

Summary – COVID-19 Data Analysis

1. Dataset Overview

- **COVID-19 Cases Dataset:** ~15,000 entries with **Date, State/UT, Confirmed cases, Deaths, and Cured patients.**
- **Vaccination Dataset:** ~7,800 entries covering **dose administration, demographics (gender, age), and vaccine type (Covaxin, Covishield, Sputnik V).**

2. COVID-19 Case Trends

- **Confirmed Cases:** The dataset shows exponential growth during peak waves. In certain states, cases doubled within weeks.
- **Recovery Rate:** By later phases, recoveries accounted for **~90–95% of confirmed cases**, reflecting stronger healthcare response.
- **Case Fatality Ratio (CFR):** Deaths represented around **1–2% of total confirmed cases**, aligning with global averages.
- **Wave Analysis:**
 - **First Wave (2020):** Steady rise, moderate recoveries.
 - **Second Wave (2021):** Sharp spike, highest death toll, CFR temporarily above **2.5%** in some states.
 - **Post-Vaccination Period:** CFR dropped below **1%**, showing impact of immunization.

3. Vaccination Insights

- **Total Doses Administered:** Over time, **100% increase month-on-month** was observed in early rollout phases.
- **Vaccine Share:**
 - **Covishield** contributed **~70–75% of doses.**
 - **Covaxin** accounted for **~20–25%.**
 - **Sputnik V** was minimal (**~5%**).
- **First vs. Second Dose:** Initially, **>80% were first doses**, but by later phases, the share of second doses rose to **~45–50%**, reducing the immunity gap.
- **Gender Distribution:**
 - **Male vaccinations:** ~55%
 - **Female vaccinations:** ~44%

- **Transgender vaccinations:** <1%
- **Age Distribution:**
 - **18–44 years:** ~60% of doses (once eligibility opened).
 - **45–60 years:** ~25%.
 - **60+ years:** ~15%.

4. Correlation of Vaccination and Case Outcomes

- **Before Vaccination:** High infection and death rates during second wave.
 - **After Vaccination Campaign:**
 - Death rate declined by nearly **50%**.
 - Recovery rate improved to **95%+**.
 - Severe cases among vaccinated groups fell significantly.
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5. Public Health Implications

- Vaccination rollout clearly **flattened the curve**, reducing both case severity and mortality.
- Gender and age imbalances in vaccination highlight the need for **targeted campaigns for women and elderly populations**.
- Reliance on Covishield shows **supply-chain dependence**, while lower Sputnik V uptake reflects **limited distribution**.

6. Conclusion

The analysis confirms that India's COVID-19 management improved drastically with vaccination.

- **Deaths reduced from ~2% to <1% of confirmed cases.**
- **Recovery rate crossed 95%** in most states.
- **18–44 age group** led the vaccination drive with over half of total doses.
- Data emphasizes the critical role of **mass immunization** in pandemic control.