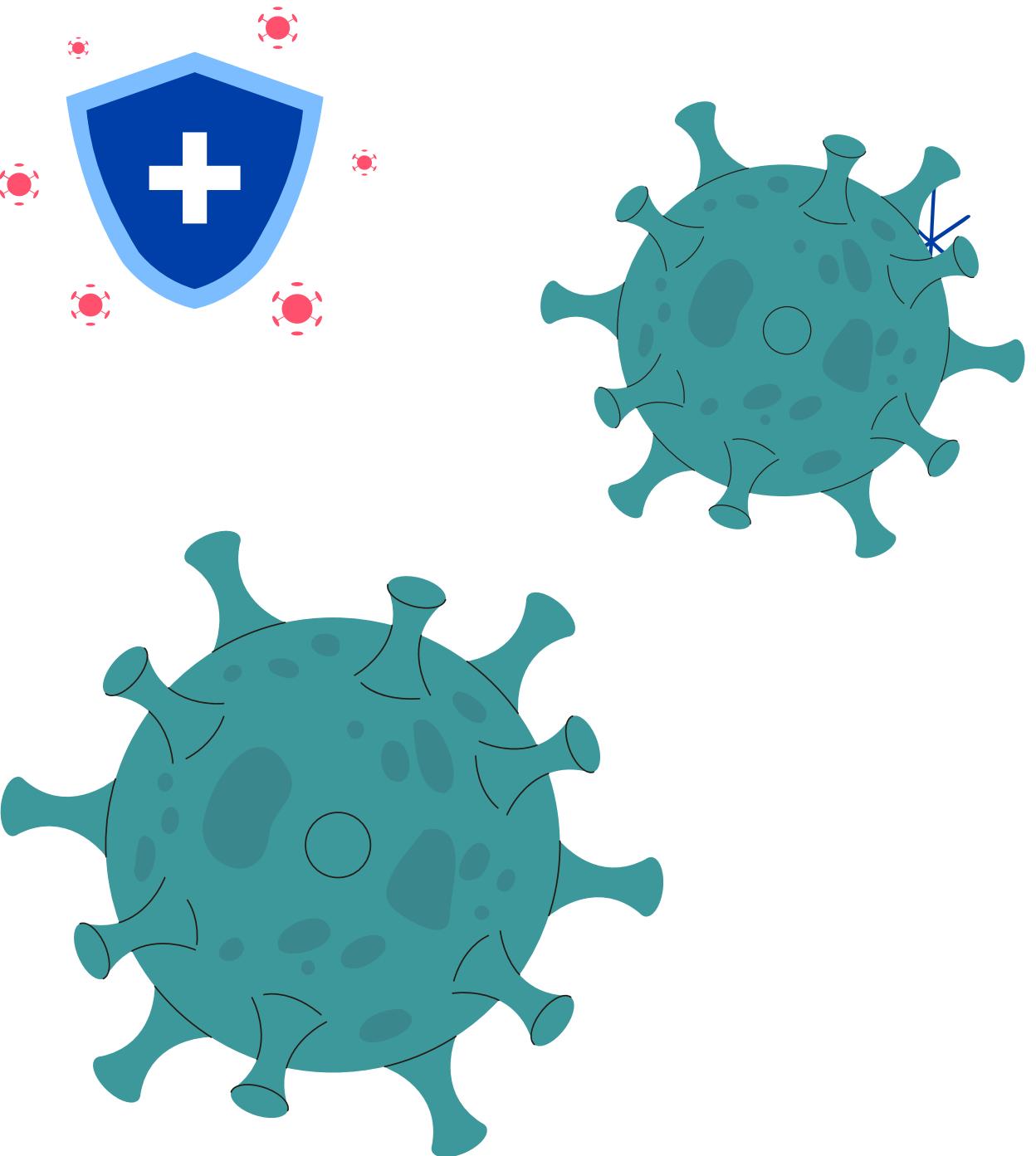


# **COVID-19 Data Analysis (2020): Lessons from Global Response Patterns**

**GROUP 2**



# OUTLINE

- 1 Research Purpose & Dataset
- 2 Early Epicenters: China - Italy - Korea
- 3 Delayed Epicenters: USA - India
- 4 Comparison
- 5 Conclusion



# I. Research Purpose & Dataset



# Research Purpose

Understand the progression of COVID-19 across countries

Which nations are responding effectively?

POV



A Data Researcher in 2020 - 2021

Extract actionable insights that could guide:

- COVID-19
- Future pandemic response

# Research Purpose

COVID-19 swept across the globe in early 2020, it left behind

A trail of disruption and loss

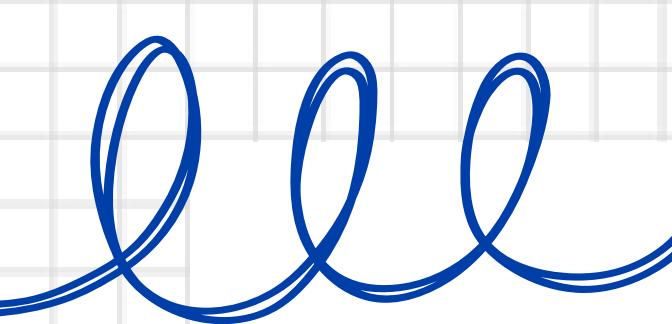


A treasure trove of data



We use **early pandemic data** to answer **critical, forward-looking questions**:

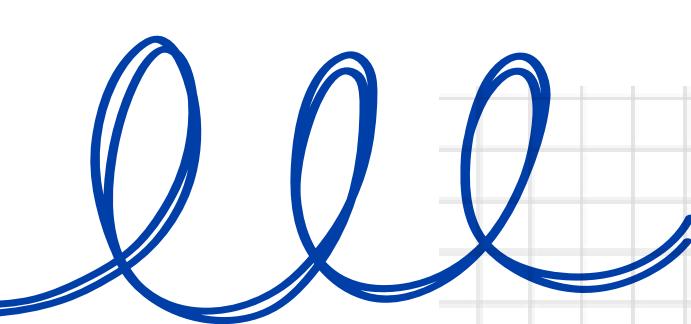
- 1 What we can learn from countries like China, South Korea and Italy - the most early impacted countries?
- 2 Which countries were witnessing rapid surges? How early intervention affects case trends?
- 3 What can other countries learn to better deal with the pandemic?



# Research Purpose

## FOCUS OF THIS NOTEBOOK

- 1 Learn from countries that reacted early and strongly (China, South Korea)
  - 2 Understand what happened in large nations where the virus arrived later (India, USA)
  - 3 Use simple and clear visualizations with Plotly's Bar and Scatter charts
- 



# Dataset

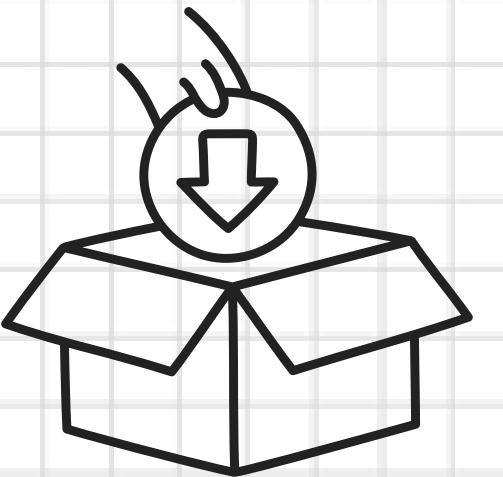


## EXAMPLE

SNo	ObservationDate	Province/State	Country/Region	Last Update	Confirmed	Deaths	Recovered
1	2020-01-22	Anhui	Mainland China	1/22/2020 17:00	1.0	0.0	0.0
2	2020-01-22	Beijing	Mainland China	1/22/2020 17:00	14.0	0.0	0.0
3	2020-01-22	Chongqing	Mainland China	1/22/2020 17:00	6.0	0.0	0.0
4	2020-01-22	Fujian	Mainland China	1/22/2020 17:00	1.0	0.0	0.0
5	2020-01-22	Gansu	Mainland China	1/22/2020 17:00	0.0	0.0	0.0

*\*Full data can be seen in the report*

Source: Novel Corona Virus 2019 Dataset (Kaggle.com)



# IMPORT PROCESS

1

Import main dataset

Importing the data set and verifying the columns  
Data available till 2021-02-27

SNo	ObservationDate	Province/State	Country/Region	Last Update	Confirmed	Deaths	Recovered	
0	1	2020-01-22	Anhui	Mainland China	1/22/2020 17:00	1.0	0.0	0.0
1	2	2020-01-22	Beijing	Mainland China	1/22/2020 17:00	14.0	0.0	0.0
2	3	2020-01-22	Chongqing	Mainland China	1/22/2020 17:00	6.0	0.0	0.0
3	4	2020-01-22	Fujian	Mainland China	1/22/2020 17:00	1.0	0.0	0.0
4	5	2020-01-22	Gansu	Mainland China	1/22/2020 17:00	0.0	0.0	0.0

2

Converting date column  
into correct format

3

Getting latest  
timestamp

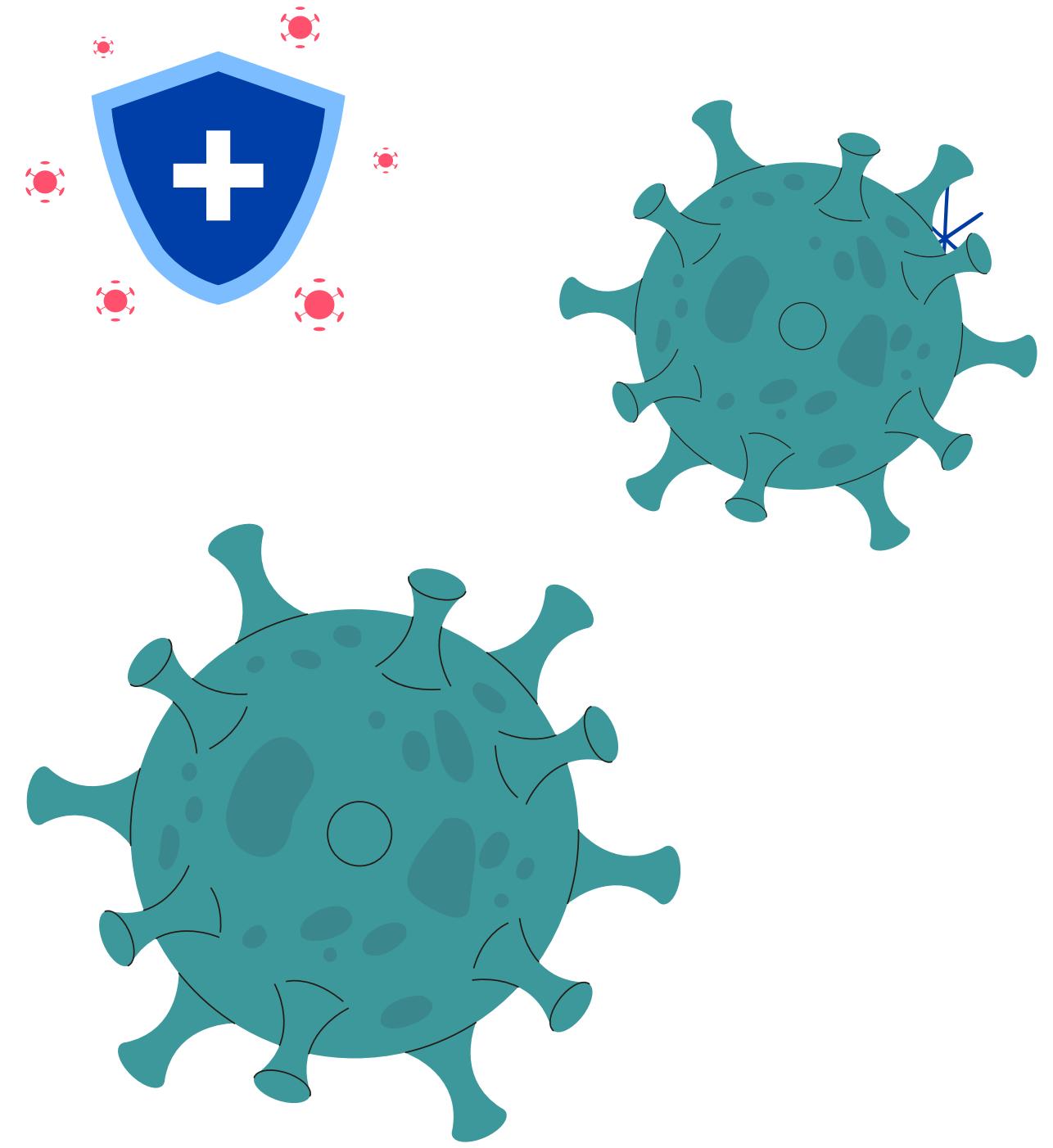
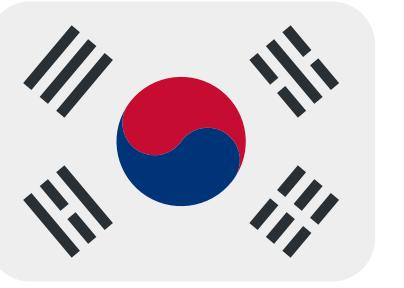
Active Cases Column Added Successfully

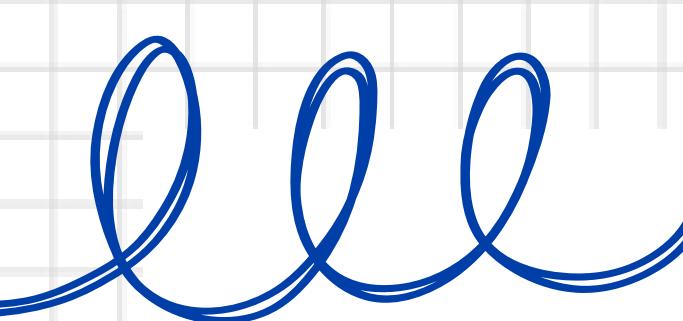
SNo	ObservationDate	Province/State	Country/Region	Last Update	Confirmed	Deaths	Recovered	ActiveCases
0	1	2020-01-22	Anhui	Mainland China	1/22/2020 17:00	1.0	0.0	0.0
1	2	2020-01-22	Beijing	Mainland China	1/22/2020 17:00	14.0	0.0	0.0
2	3	2020-01-22	Chongqing	Mainland China	1/22/2020 17:00	6.0	0.0	0.0
3	4	2020-01-22	Fujian	Mainland China	1/22/2020 17:00	1.0	0.0	0.0
4	5	2020-01-22	Gansu	Mainland China	1/22/2020 17:00	0.0	0.0	0.0

4

Getting latest date

## II. Early Epicenters





# 1. CHINA



By grouping the data by '**Observation Date**' and adding a '**Week**' column, we can track and visualize the weekly progression of the outbreak

## Code and Result:

```
#Taking out of data for China region
df_china=df[df['Country/Region'] == 'Mainland China']
print("Number of Records for China are {}".format(df_china.shape))
df_china.head()
```

Number of Records for China are (12500, 9)

SNo	ObservationDate	Province/State	Country/Region	Last Update	Confirmed	Deaths	Recovered	ActiveCases
0	1	Anhui	Mainland China	1/22/2020 17:00	1.0	0.0	0.0	1.0
1	2	Beijing	Mainland China	1/22/2020 17:00	14.0	0.0	0.0	14.0
2	3	Chongqing	Mainland China	1/22/2020 17:00	6.0	0.0	0.0	6.0
3	4	Fujian	Mainland China	1/22/2020 17:00	1.0	0.0	0.0	1.0
4	5	Gansu	Mainland China	1/22/2020 17:00	0.0	0.0	0.0	0.0

We can analyze the virus's spread and identify key patterns in the pandemic.



# 1. CHINA

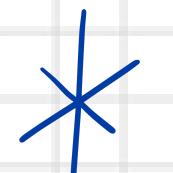
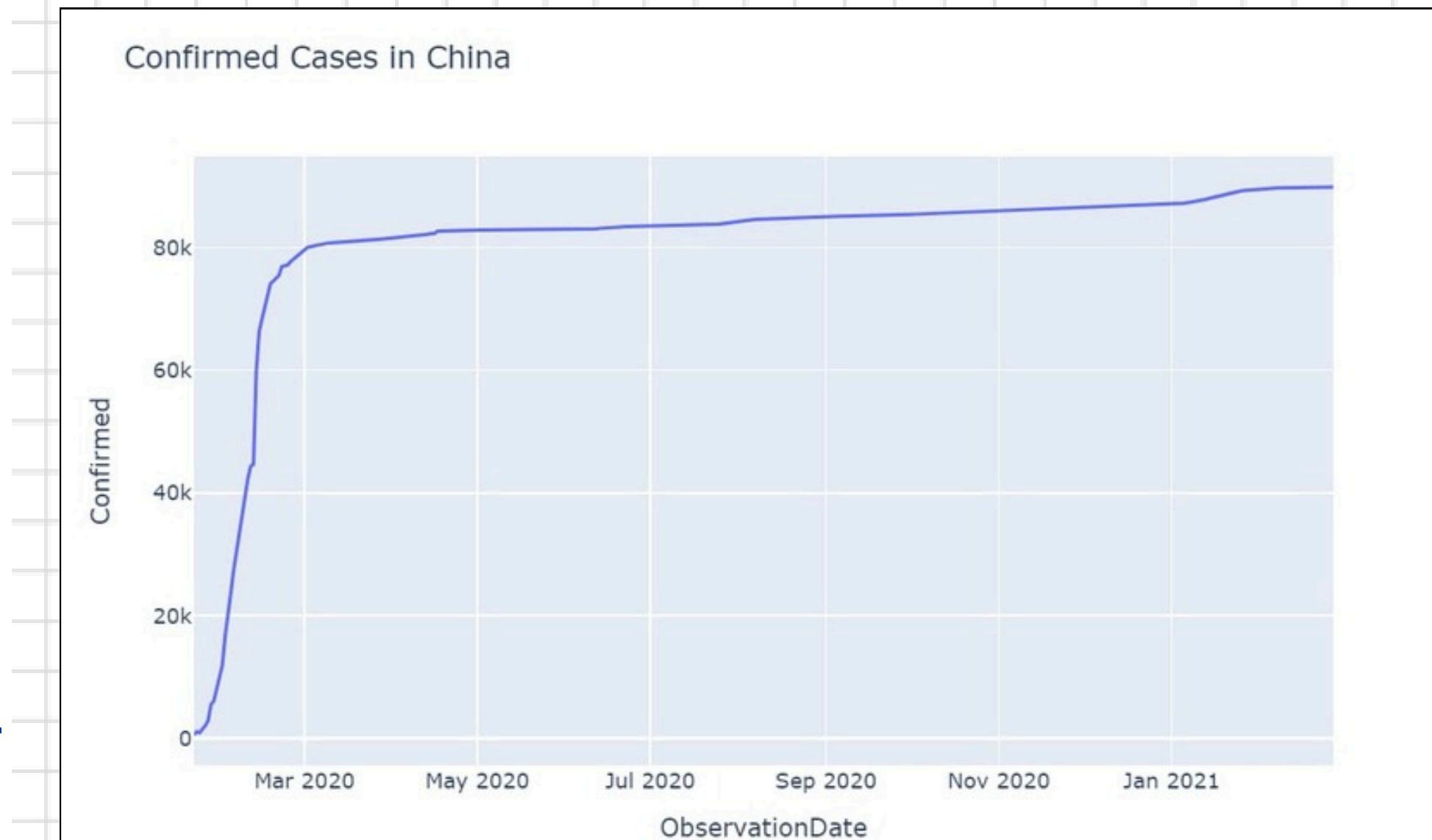


## 1.1. Confirmed cases

- Confirmed cases in China surged rapidly from late January to February, reflecting the initial outbreak in Wuhan and nearby provinces.

- The increase then slowed down

Control measures may have started to be effective.

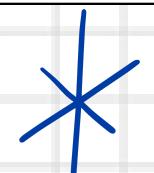
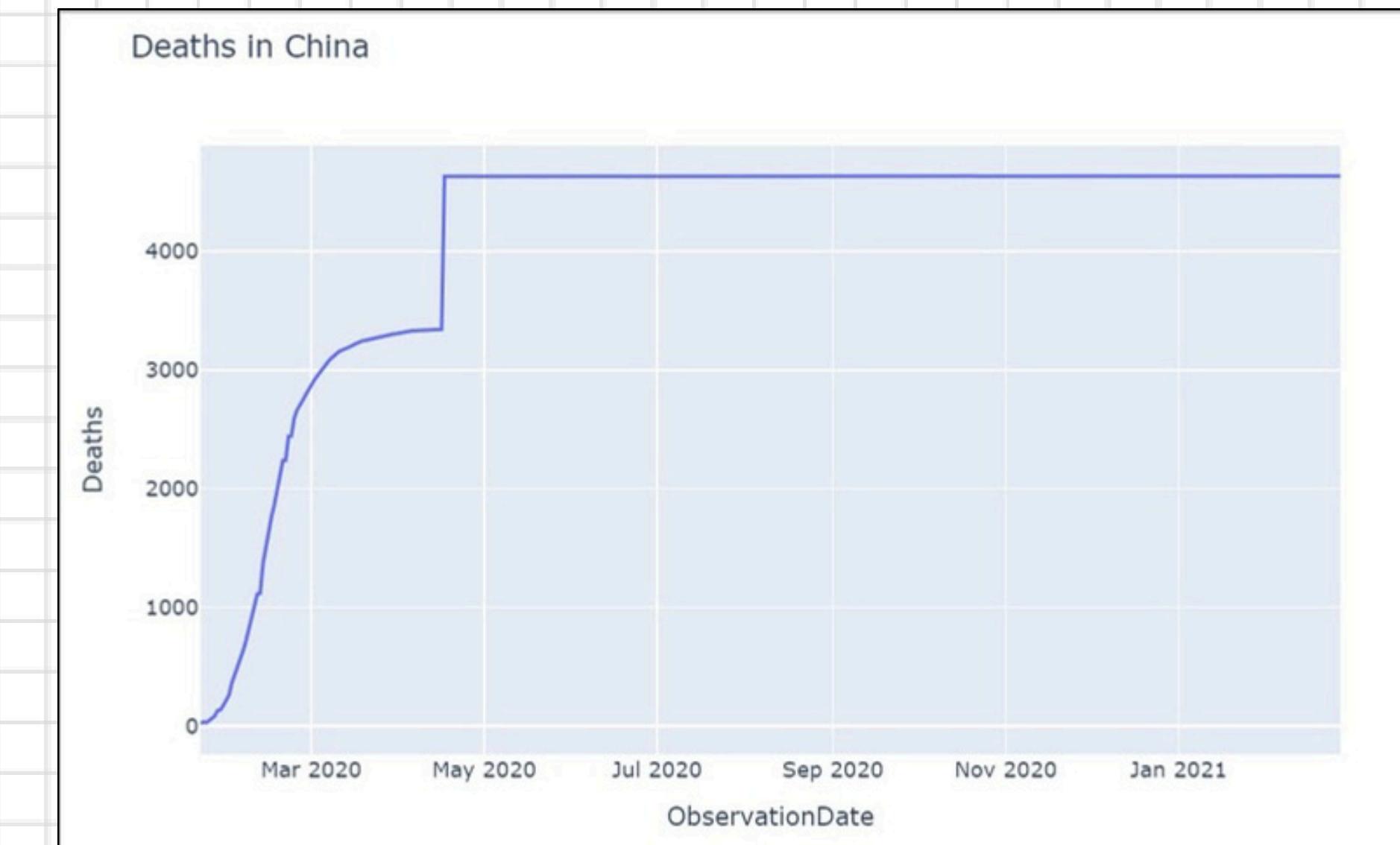


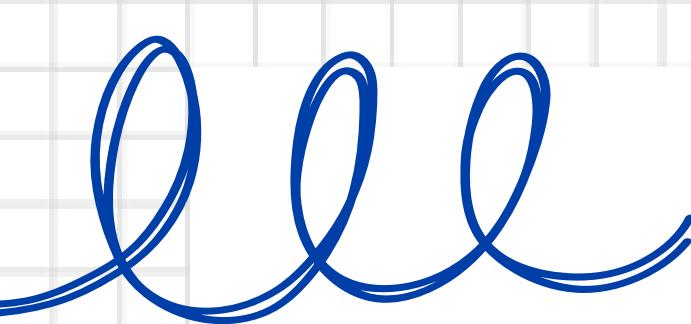
# 1. CHINA



## 1.2 Deaths

- Deaths increased alongside **confirmed cases** but at a **slower rate**.
- A **sudden spike** occurred in April, likely due to previously **unreported cases**.
- After April 2020, the death remained stable, suggesting **effective management of fatality rates**.



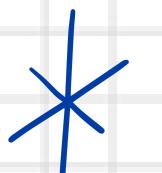
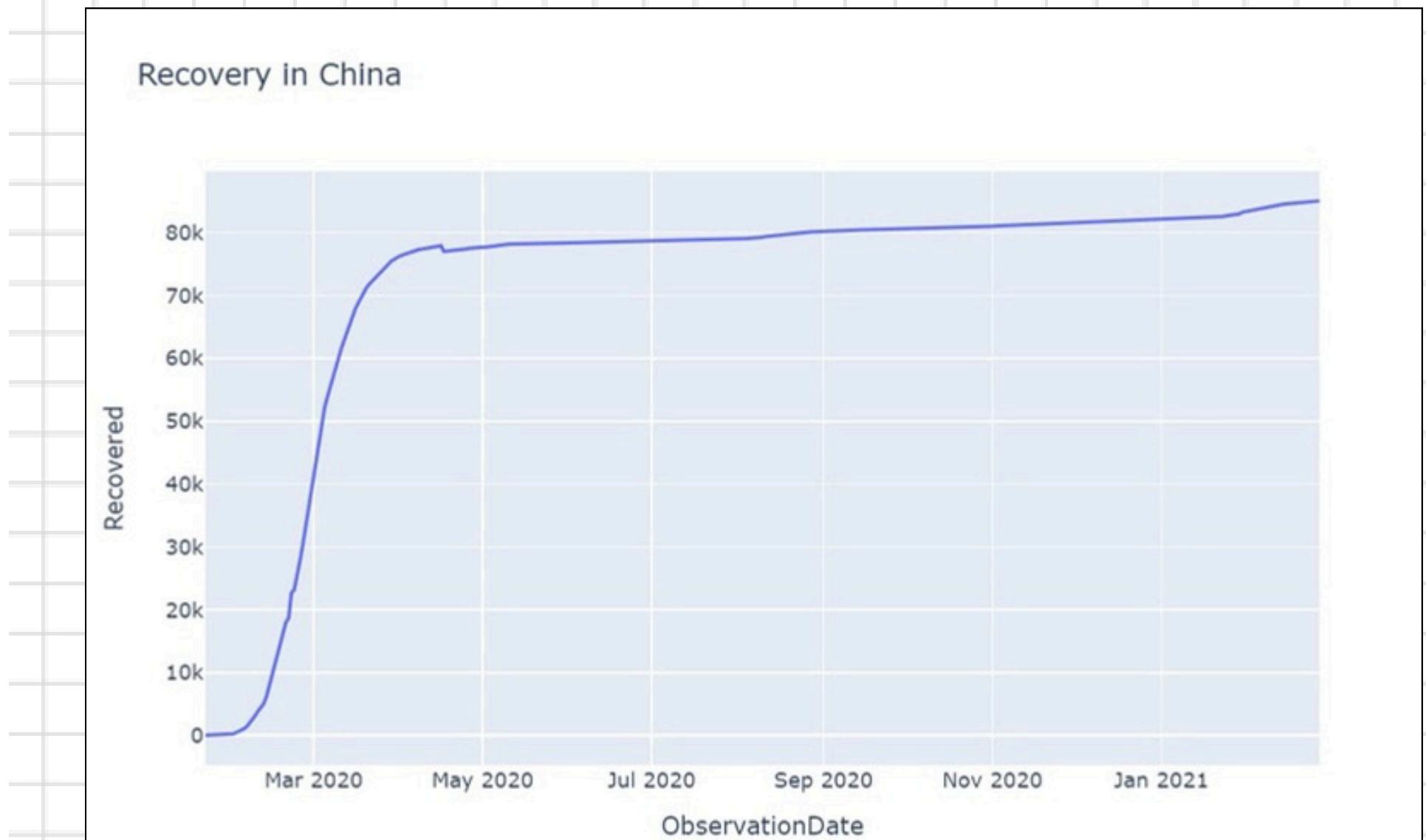


# 1. CHINA



## 1.3 Recovery

- Recovered cases surged rapidly in the months following the outbreak's peak, reflecting effective public health measures and quarantines.
- Afterwards, recoveries continued to rise steadily, indicating the virus was largely under control with only occasional cases.



# 1. CHINA

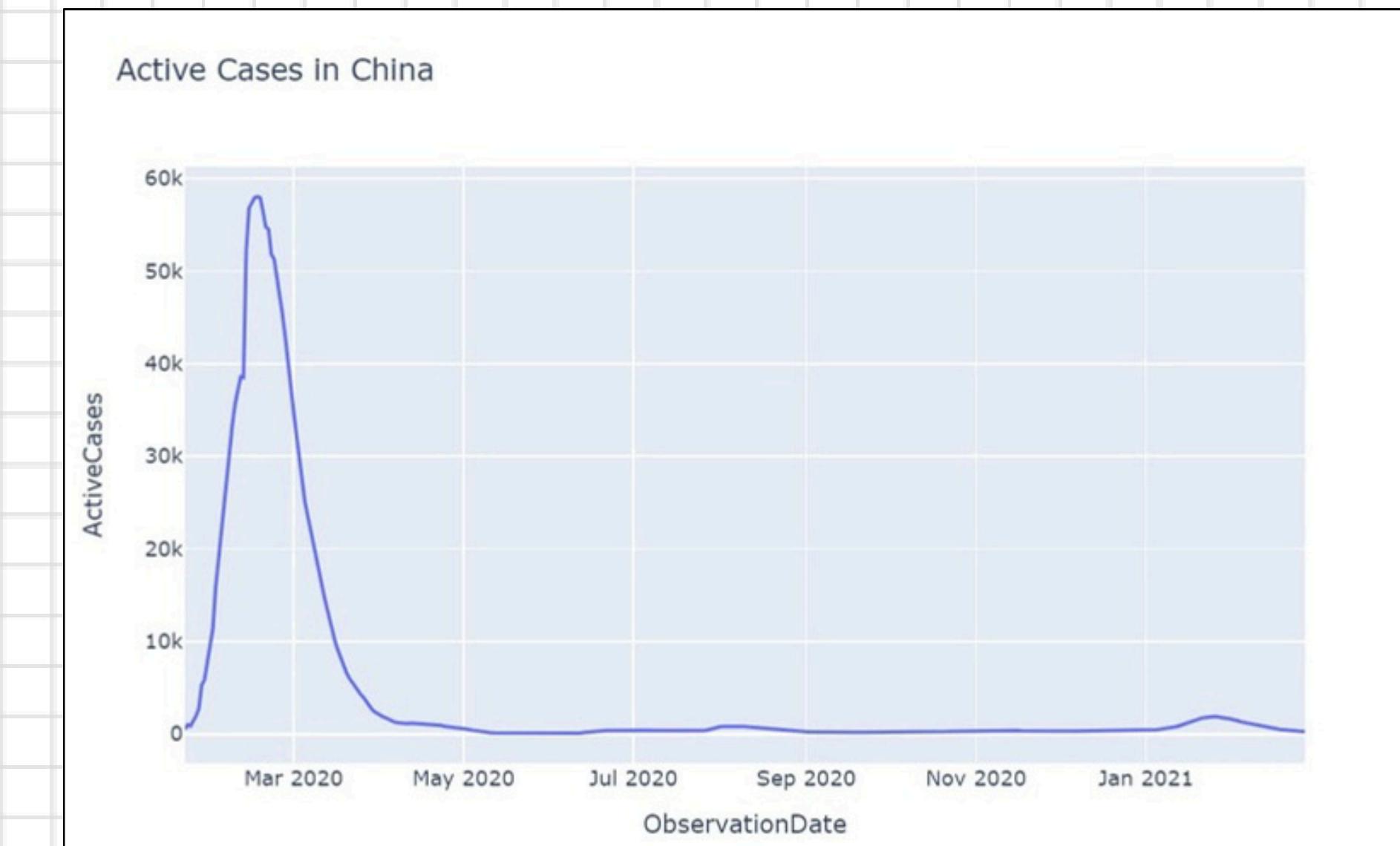


## 1.4 Active cases

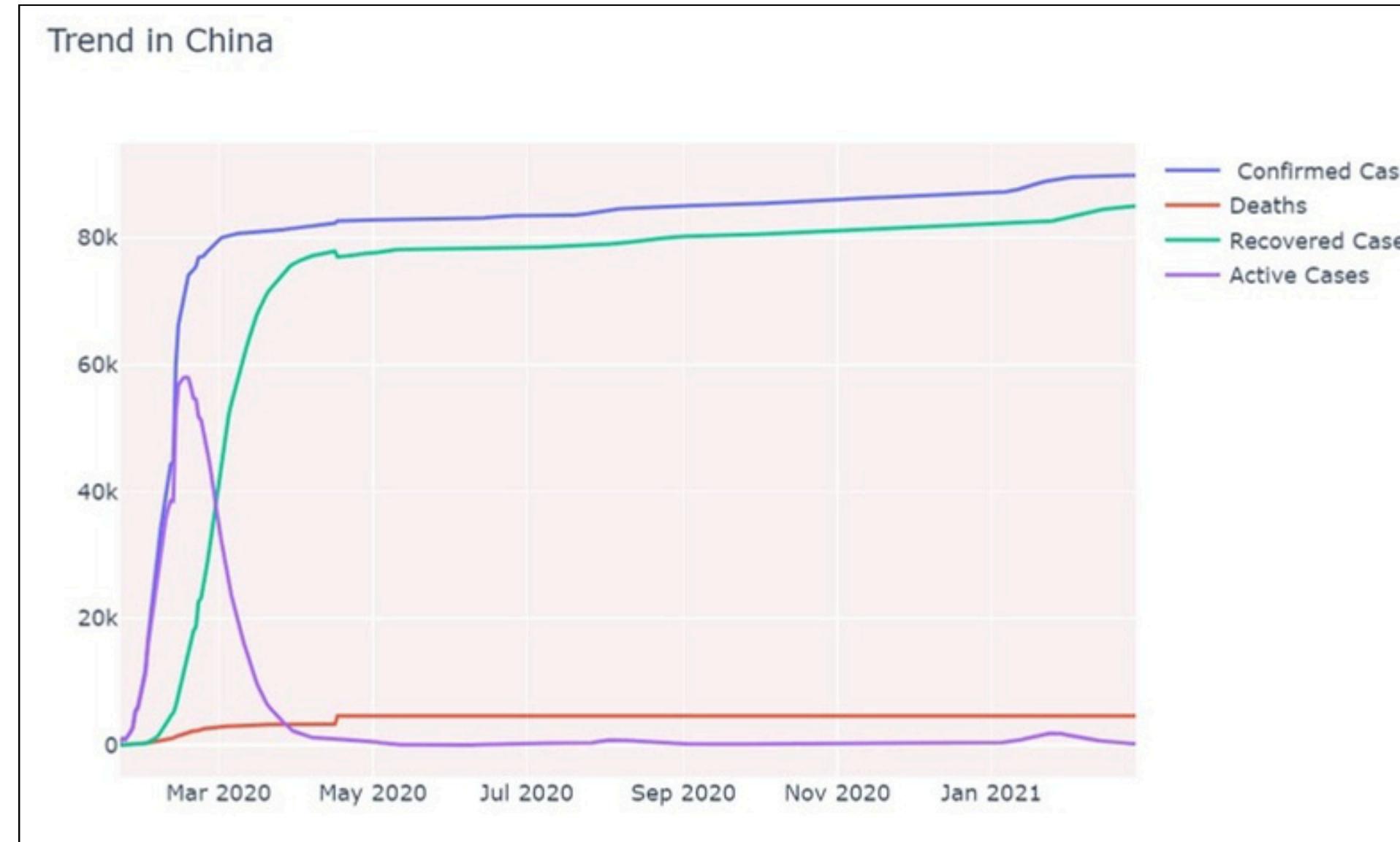
- Active cases peaked in early February and then steadily declined

Recoveries outpaced new infections.

China successfully controlled the spread and transitioned from a crisis phase to recovery.



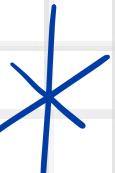
Let's visualize this in a single graph for comparison :



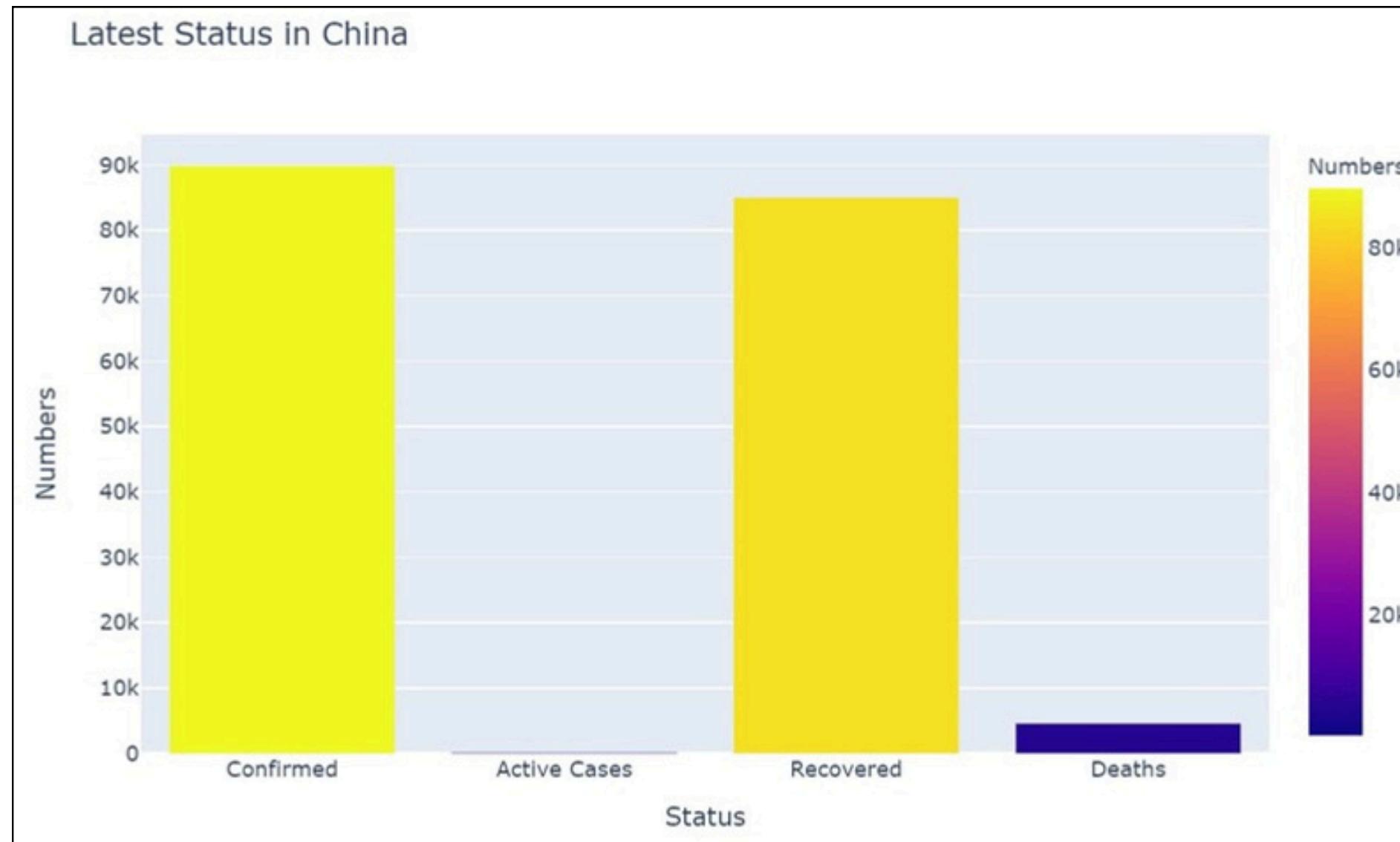
- ✓ China had managed to contain the outbreak early
- ✓ Maintain a low number of deaths
- ✓ Reduce active cases over time.

These results + The measures taken: Wuhan Lockdown, Social Distancing, Trial Rollout of Vaccines...

→ offered crucial insights for crisis management in pandemics



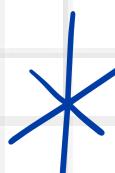
Let's visualize this in a single graph for comparison :

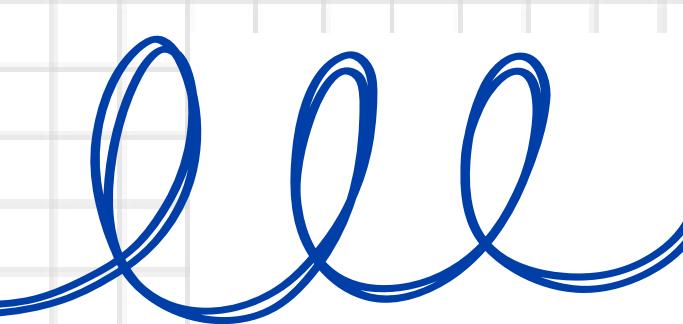


- Active Cases and Recovery percentage is 0.0, 95.0 respectively
- Death rate is 5.0

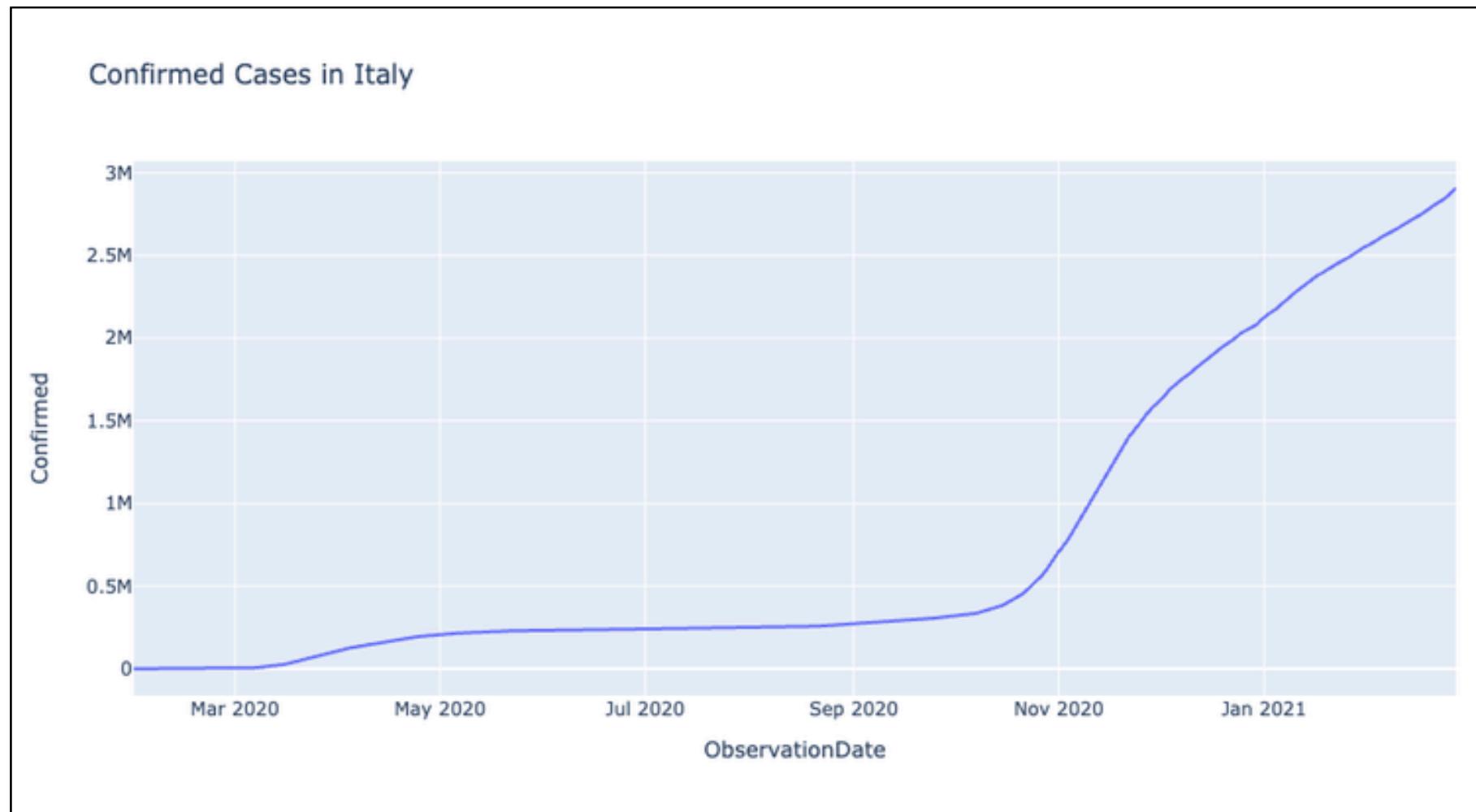


This represents a remarkable comeback for China.



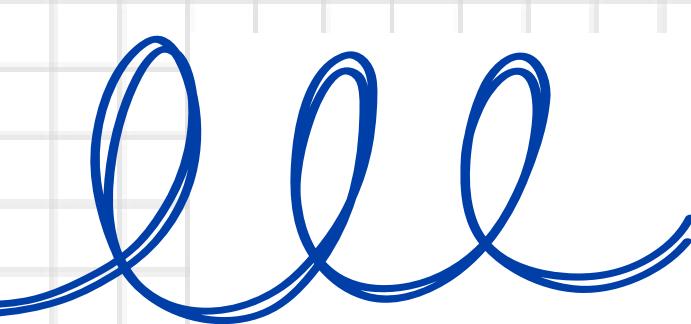


## 2. ITALY



### 2.1. Confirmed cases

- COVID-19 cases in Italy increased **slowly** during the first half of 2020 but **surged rapidly** starting from October 2020, surpassing 2 million cases by early 2021.

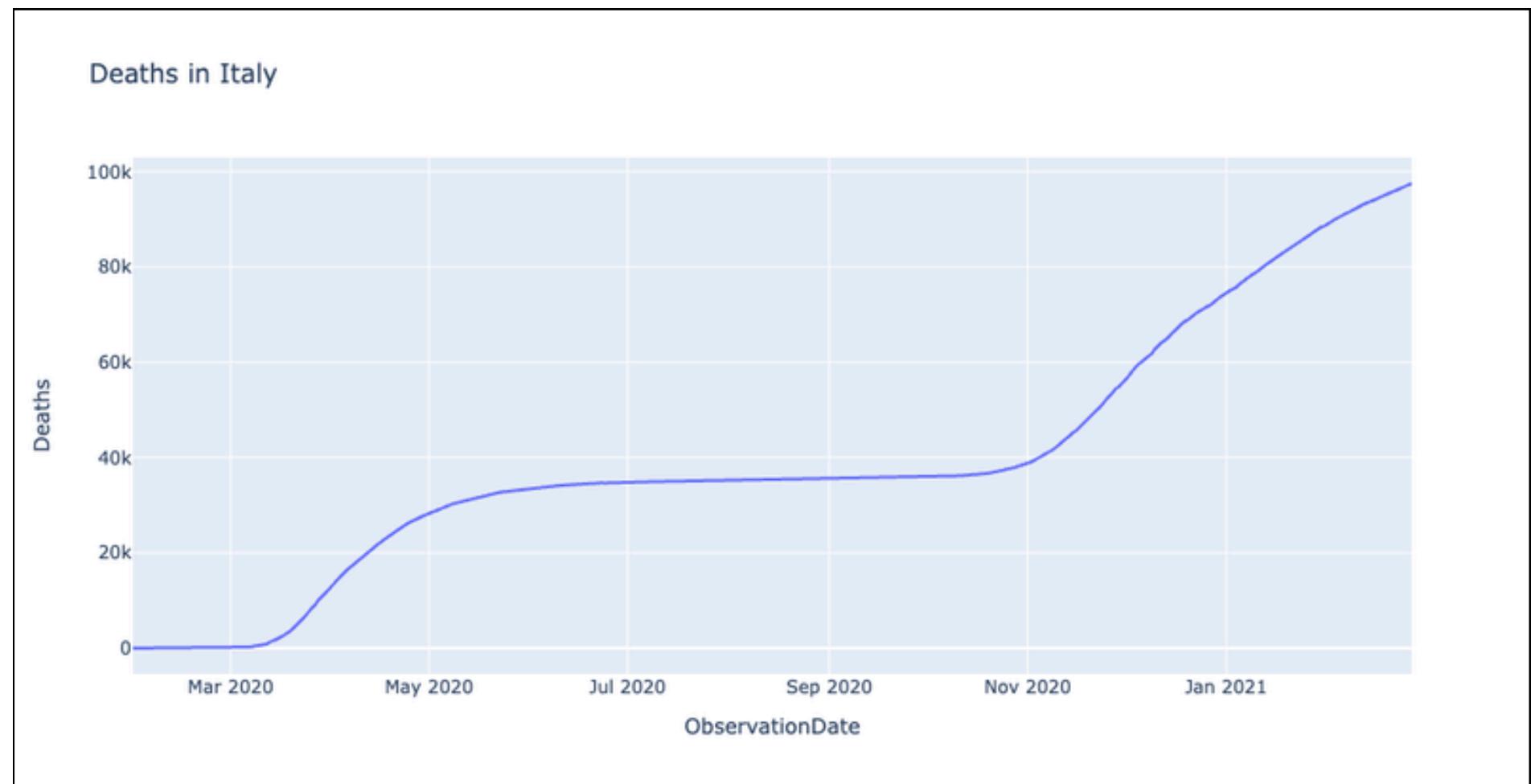


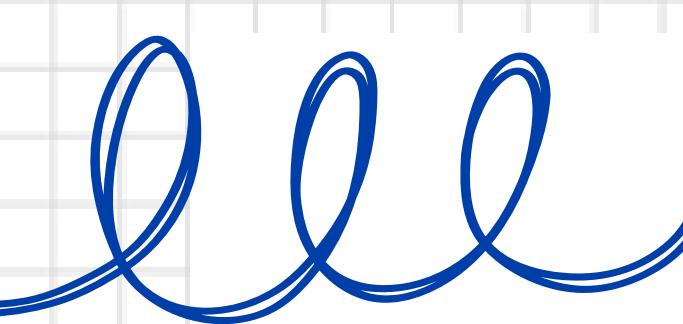
## 2. ITALY



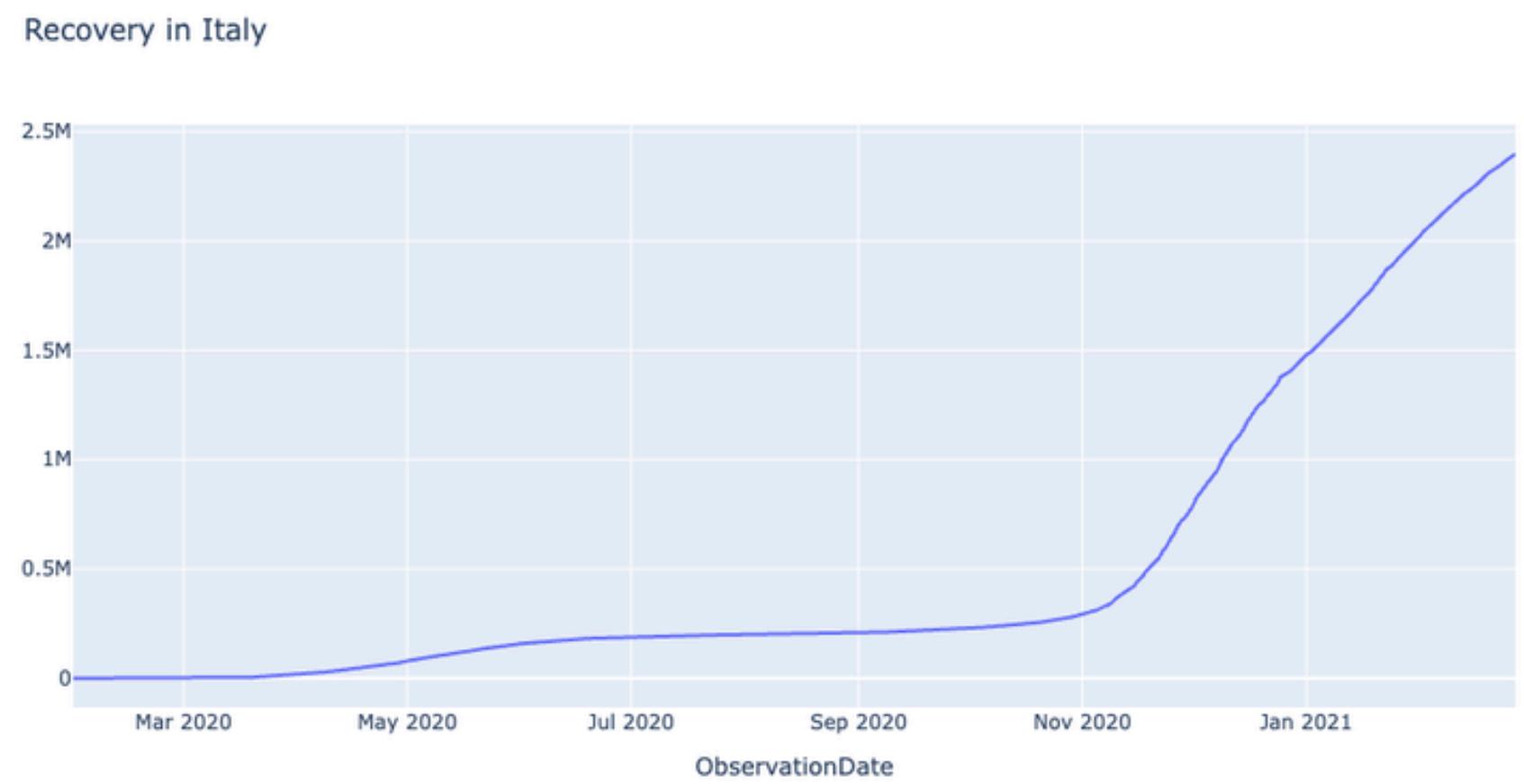
### 2.2 Deaths

- The graph indicates a **sharp** rise in COVID-19-related deaths in Italy around March–May 2020, followed by a relatively **stable** phase during the summer.
- **However, from October 2020 onwards, there was another significant spike, with total deaths approaching 100,000 by early 2021.**





## 2. ITALY

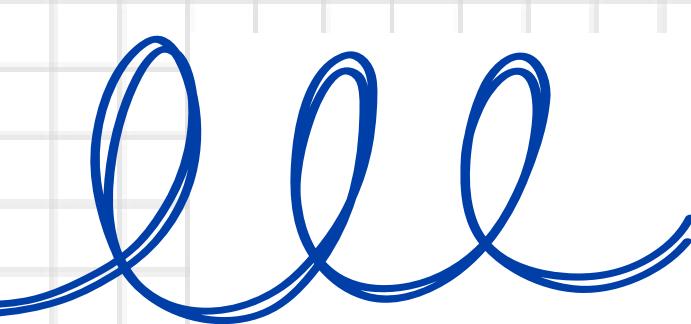


### 2.3 Recovered Cases

- The chart shows a **gradual** increase in recovered cases from March to around October 2020.
- A **significant** surge in recoveries began around November 2020, continuing into early 2021, reaching over 2.4 million by that time.



**May be due to improved treatment protocols and healthcare response over time.**

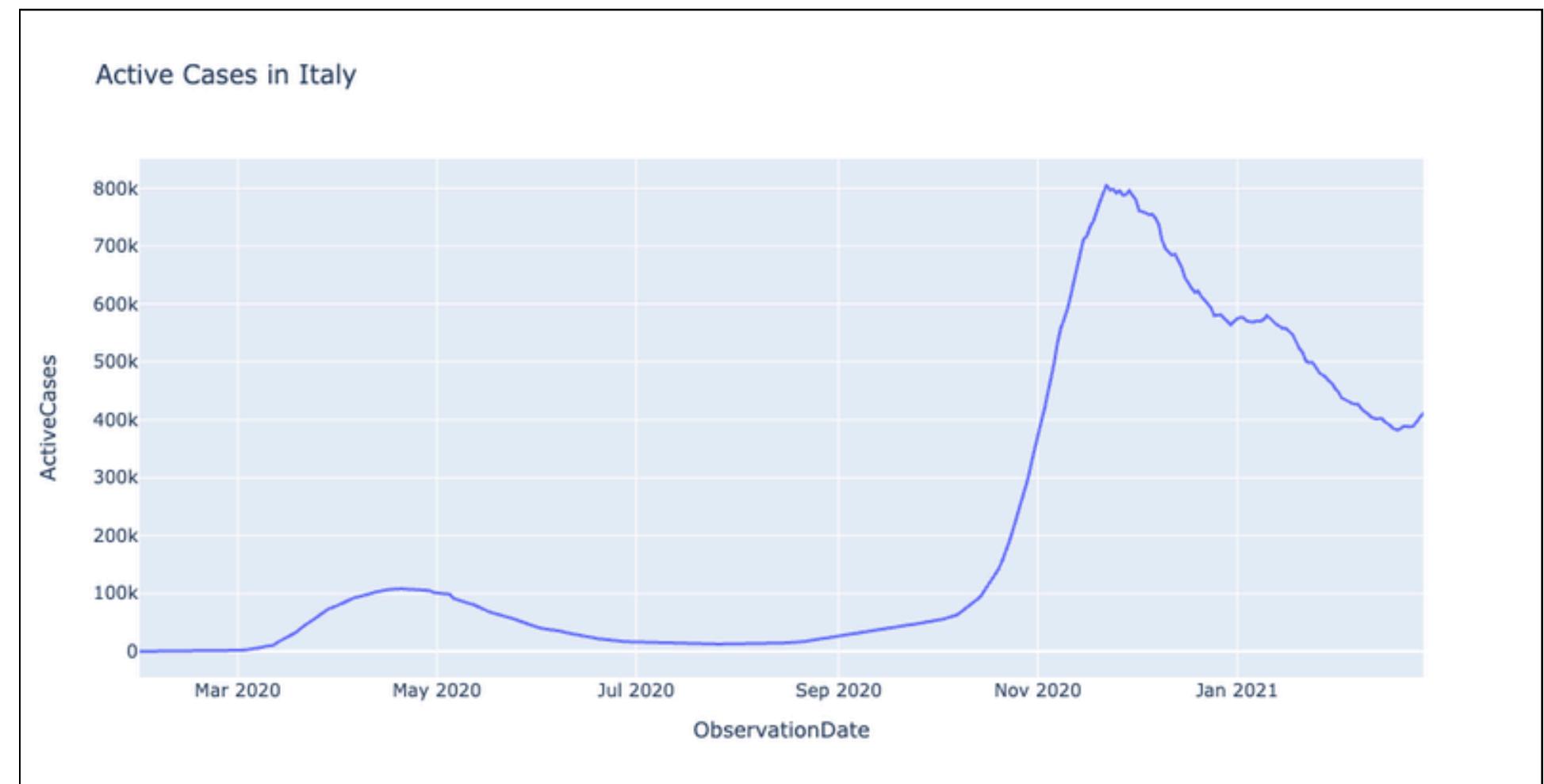


## 2. ITALY

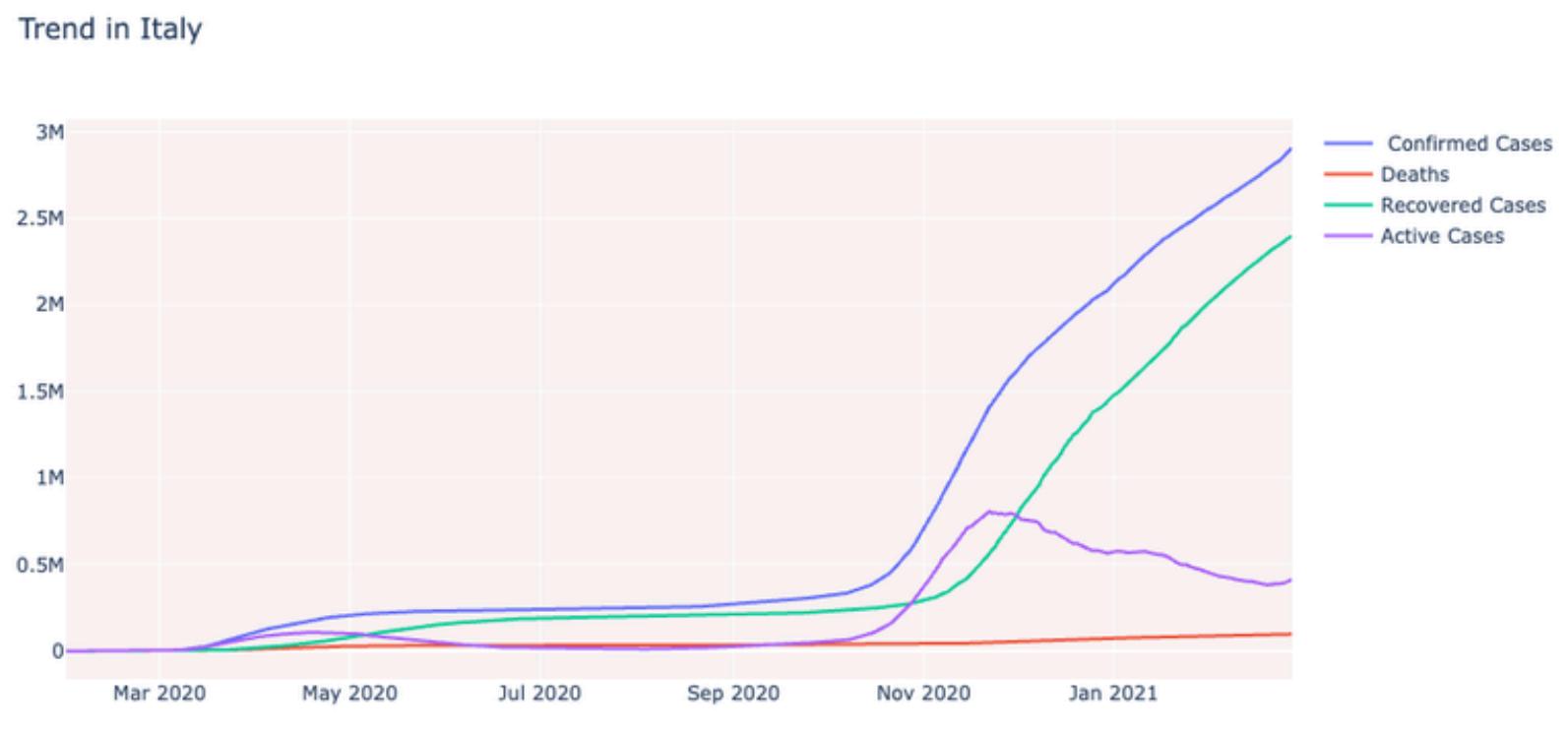


### 2.4. Active Cases

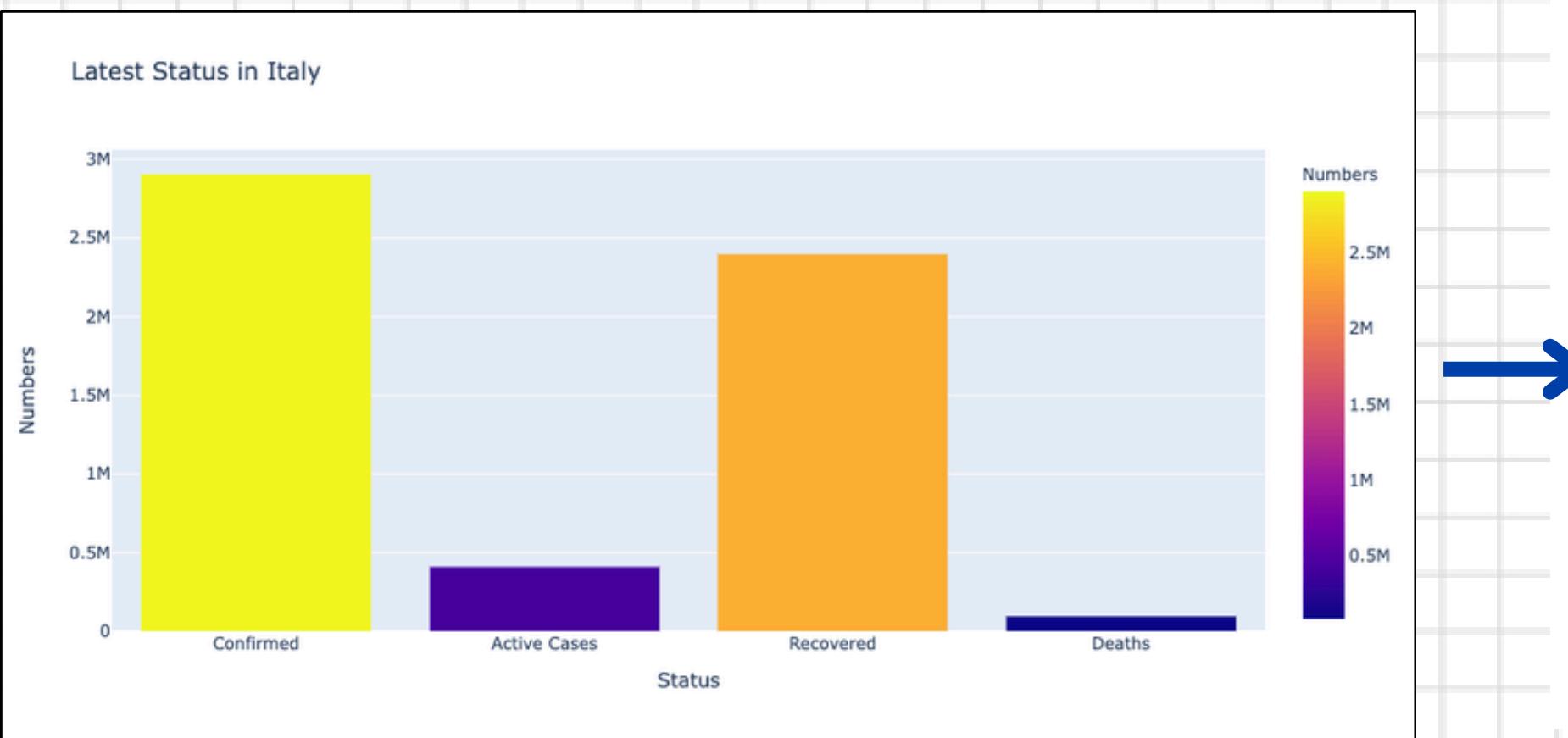
- There was a **sharp increase** starting around October 2020, peaking in November 2020.
- After the peak, active cases **declined gradually** in early 2021, thanks to strict lockdowns and recoveries.



## Let's visualize this in a single graph for comparison :

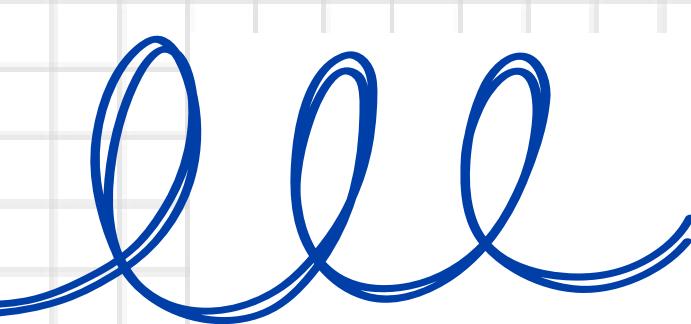


- Rate by which confirmed cases increasing is higher than the rate of recovery and deaths - not the case in China
- The graphs reflect **two clear phases**: an **initial outbreak** in early 2020, some **control mid-year** and then a **major resurgence** in late 2020.
- The resurgence of COVID-19 in Italy can be attributed to the **eased restrictions, reopening of school in September 2020...**



During the period, the situation in Italy **remained concerning**, with a relatively low recovery rate and a continuous rise in the number of deaths.

However, though a little bit late, the response from the government had already **showed signs of improvement**.



# 3. KOREA



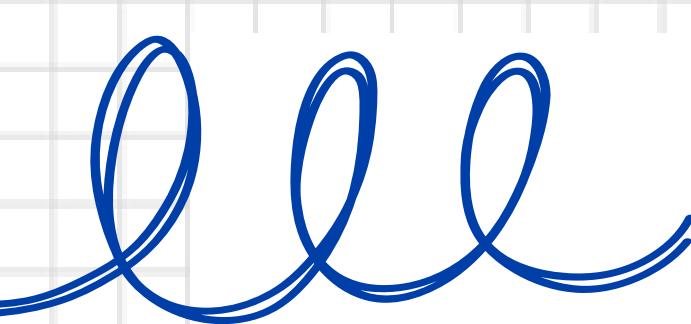
## 3.1. Confirmed cases



- The number of confirmed cases quickly rose from 31 to 602 between Feb 19-Feb 24. (Patient31 Incident)
- During the first half of 2020, the number of cases increased slowly.
- However, around Nov 2020, there was a clear surge that continued into early 2021.



South Korea maintained **strong control** in the early stages, but faced a **significant wave of infections** at the end of the year.



# 3. KOREA

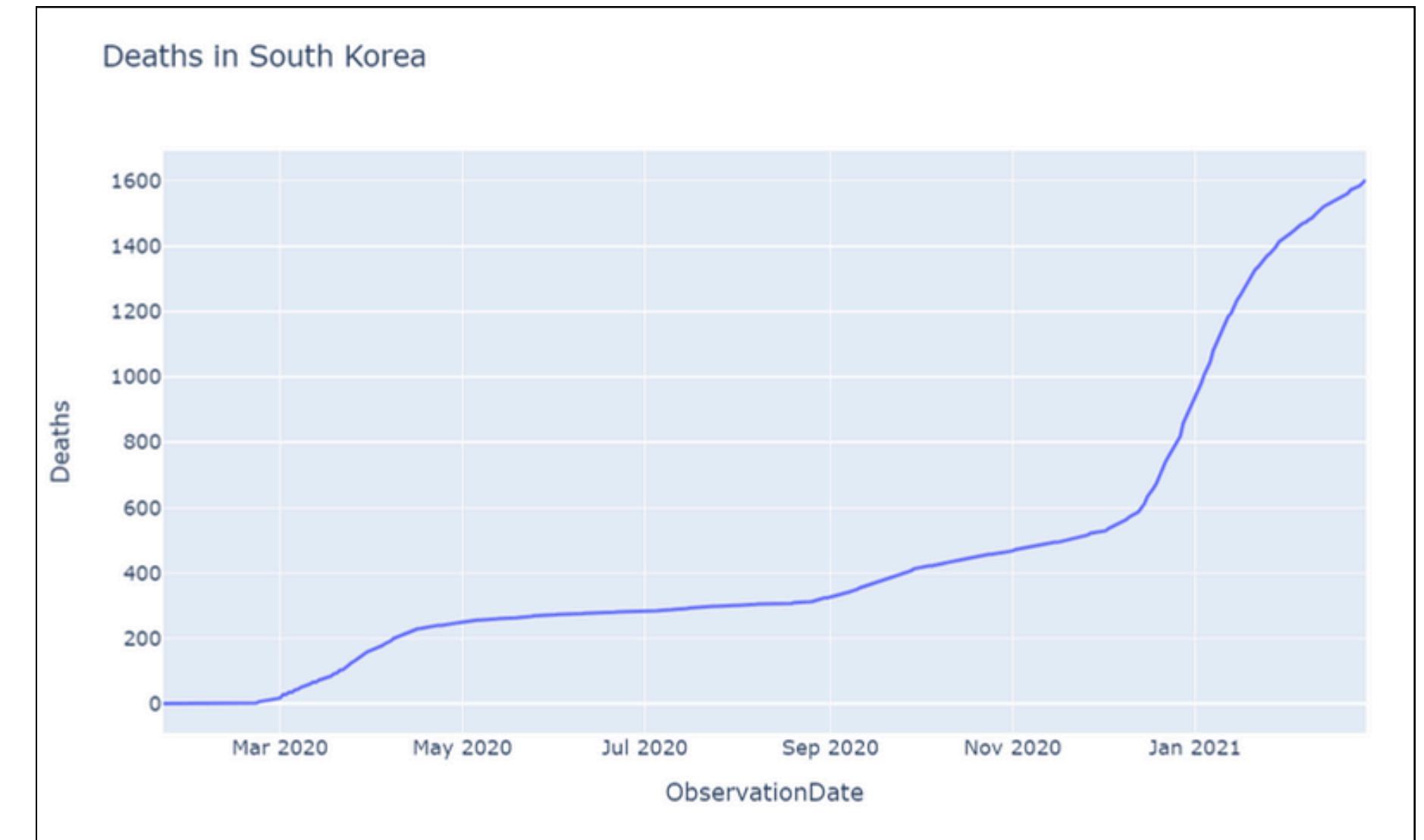


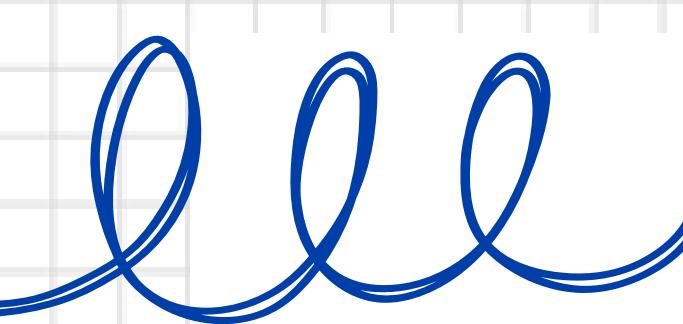
## 3.2. Deaths

- The death count increased slowly and remained significantly lower than the confirmed cases.

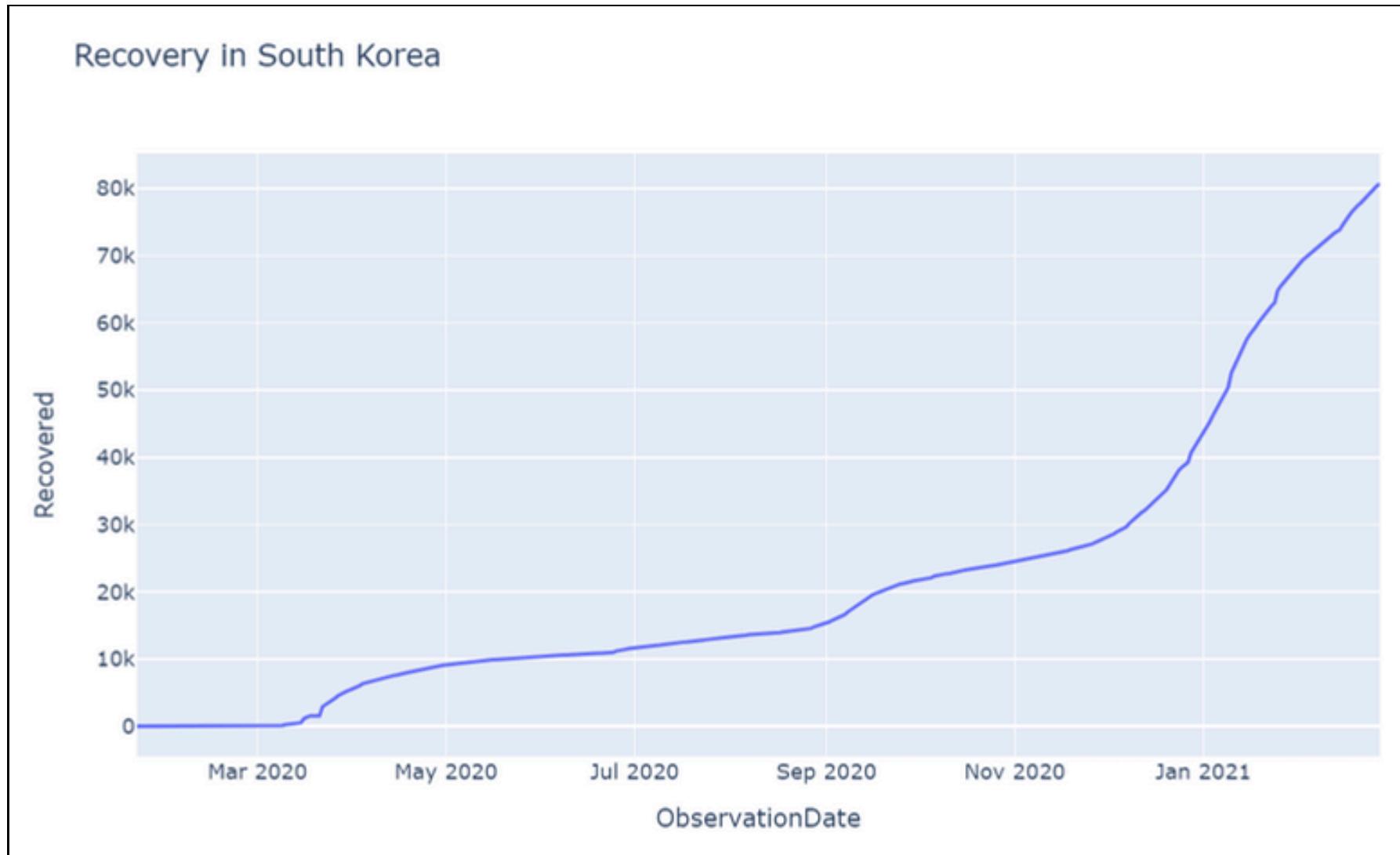


This indicates low mortality and a well-functioning healthcare system



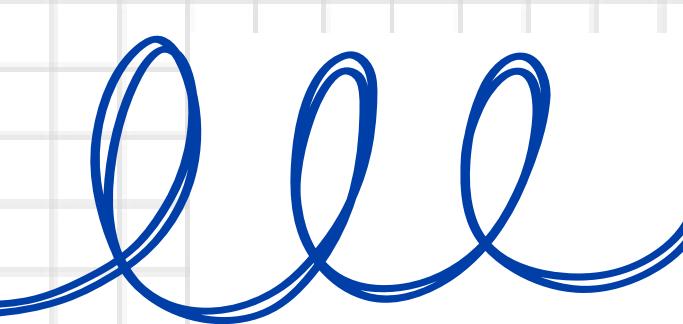


# 3. KOREA



## 3.3. Recovered Cases

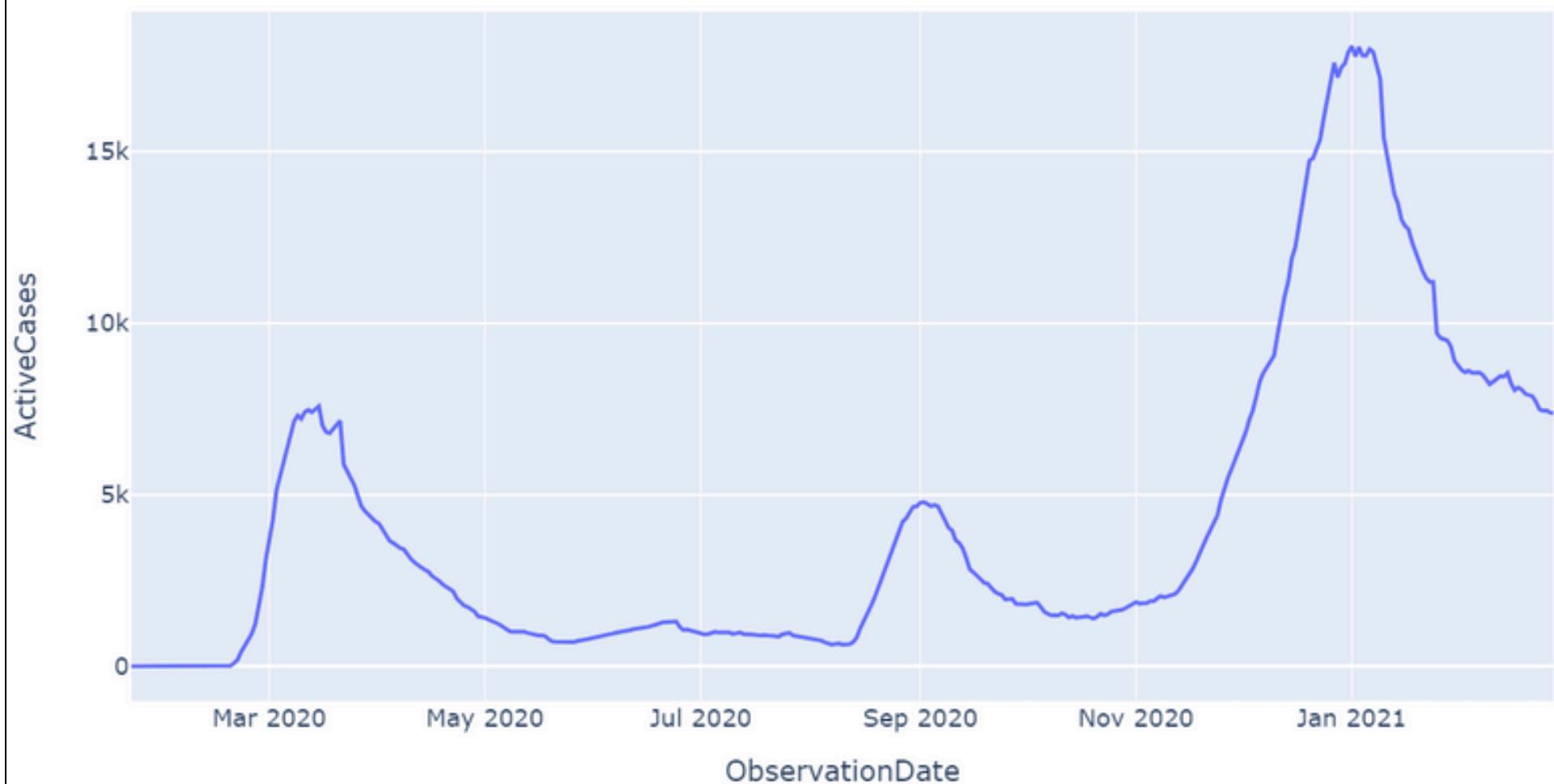
- The recovered cases closely follow the trend of confirmed cases (almost parallel) => a high recovery rate.
- The steep increase in recoveries in late 2020 and early 2021 helped reduce the number of active cases.



# 3. KOREA



Active Cases in South Korea



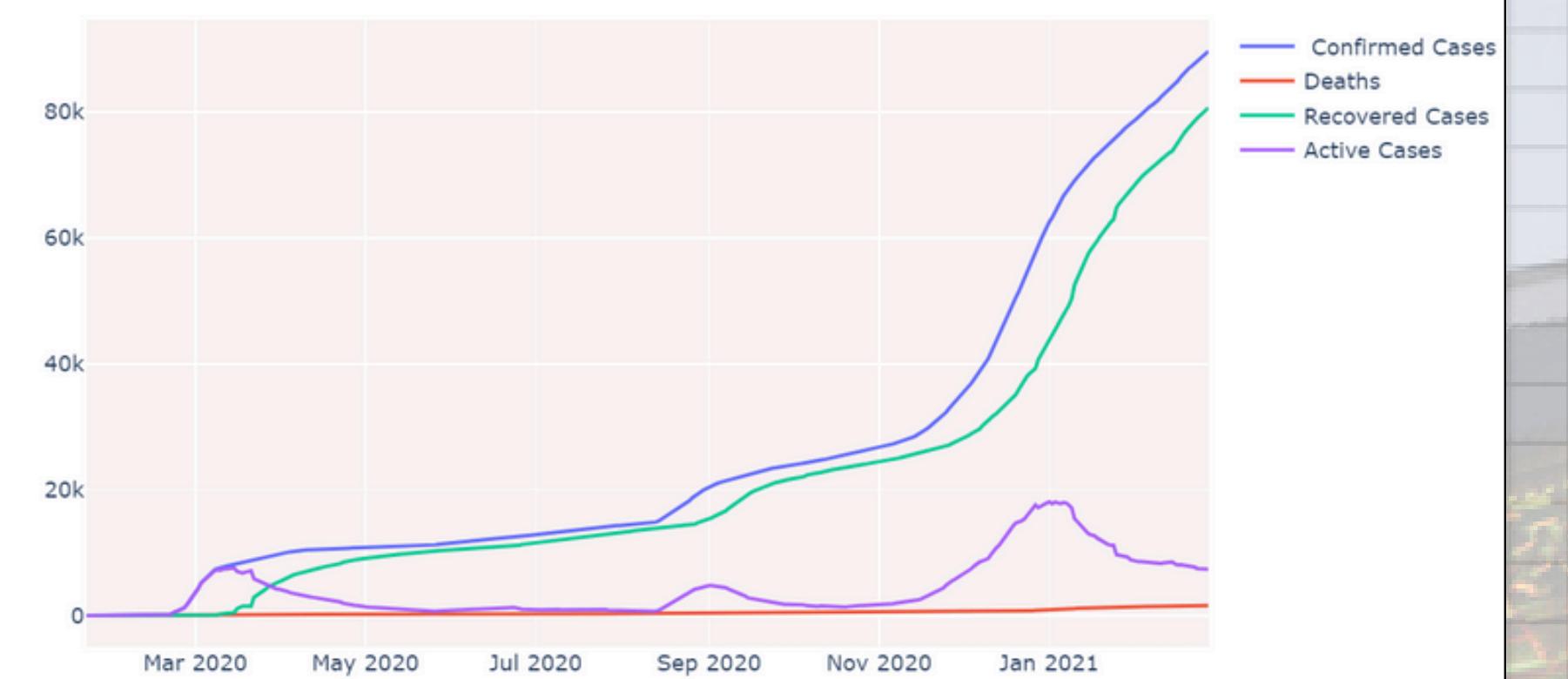
## 3.4. Active Cases

- There was an early peak around March–April 2020, followed by a steep decline.
- By early 2021, after minor spikes, active cases began to decline again, showing signs of control.



This reflects effective testing, contact tracing, and isolation measures throughout the year.

Trend in South Korea



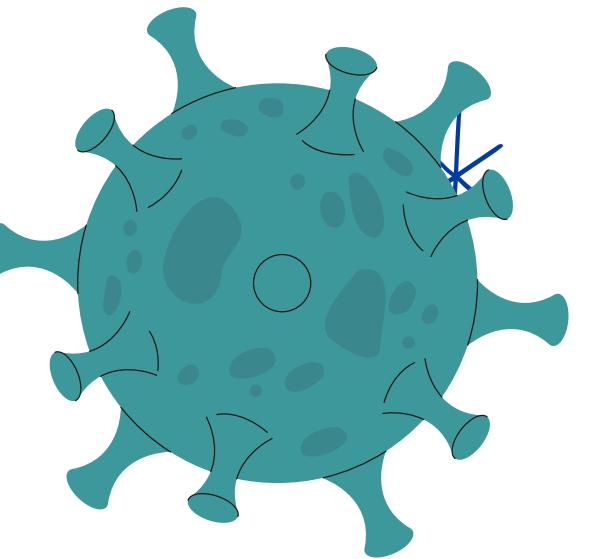
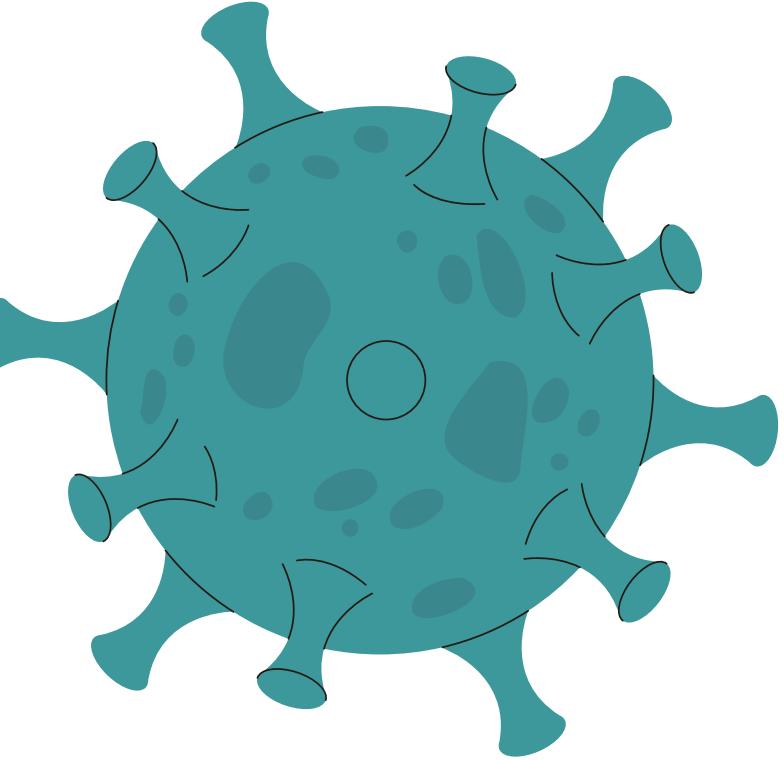
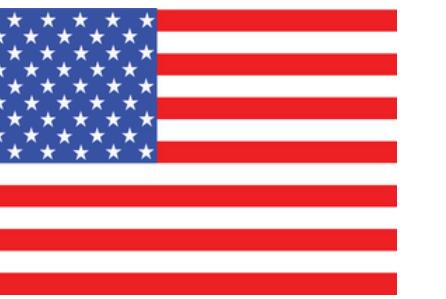
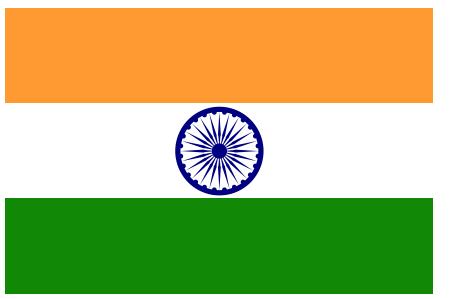
Latest Status in SouthKorea

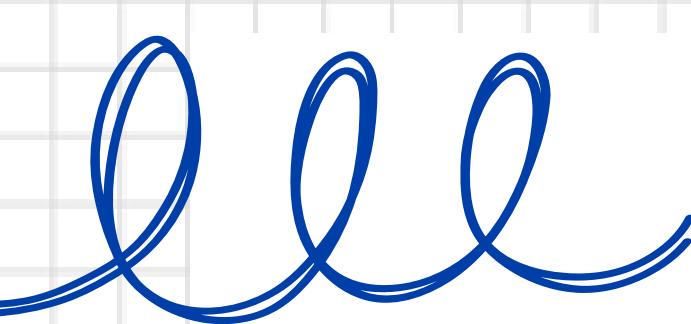


Let's visualize this in a single graph for comparison

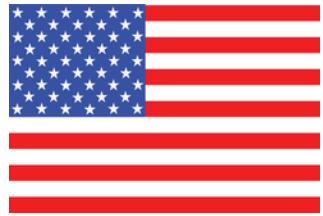
- South Korea managed the pandemic remarkably well for most of 2020, **keeping infection and death numbers relatively low**.
- Although a larger outbreak occurred in late 2020, the situation did not spiral out of control thanks to **swift public health responses: Mass testing, Digital tracking, Contact Tracing, School Lockdown...**
- By early 2021, the number of active cases was already declining, supported by high recovery rates and low fatalities — **a sign of an improving and stable trend**.

# III. Delayed Epicenters



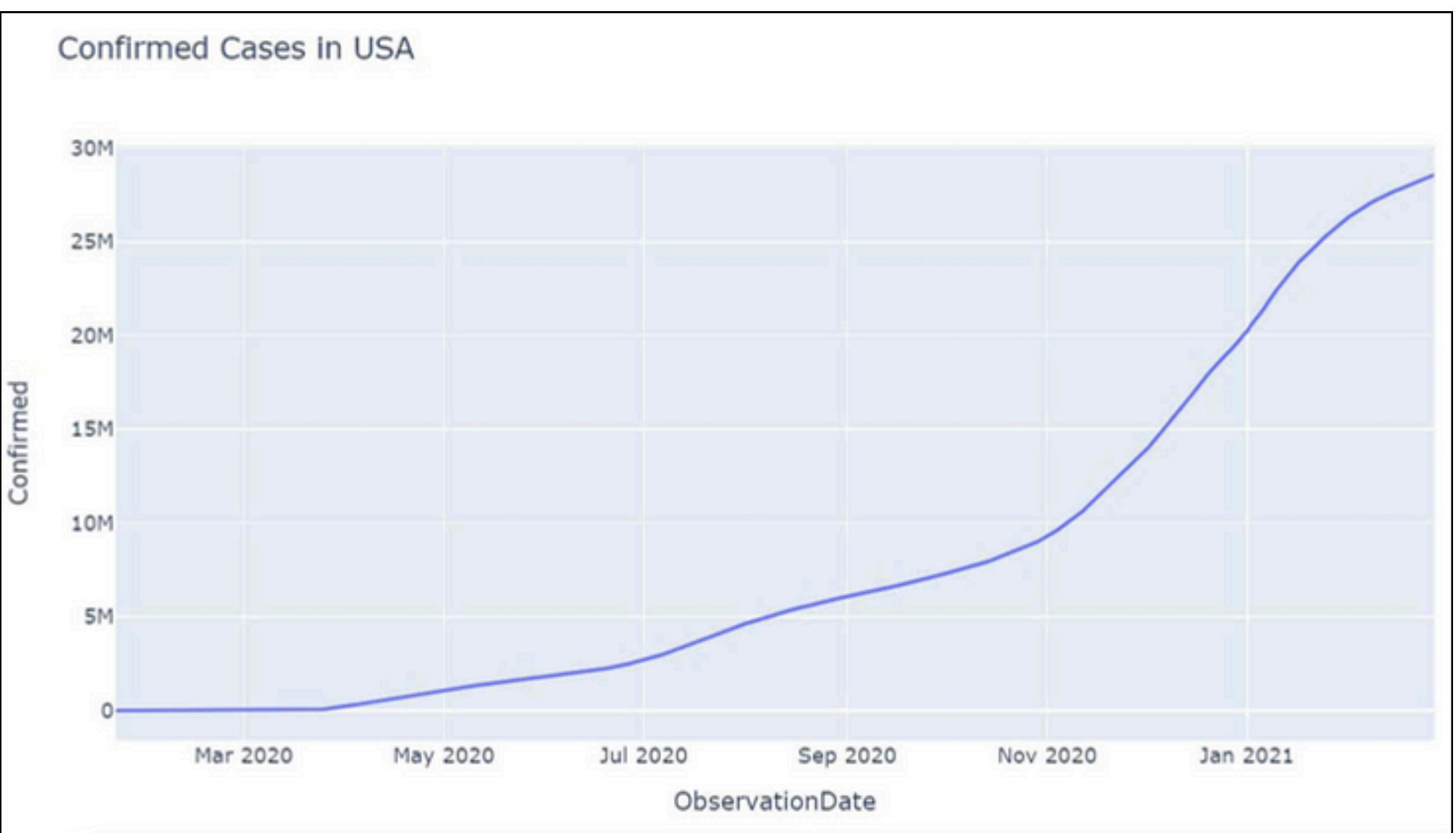


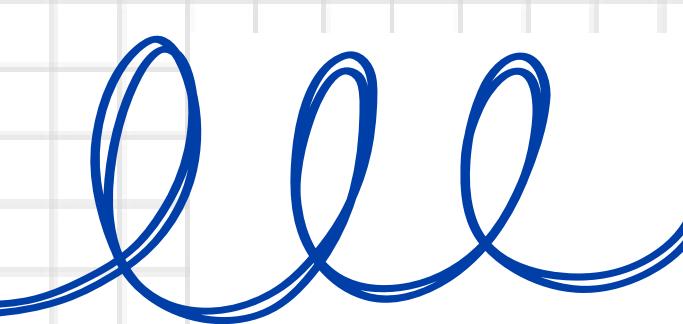
# 1. USA



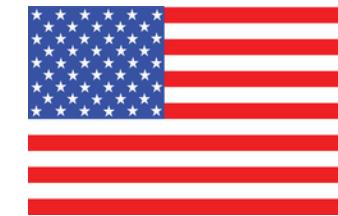
## 1.1. Confirmed Cases

- The number of confirmed cases shows **a steep and continuous rise**, especially from October 2020 onwards.
- By early 2021, the total number surpassed 27 million, indicating **one of the highest case counts globally**.
- Widespread transmission and limited early containment.
- Rapid acceleration from October suggests a major outbreak wave during winter.

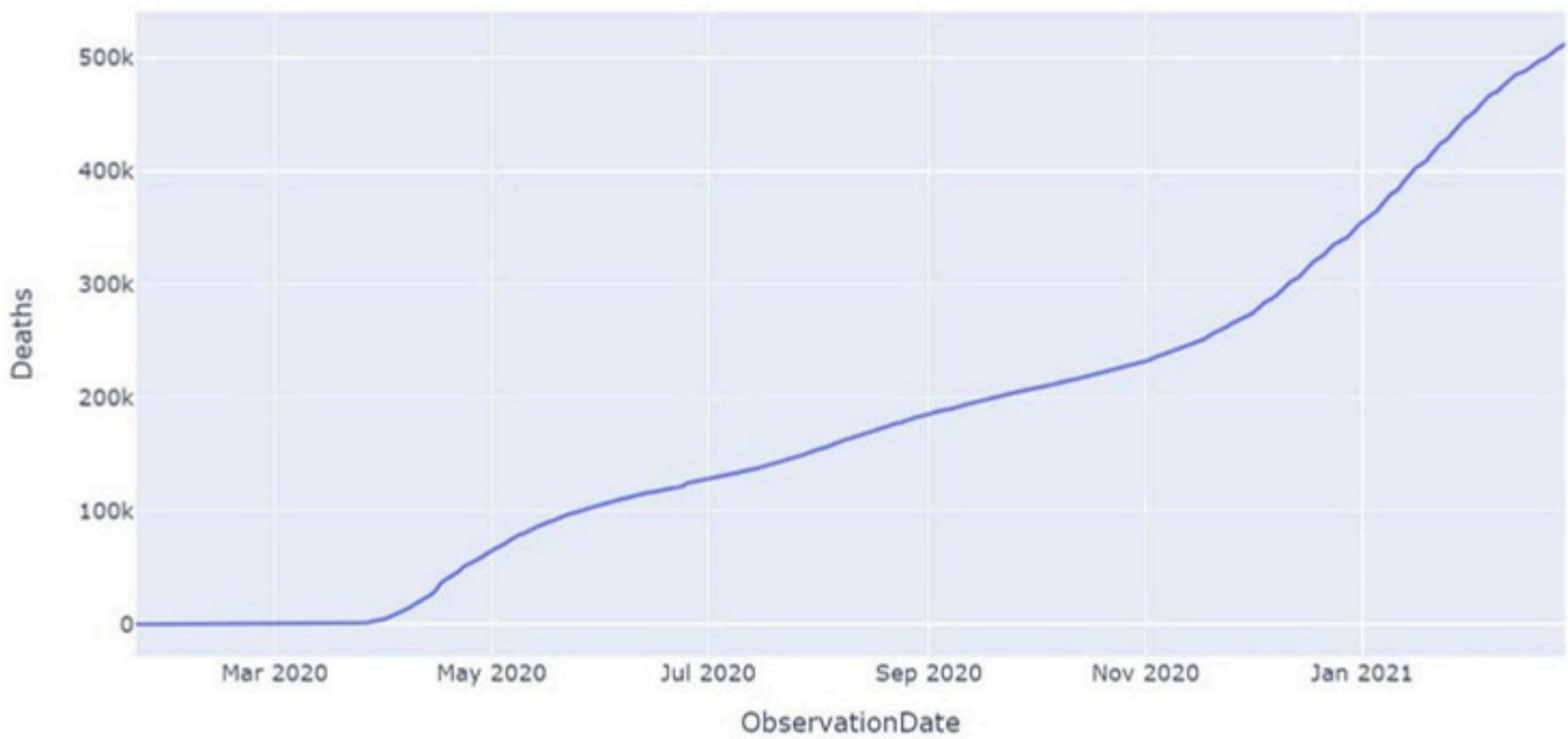




# 1. USA



Deaths in USA

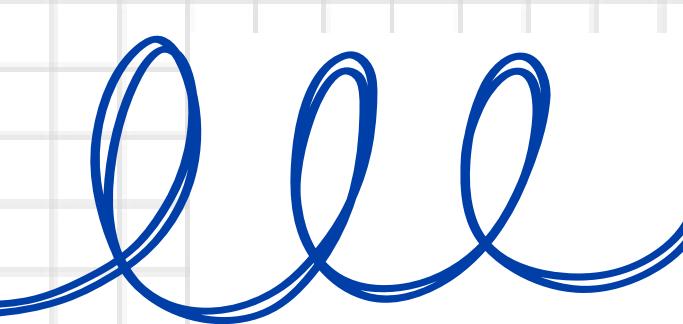


## 1.2. Deaths

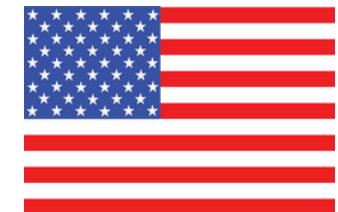
- The number of deaths gradually increases throughout the year, recorded hundred thousands of deaths.



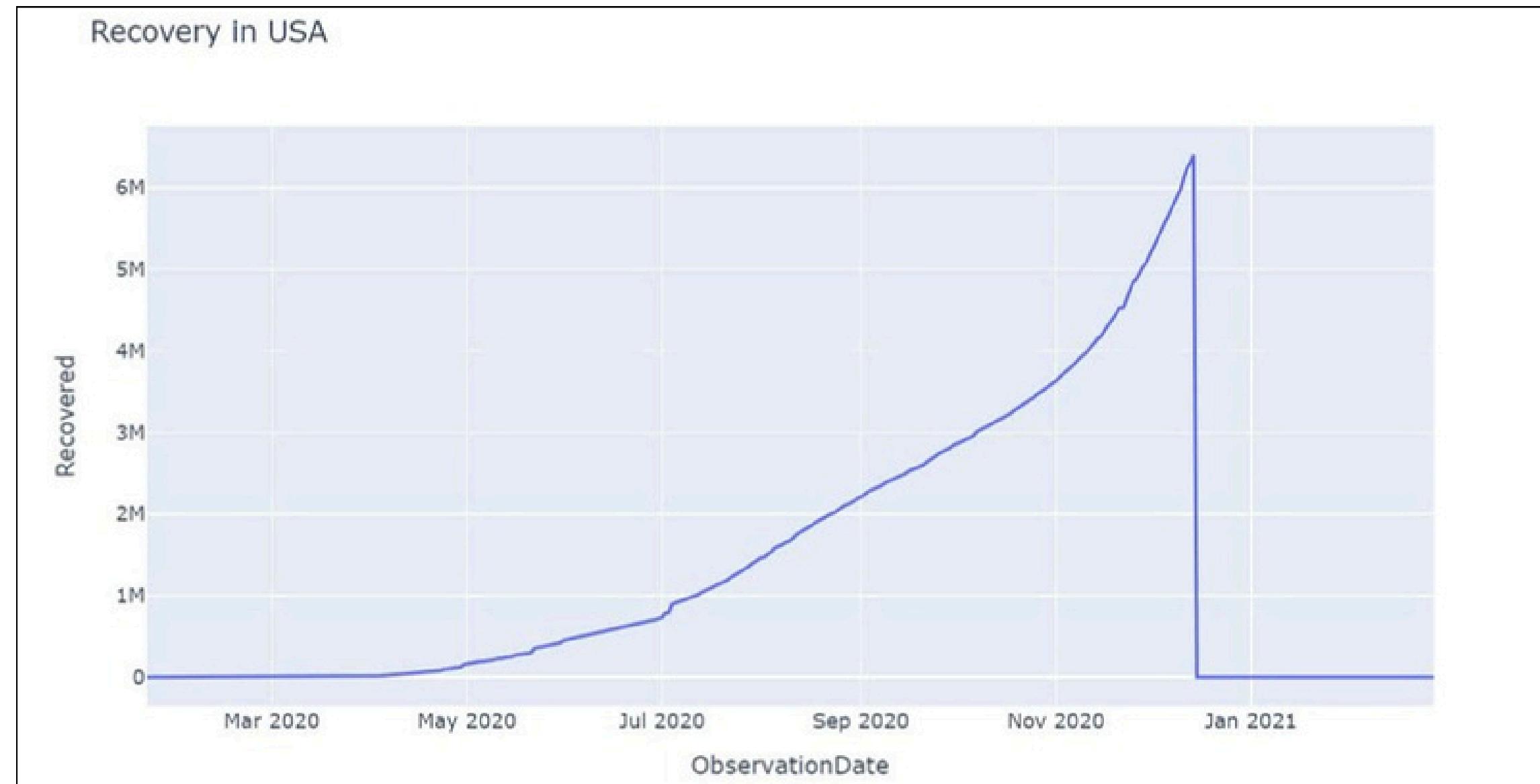
Implies **persistent mortality** over time, though the slope is much **less steep than confirmed cases**.



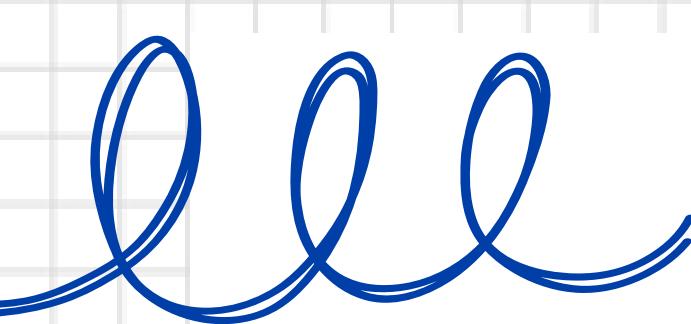
# 1. USA



## 1.3. Recovered Cases



Gradually rose overtime, but far below total cases



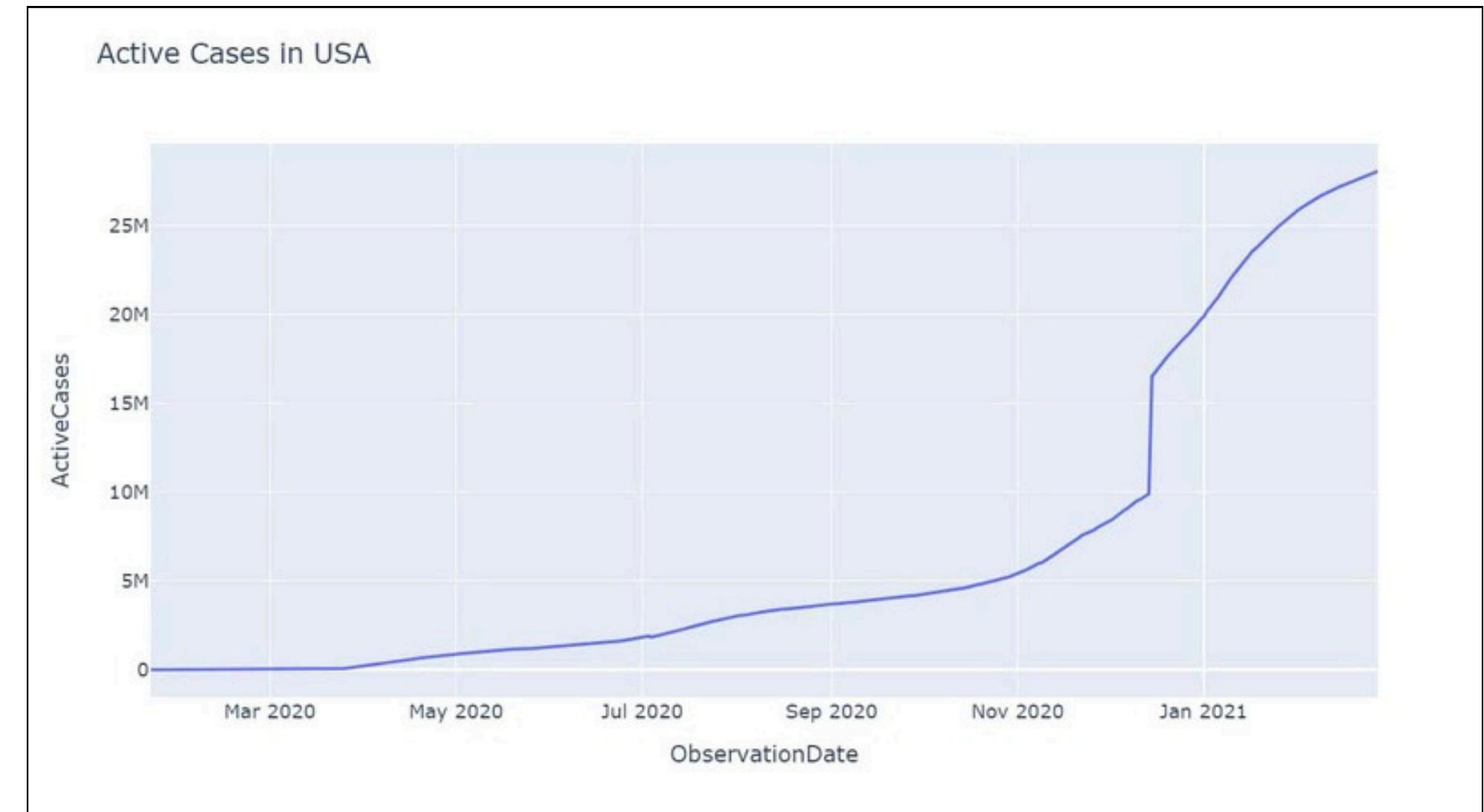
# 1. USA



## 1.4. Active Cases

Closely follows the trend of confirmed cases, showing a very high number of active cases, especially during the last few months of 2020.

6  
A large portion of cases remained unresolved (neither recovered nor dead).



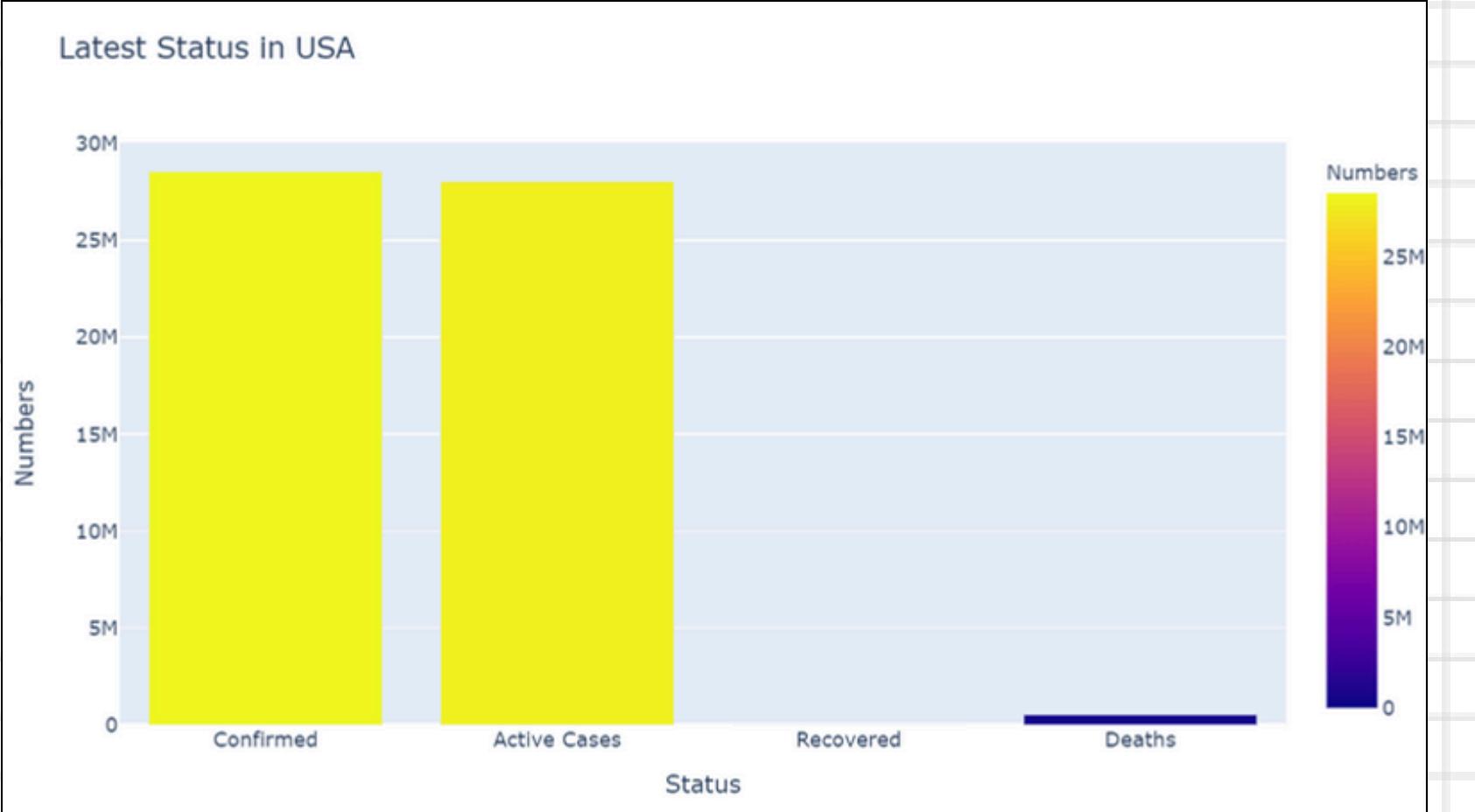
Trend in USA

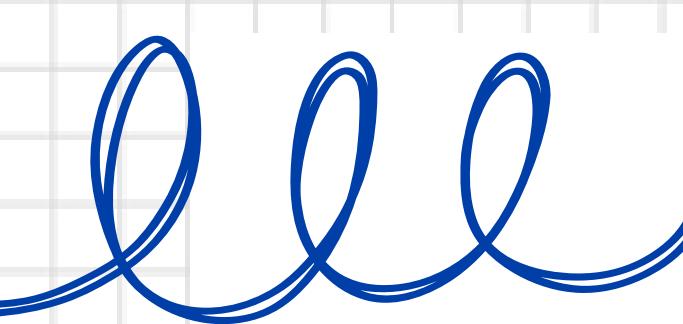


Let's visualize this in a single graph for comparison

- The imbalance between confirmed and recovered numbers led to **high active case load, overwhelming healthcare systems.**
- Majority of cases are still **active**.
- Indicates the **need for more effective data handling, public health communication, and containment strategies**. Recently, US Government has **yet to launch a strict prevention campaign** to deal with the situation.
- **Decentralized response and lack of nationwide lockdown** can worsen the situation.

Latest Status in USA

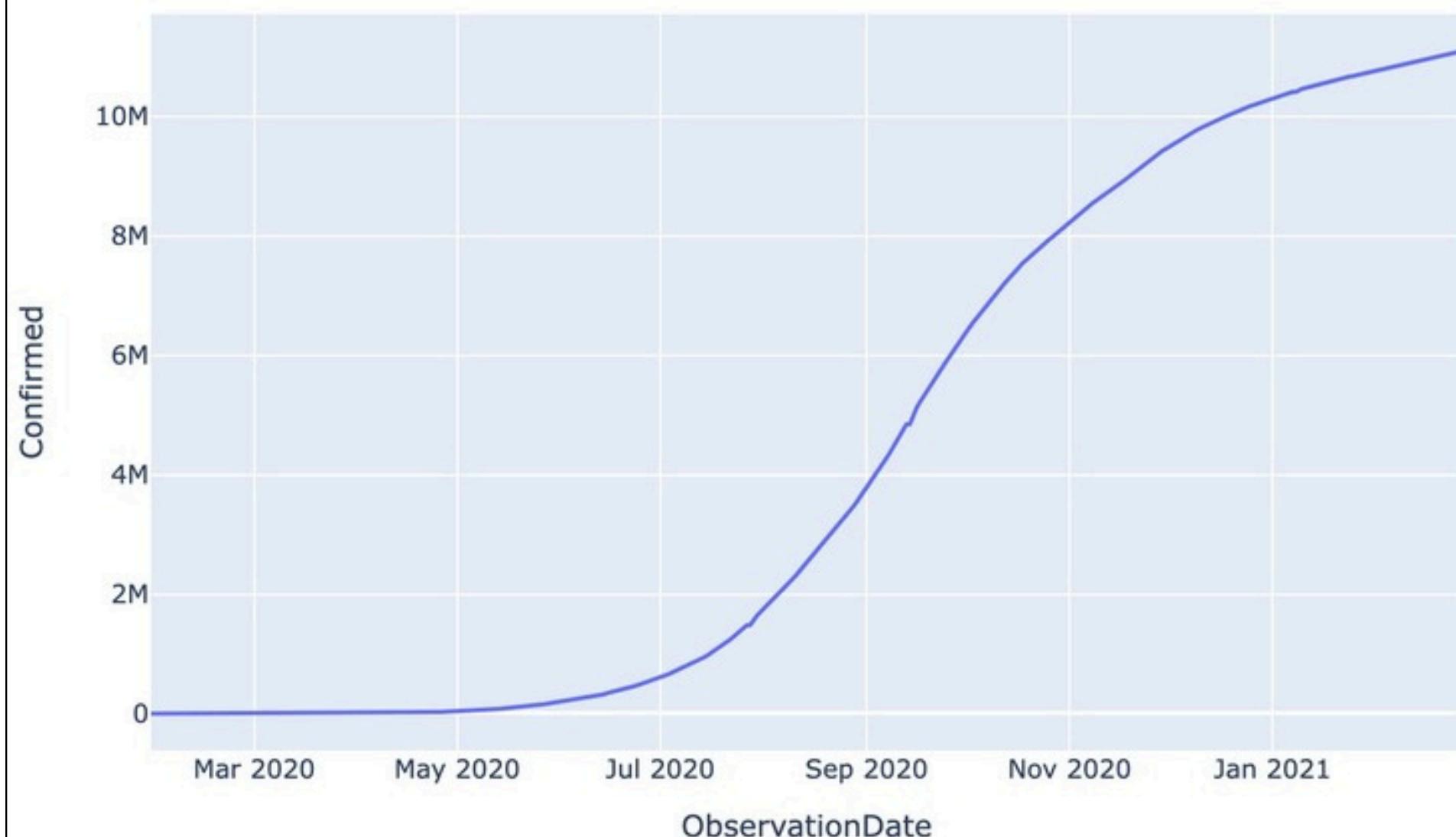




## 2. India

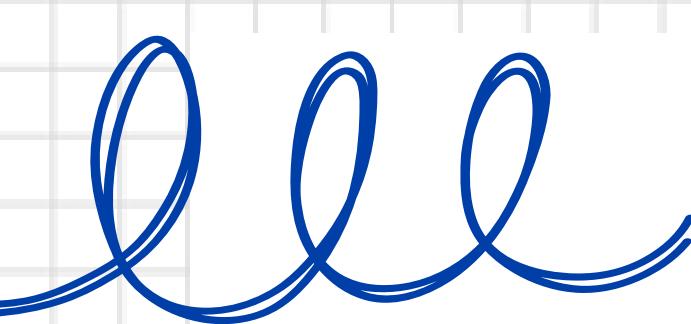


Confirmed Cases in India



### 2.1. Confirmed Cases

- The number of confirmed COVID-19 cases started rising sharply around June 2020, showing exponential growth until about October 2020.
  - Continued increasing at a slower rate.
- The sharp rise suggests **widespread community transmission** and possibly **ramped-up testing capacity** during that period.



## 2. India

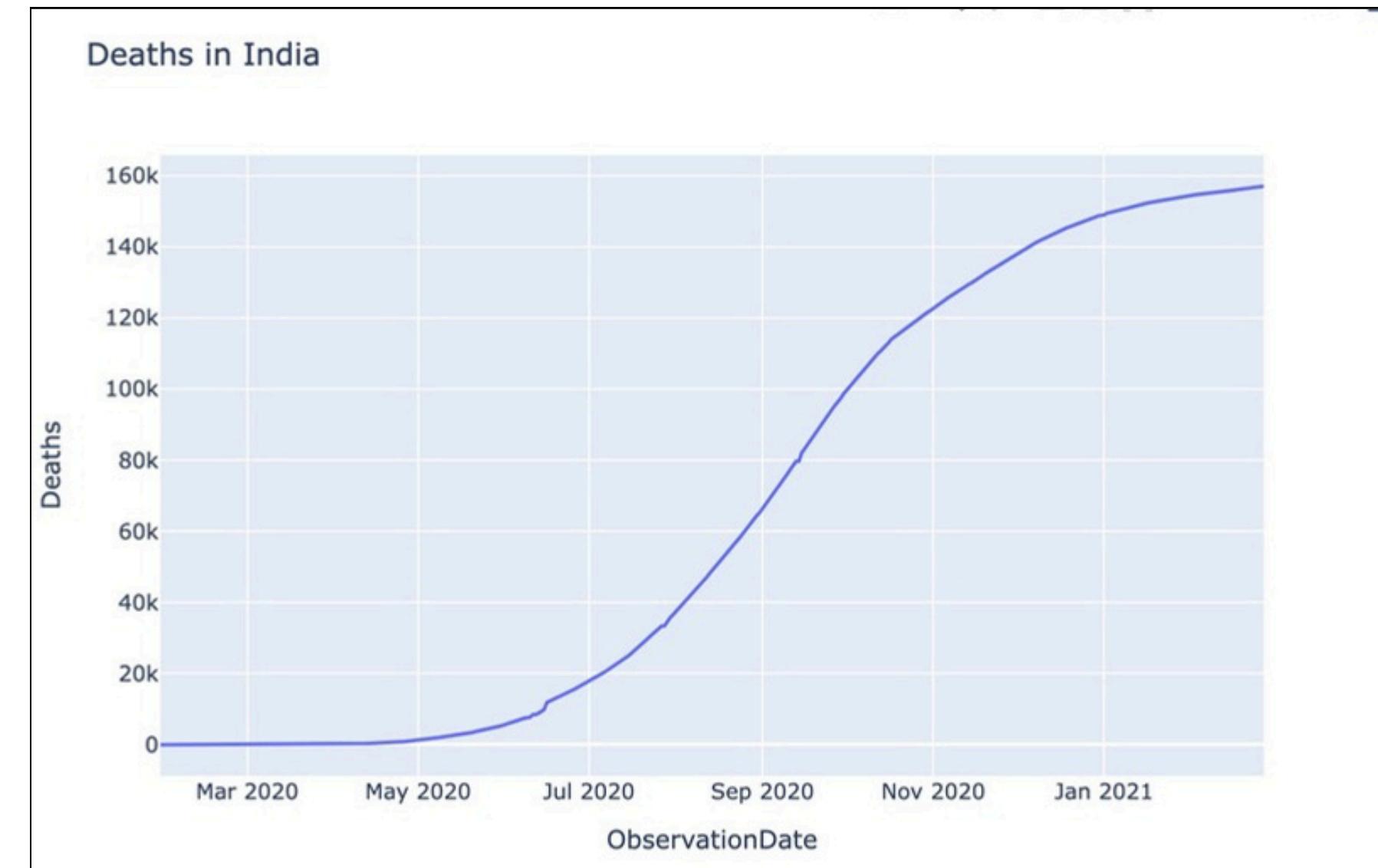


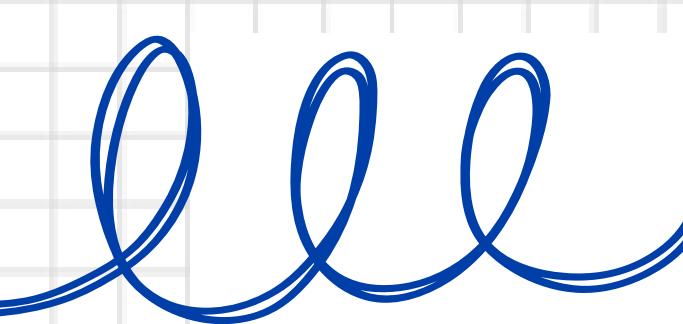
### 2.2. Deaths

- The number of deaths increased steadily but remained significantly lower compared to confirmed and recovered cases.

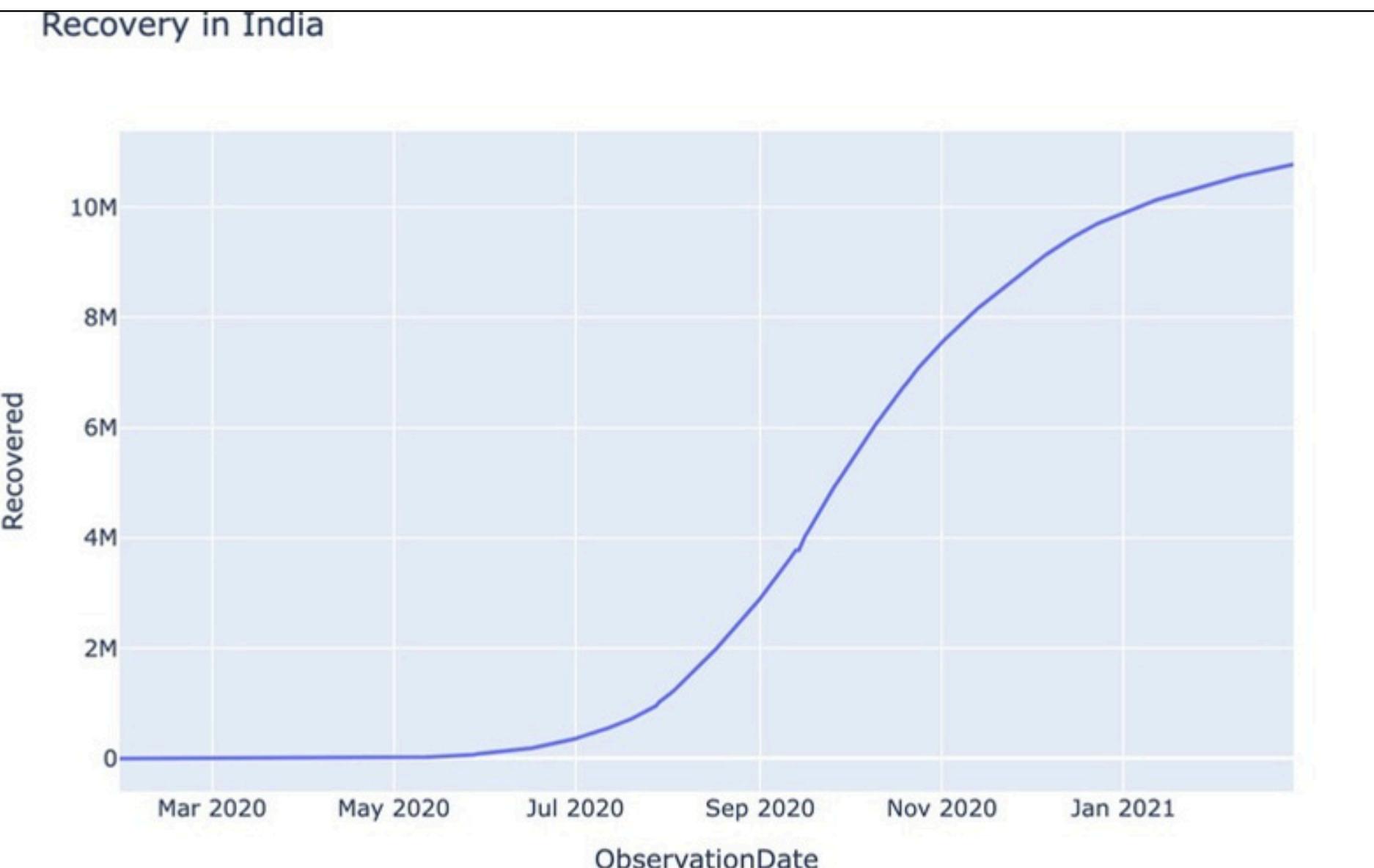


The low death rate suggests that **most cases were either mild or treated effectively.**



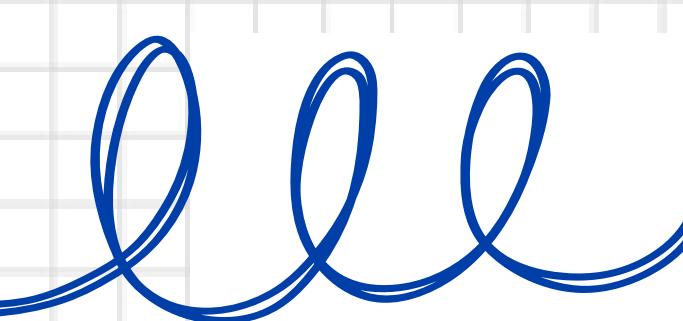


## 2. India



### 2.3. Recovered Cases

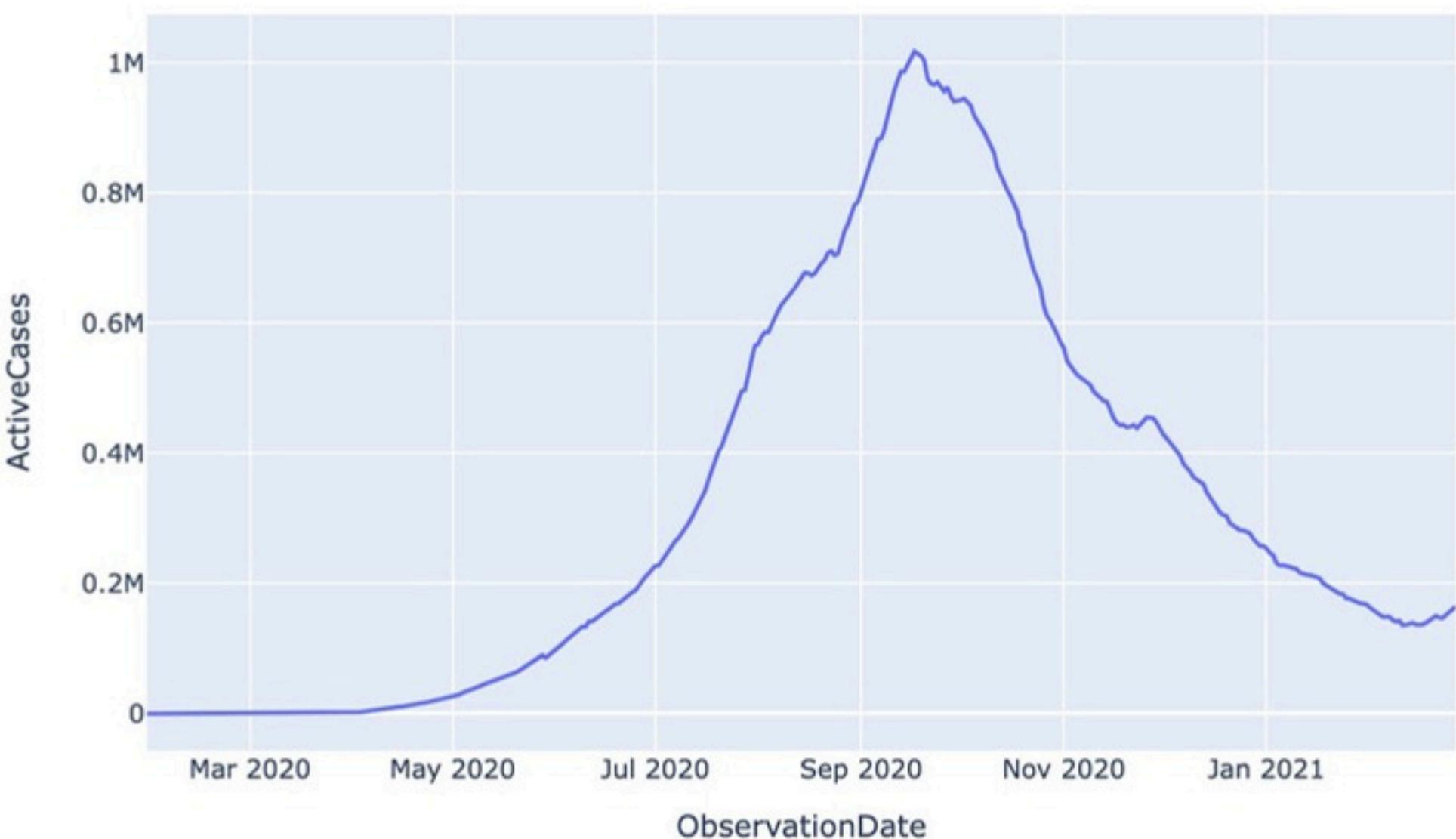
- The number of recovered cases also rose significantly, almost parallel to confirmed cases, and by early 2021, it nearly matched the total confirmed cases.



## 2. India

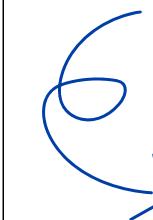


Active Cases in India



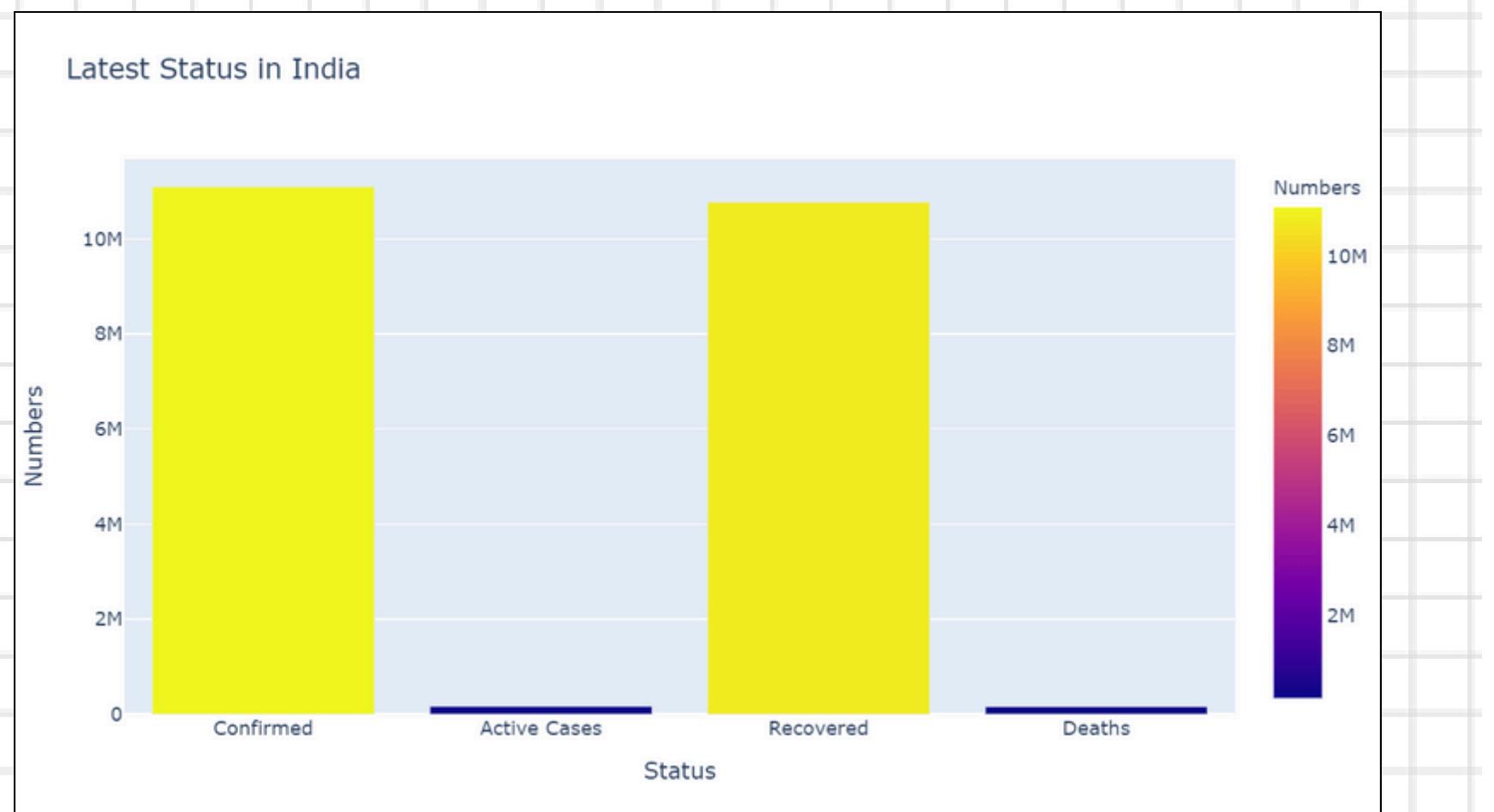
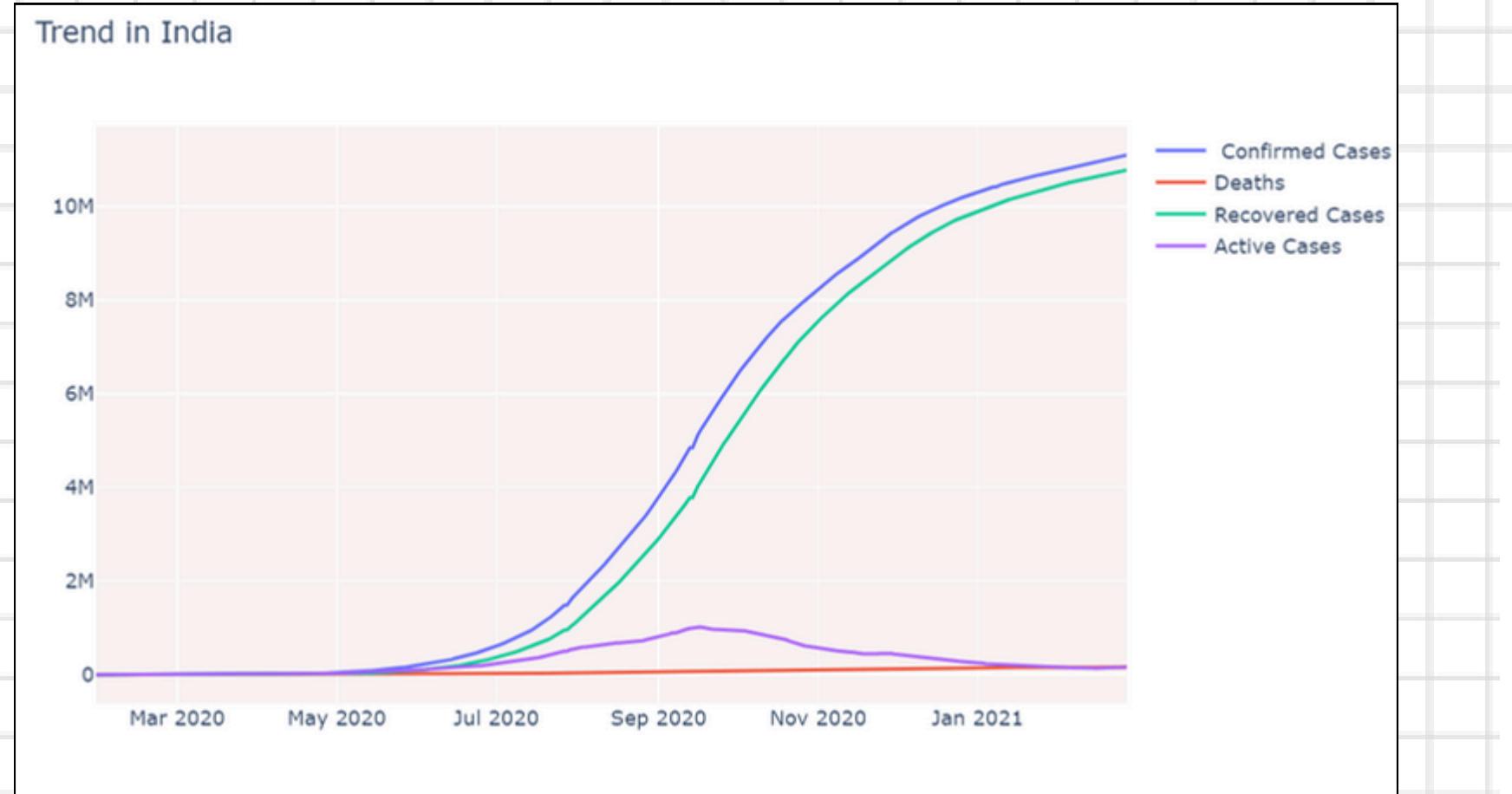
### 2.4. Active Cases

- Active cases peaked around September–October 2020 and then began to decline steadily through early 2021.



The decline reflects increasing recoveries and possibly fewer new infections due to better control measures.

Let's visualize this in a single graph for comparison



- India experienced a **major surge** in COVID-19 cases from **mid to late 2020**.

- However, by **early 2021**, the situation showed **signs of improvement** and control, with recovery rates rising and active cases decreasing.

- **Effective Medical Response**



**Strong natural immune response among the population**

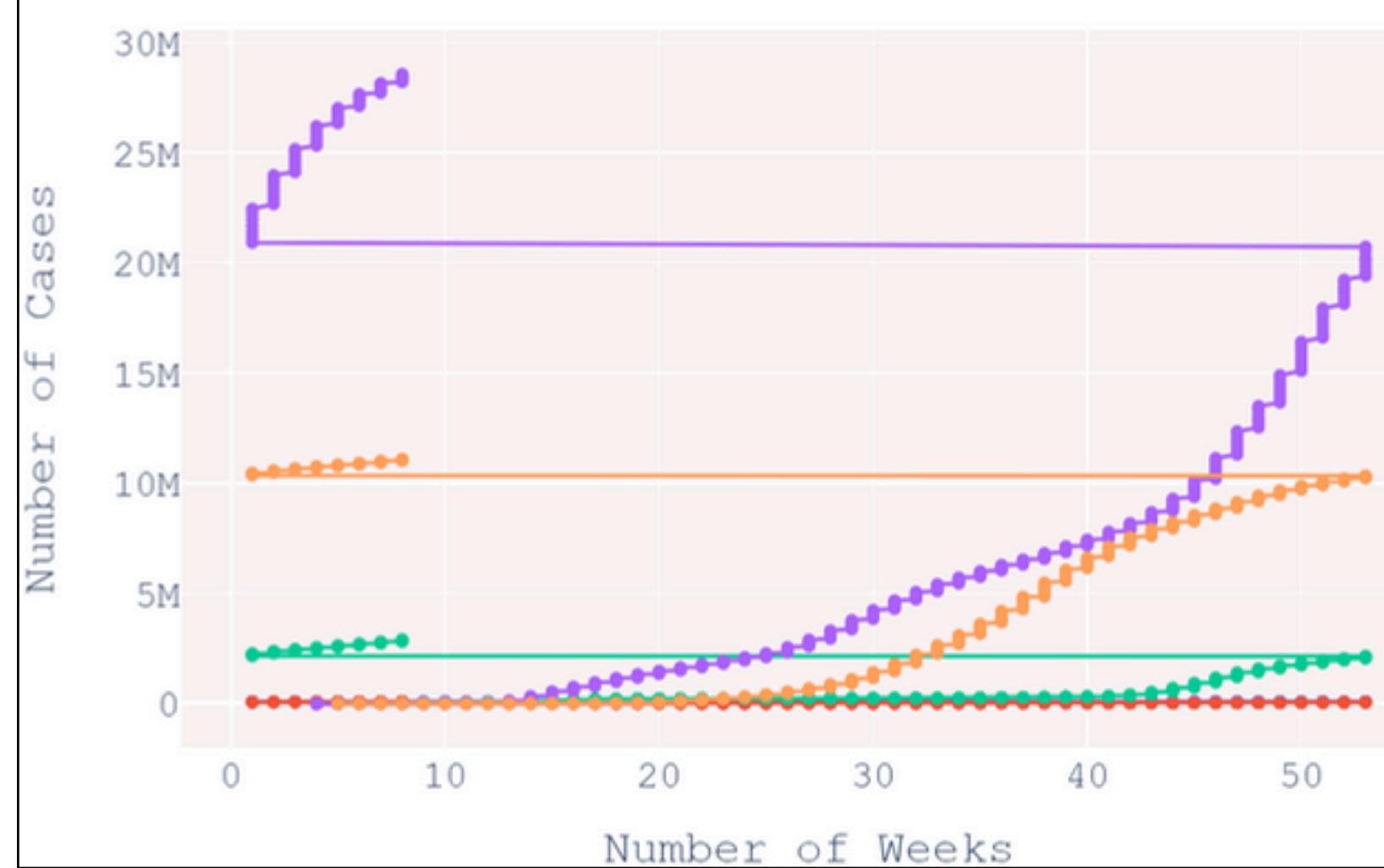
The significant gap between confirmed and death cases - Indicating **Low Fatality Rate**

# COMPARISON

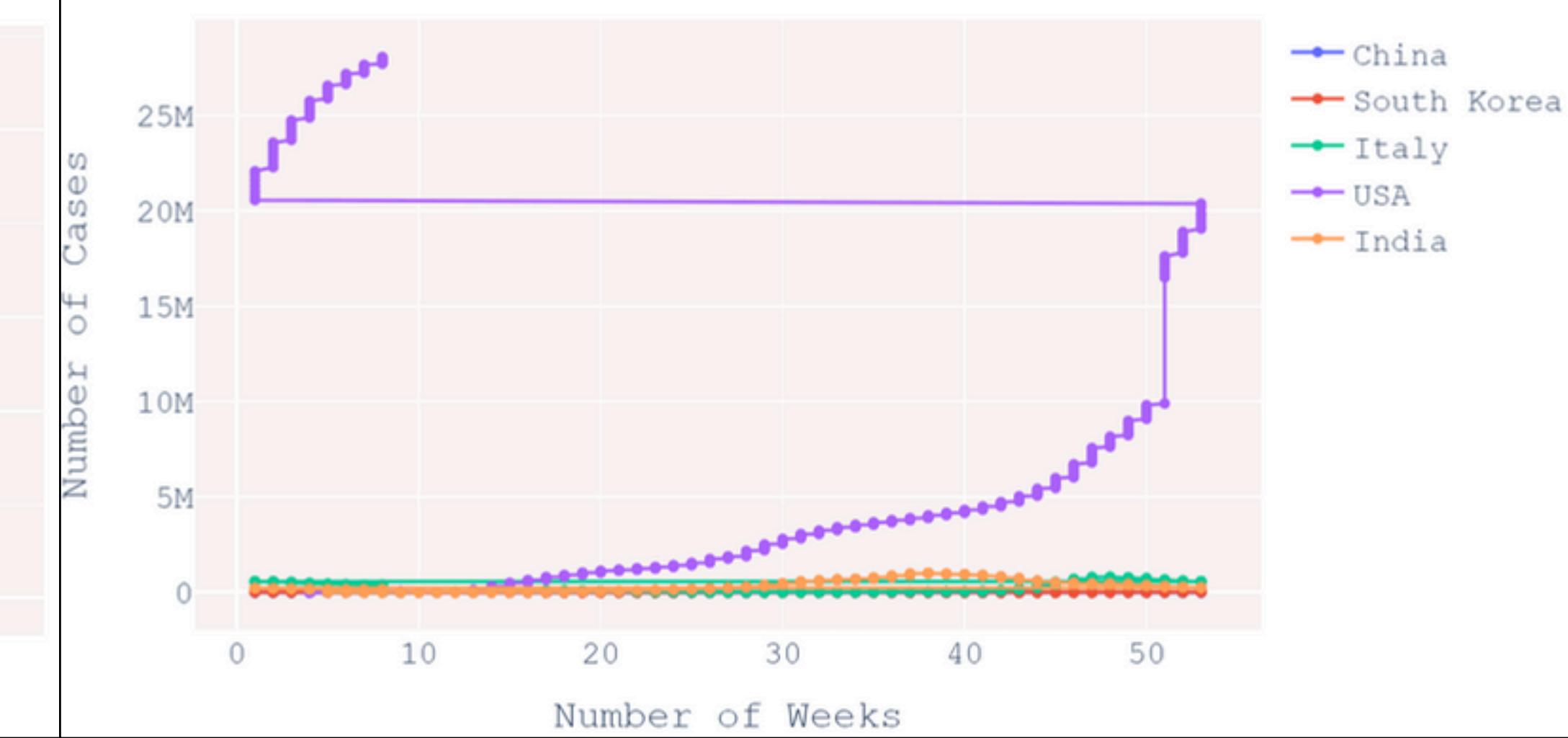


# Confirmed Cases and Active Cases Comparison

Confirmed Cases Across Countries in Weeks



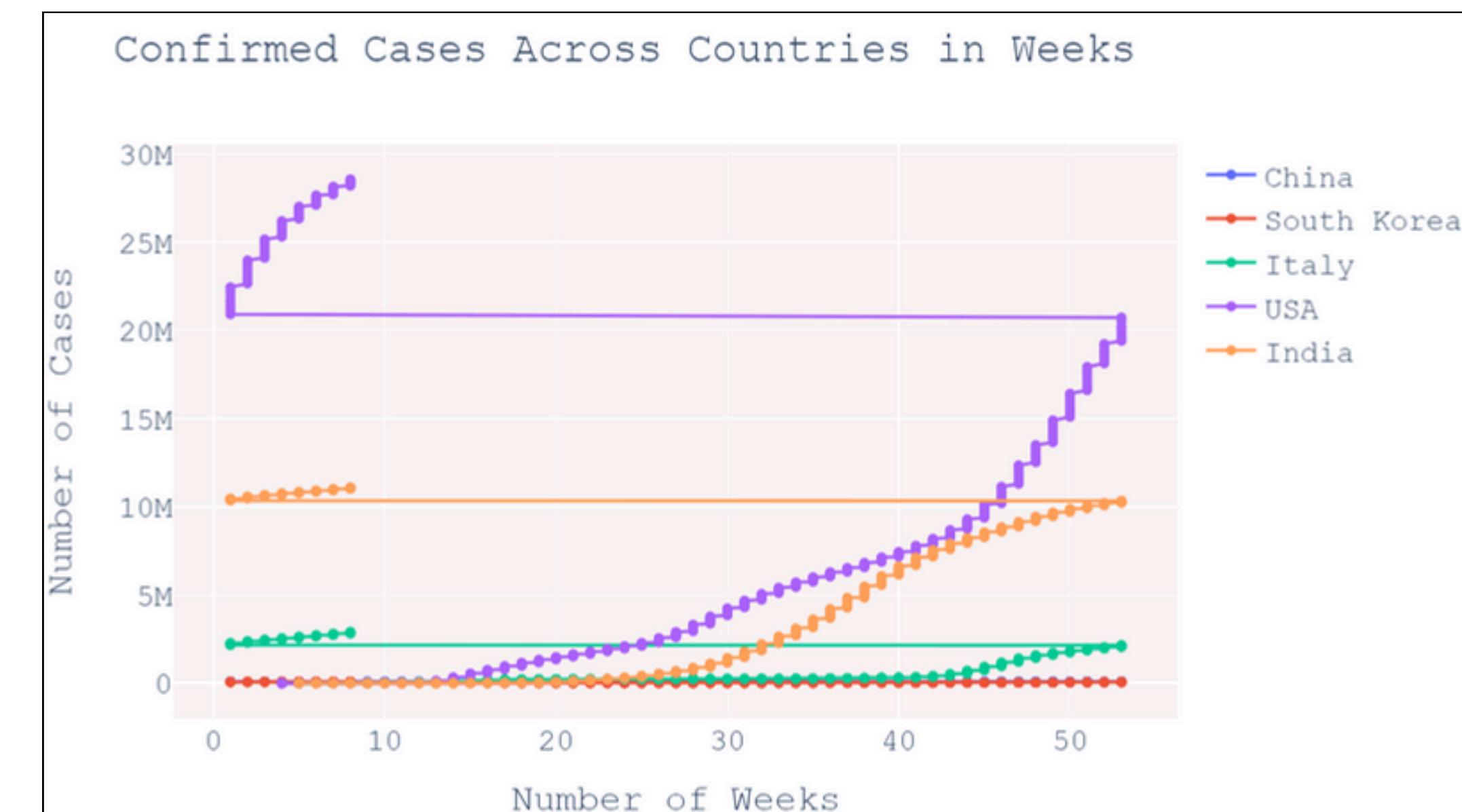
Active Cases Across Countries in Weeks



# Confirmed Cases and Active Cases Comparison



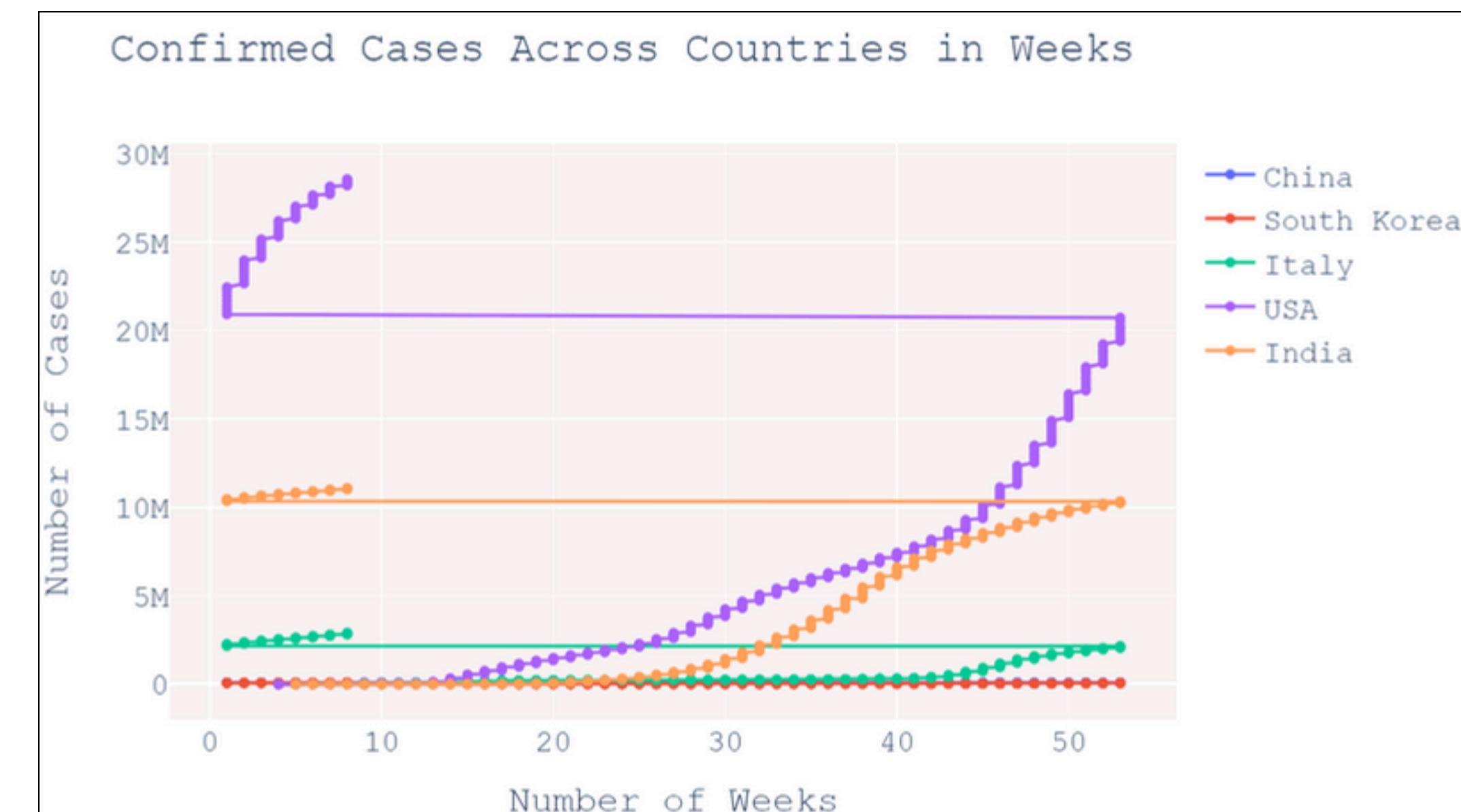
- Intial weeks, there was a **surge in Confirmed cases.**
- After 4th week of reporting intial cases (#8 at x-axis in above graphs), **Active cases** started declining.



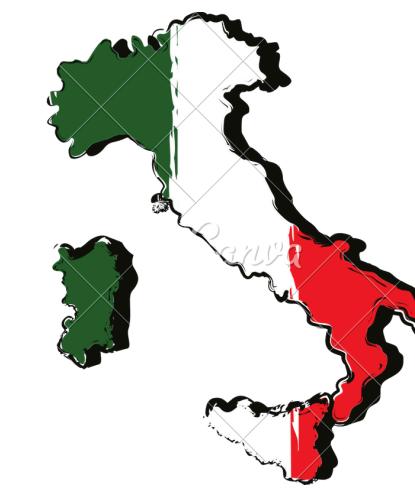
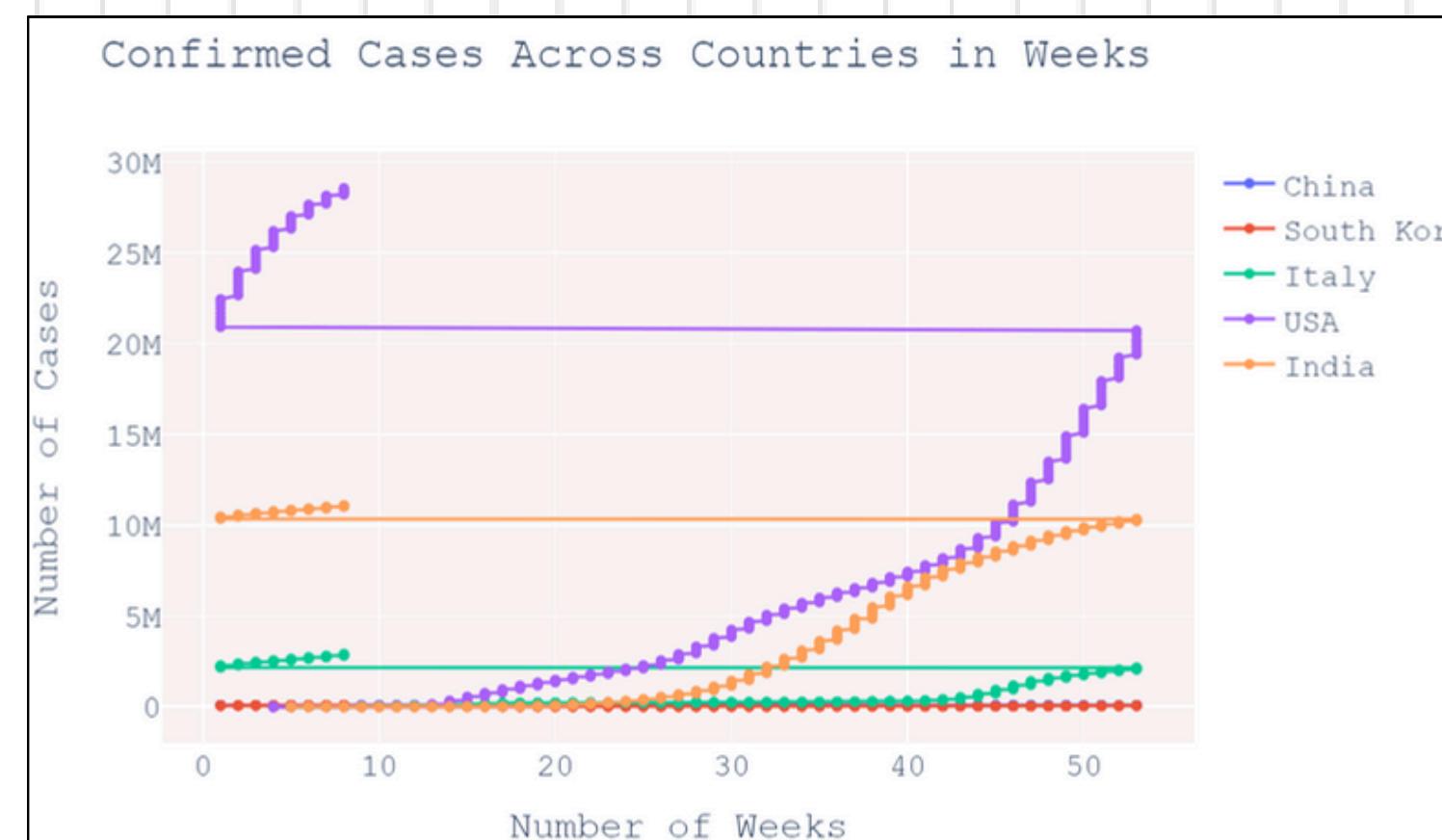
# Confirmed cases and Active cases Comparison



- After 4th week of reporting initial cases (#11 at x-axis in above graph), Confirmed cases were not increasing much and Active cases were declining slowly.



# Confirmed cases and Active cases Comparison



- After 7th week of reporting initial cases (#11 at x-axis in above graph), there was **sudden surge in Confirmed cases** and this is rapidly increasing week by week
- Observing each **\*\*Week Steps Height\*\*** in above graphs, which is quite **high** for US/Italy as compare to China/South Korea)

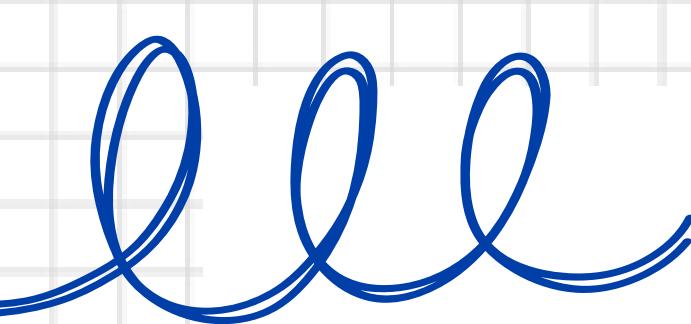
# Confirmed cases and Active cases Comparison



- Were not very high.
- A noticeable **surge** after the 7th week since the initial cases were reported (*around point #11 on the x-axis in the graph*).
- Still, this increase was **significantly lower** compared to the surges seen in Italy and the US.

# CONCLUSION





# Conclusion

## Effective Management

### China & South Korea

- ✓ Successfully controlled the spread of COVID-19 by implementing early preventive measures: Lockdown, Social Distancing, Mass Testing...

- ✓ Significant drop in active cases after the fourth week of initial cases

### India

- ✓ Relatively low death rates

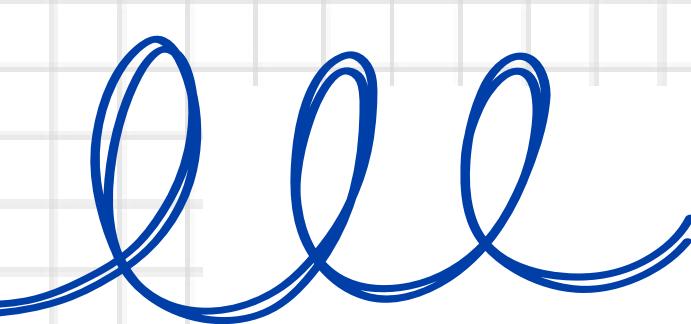
## Ineffective Management

### Italy & USA

- ✗ Polynomial Regression trend in confirmed and active cases, indicating rising numbers.

- ✗ Absence of nationwide lockdown, focusing only on high-risk areas

- ✗ Delayed Action: 7-week gap between initial cases and surge, with no significant actions taken



# Conclusion



**TIMING IS EVERYTHING.  
THE EARLIER A COUNTRY ACTS, THE  
EASIER IT IS TO CONTAIN  
EXPONENTIAL GROWTH**

# What should governments do to deal with a global health crisis?

1

## React Early, Not After the Surge



enforced lockdown by Jan 23 – before cases exploded.



launched mass testing in early February

**“Delays cost lives. Timing is everything.”**

2

## Widespread Testing and Active Contact Tracing

- South Korea controlled the outbreak without a full lockdown.
- Technology-powered tracing (apps, credit card logs, CCTV).

# What should governments do to deal with a global health crisis?

3

## Transparent Communication Builds Public Trust

- Regular updates, data dashboards, clear policies.
- People follow rules when they understand the risks.



4

## Targeted Social Distancing or Full Lockdowns

5

## Strengthen Healthcare Systems in advance

- Italy and the US suffered from overwhelmed hospitals.
- Preparedness reduces fatality rates.



**THANK YOU  
FOR LISTENING**