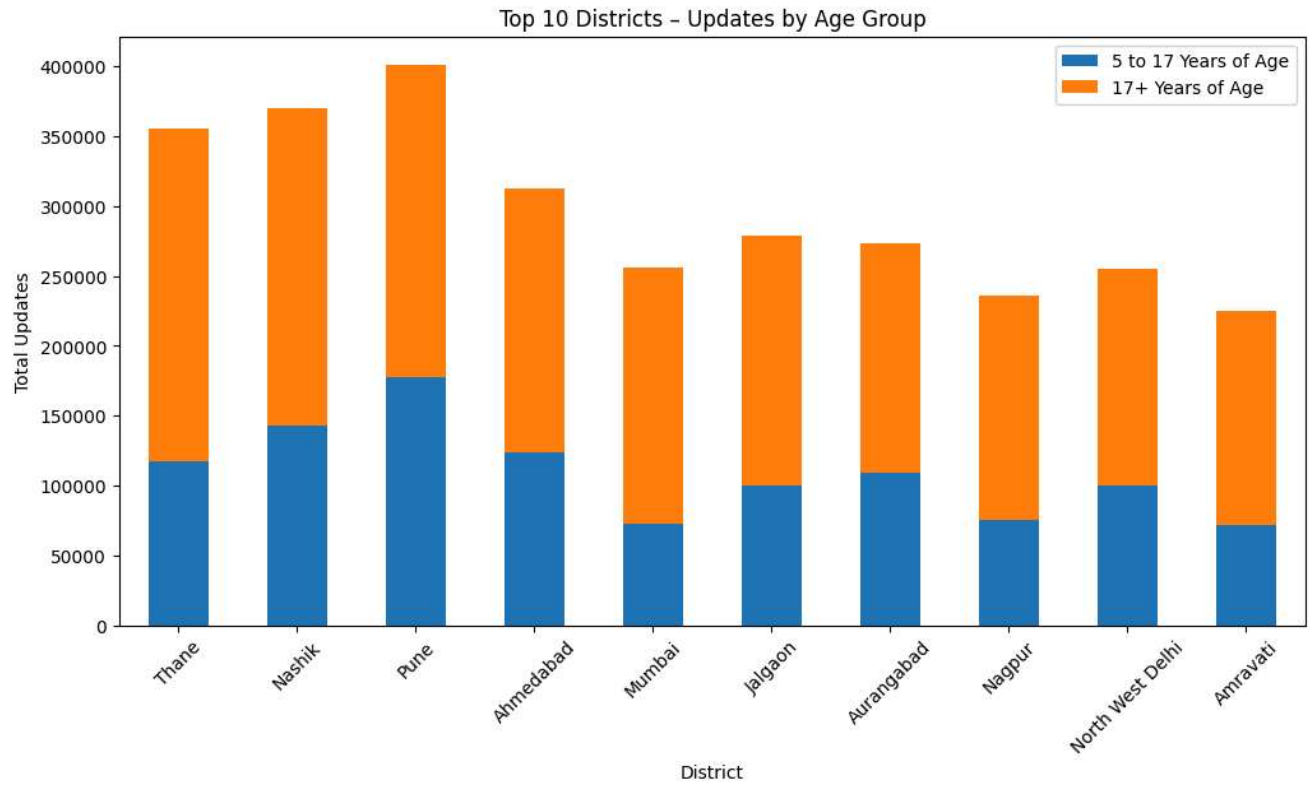

```
state_avg = data.groupby('State')['Total Updates'].mean().sort_values(ascending=False)

print("Average Updates per Record by State:")
print(state_avg.head(10))
```

```
Average Updates per Record by State:
State
Delhi                     405.682802
Madhya Pradesh            249.013151
Dadra and Nagar Haveli    230.612903
Chhattisgarh              197.432972
Haryana                   165.446223
Bihar                     158.948235
Jharkhand                 158.527077
Uttar Pradesh             157.234492
Maharashtra               152.257146
Chandigarh                135.561555
Name: Total Updates, dtype: float64
```

```
plt.figure(figsize=(12,6))
state_avg.head(10).plot(kind='bar')
plt.title("Top 10 States – Average Updates per Record")
plt.ylabel("Average Updates")
plt.xticks(rotation=45)
plt.show()
```




```
district_age = data.groupby('District')[['5 to 17 Years of Age', '17+ Years of Age']].sum()

district_age.sort_values(by='17+ Years of Age', ascending=False).head(10).plot(
    kind='bar', stacked=True, figsize=(12,6))

plt.title("Top 10 Districts – Updates by Age Group")
plt.ylabel("Total Updates")
plt.xticks(rotation=45)
plt.show()
```




```
state_month = data.pivot_table(
    values='Total Updates',
    index='State',
    columns='Month',
    aggfunc='sum'
)

print(state_month.head())
```

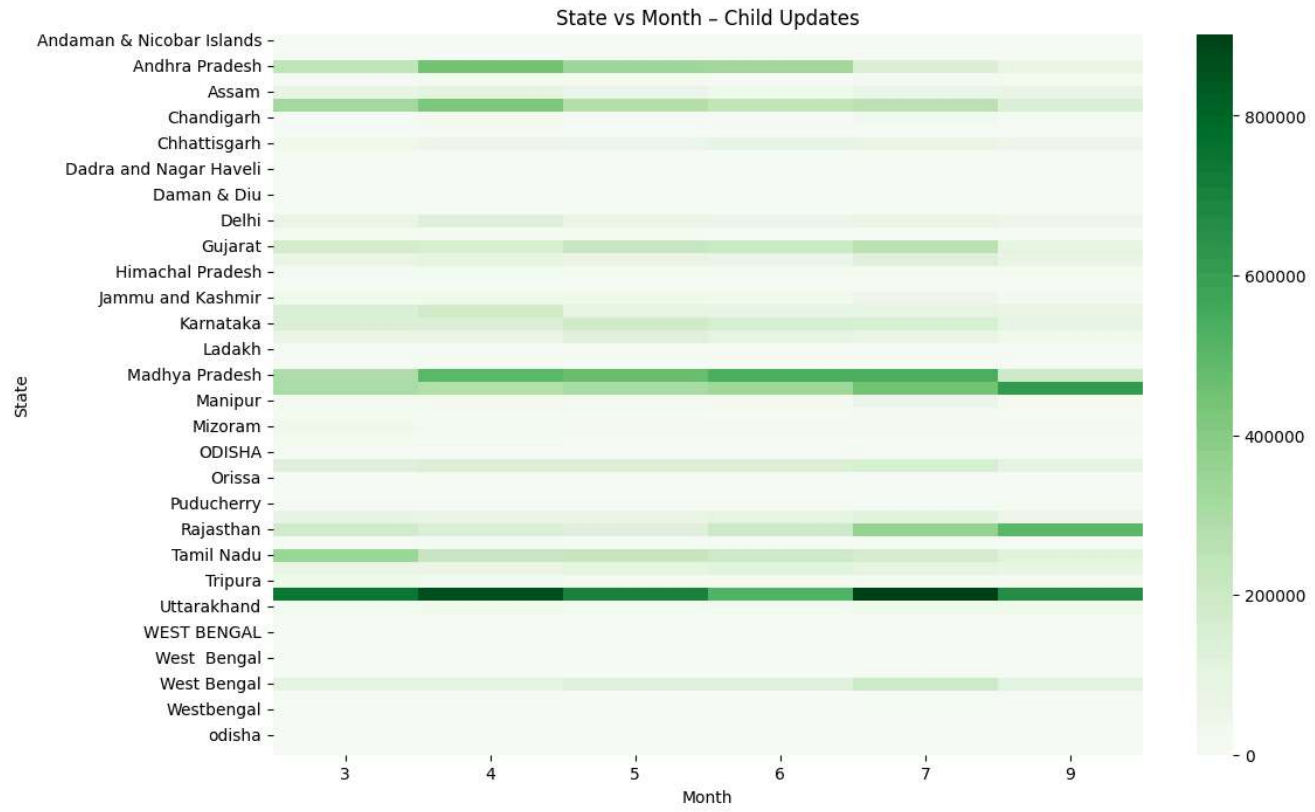
```
Month                            3         4         5         6         7  \
State
Andaman & Nicobar Islands       209.0     184.0     180.0     140.0     259.0
Andaman and Nicobar Islands    2494.0    2560.0    1715.0    1804.0    2569.0
Andhra Pradesh               403296.0  608589.0  500660.0  508472.0  334226.0
Arunachal Pradesh              7400.0    8375.0    8305.0    7138.0    8442.0
Assam                         92931.0  139659.0   83841.0   71576.0   95172.0

Month                            9
State
Andaman & Nicobar Islands      382.0
Andaman and Nicobar Islands   2115.0
Andhra Pradesh              202255.0
Arunachal Pradesh             6947.0
Assam                        91209.0
```

```
state_month = data.pivot_table(
    values='Total Updates',
    index='State',
    columns='Month',
    aggfunc='sum'
)

print(state_month.head())
```

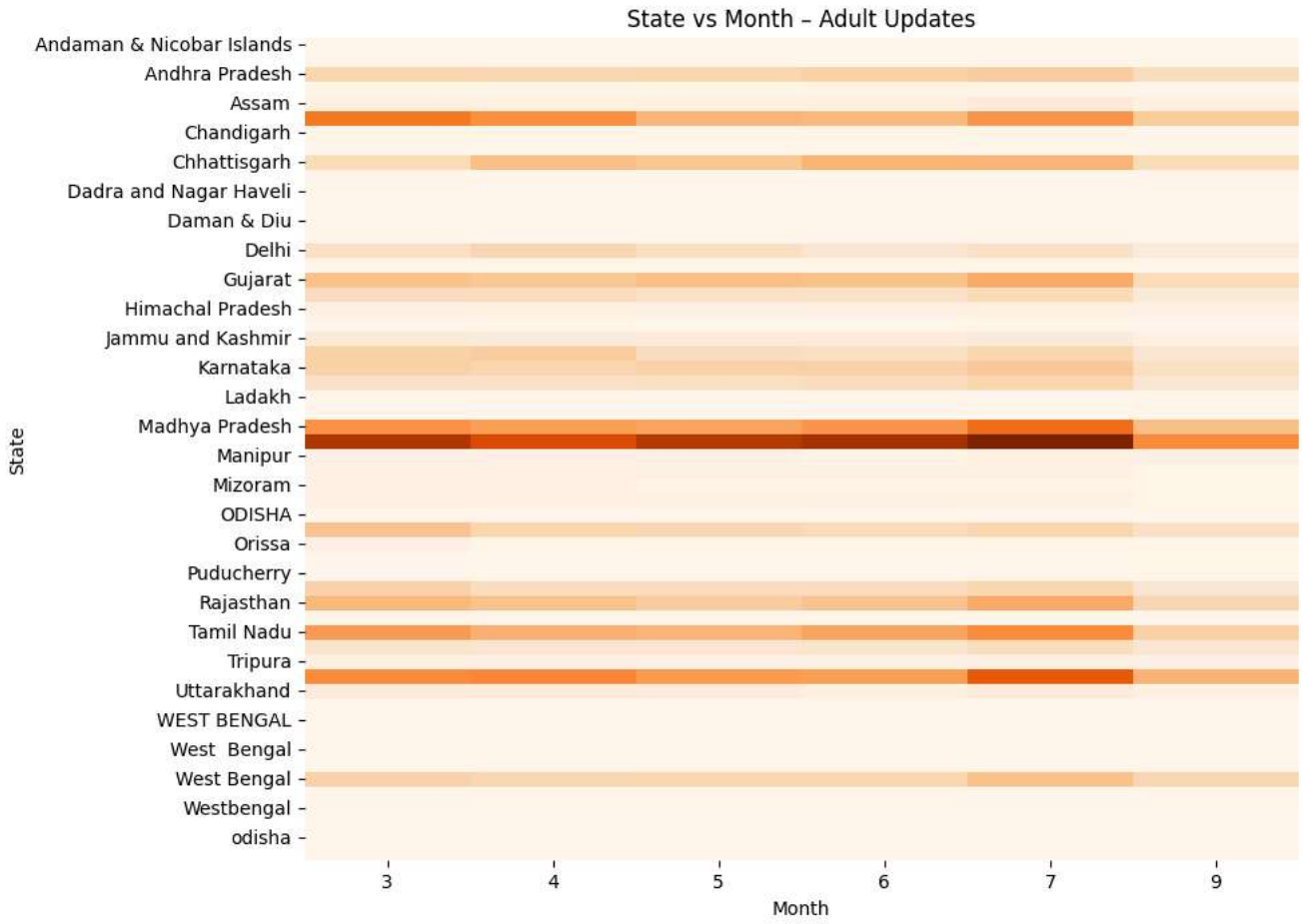
```
Month                            3         4         5         6         7  \
State
Andaman & Nicobar Islands       209.0     184.0     180.0     140.0     259.0
Andaman and Nicobar Islands    2494.0    2560.0    1715.0    1804.0    2569.0
Andhra Pradesh               403296.0  608589.0  500660.0  508472.0  334226.0
Arunachal Pradesh              7400.0    8375.0    8305.0    7138.0    8442.0
Assam                         92931.0  139659.0   83841.0   71576.0   95172.0
```

```
Month                              9
State
Andaman & Nicobar Islands       382.0
Andaman and Nicobar Islands    2115.0
Andhra Pradesh               202255.0
Arunachal Pradesh              6947.0
Assam                         91209.0
```

```
state_month_child = data.pivot_table(
    values='5 to 17 Years of Age',
    index='State',
    columns='Month',
    aggfunc='sum'
)

plt.figure(figsize=(12,8))
sns.heatmap(state_month_child.fillna(0), cmap='Greens')

plt.title("State vs Month – Child Updates")
plt.ylabel("State")
plt.xlabel("Month")
plt.show()
```




```
state_month_adult = data.pivot_table(
    values='17+ Years of Age',
    index='State',
    columns='Month',
    aggfunc='sum'
)

plt.figure(figsize=(12,8))
sns.heatmap(state_month_adult.fillna(0), cmap='Oranges')

plt.title("State vs Month – Adult Updates")
plt.ylabel("State")
plt.xlabel("Month")
plt.show()
```

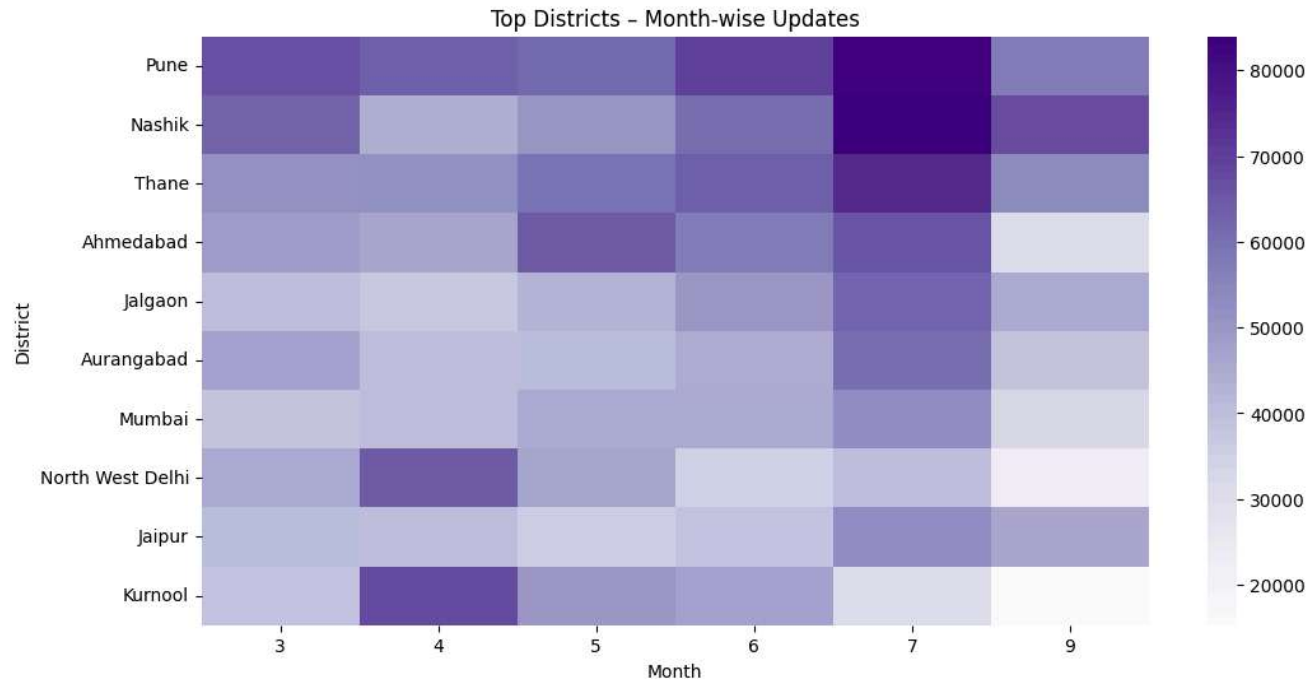



```
district_month = data.pivot_table(
    values='Total Updates',
    index='District',
    columns='Month',
    aggfunc='sum'
)

district_month.head()
```

District	Month 3	4	5	6	7	9
ANUGUL	56.0	59.0	32.0	36.0	NaN	13.0
Adilabad	12872.0	9333.0	10412.0	14734.0	17026.0	14233.0
Agar Malwa	1689.0	2148.0	2044.0	2488.0	2621.0	1266.0
Agra	24525.0	33549.0	28578.0	21073.0	39762.0	19531.0
Ahmadabad	774.0	1260.0	2835.0	1710.0	1075.0	2067.0

Next steps: Generate code with district_month | New interactive sheet

```
top_districts = data.groupby('District')['Total Updates'].sum().nlargest(10).index

plt.figure(figsize=(12,6))
sns.heatmap(district_month.loc[top_districts], cmap='Purples')

plt.title("Top Districts - Month-wise Updates")
plt.xlabel("Month")
plt.ylabel("District")
plt.show()
```




```
age_share = data.groupby(['State','Month'])[['5 to 17 Years of Age','17+ Years of Age']].sum()

age_share_percent = age_share.div(age_share.sum(axis=1), axis=0) * 100

age_share_percent.head(10)
```

State	Month	5 to 17 Years of Age	17+ Years of Age
Andaman & Nicobar Islands	3	7.655502	92.344498
	4	9.239130	90.760870
	5	12.222222	87.777778
	6	7.857143	92.142857
	7	7.722008	92.277992
	9	23.298429	76.701571
Andaman and Nicobar Islands	3	63.993585	36.006415
	4	63.007813	36.992188
	5	55.976676	44.023324
	6	46.230599	53.769401

Next steps: Generate code with age_share_percent | New interactive sheet

INSIGHT 1 – AGE GROUP DISTRIBUTION

• A total of 48.58 million Aadhaar updates were analyzed for the year 2025. • Adults (17+ years) account for 25.15 million updates, which is higher than children (5–17 years) with 23.43 million updates. • Adult updates constitute approximately 51.8% of total updates, while child updates account for 48.2%. • The relatively balanced distribution indicates that Aadhaar update services are equally relevant across both demographic groups. • Slight dominance of adult updates suggests frequent changes such as address, mobile number, and biometric updates among working-age population.

INSIGHT 2 – GEOGRAPHIC CONCENTRATION

• Aadhaar update activity is highly concentrated in a few major states. • Uttar Pradesh leads with 6.64 million updates, followed closely by Maharashtra with 6.00 million. • Together, these two states alone contribute more than 26% of all updates in the dataset. • Madhya