# Conduct Product Market Fit Research for Air Purifier Development Using AQI Analytics

A Resume Project Challenge Co-powered by

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# PROBLEM STATEMENT

**AirPure Innovations** is a startup born out of the air quality crisis in India, with 14 cities ranking among the world's top 20 most polluted urban centers. The company is in the early stages of product development and is unsure whether there is a strong, sustained demand for its air purifier product.

Before committing to production and R&D, they need to answer critical questions:

1. What pollutants or particles should their air purifier target?
2. What are the most essential features that should be incorporated into the air purifier?
3. Which cities have the highest demand for air purifiers, and what is the market size in these regions?
4. How can R&D be aligned with localized pollution patterns?
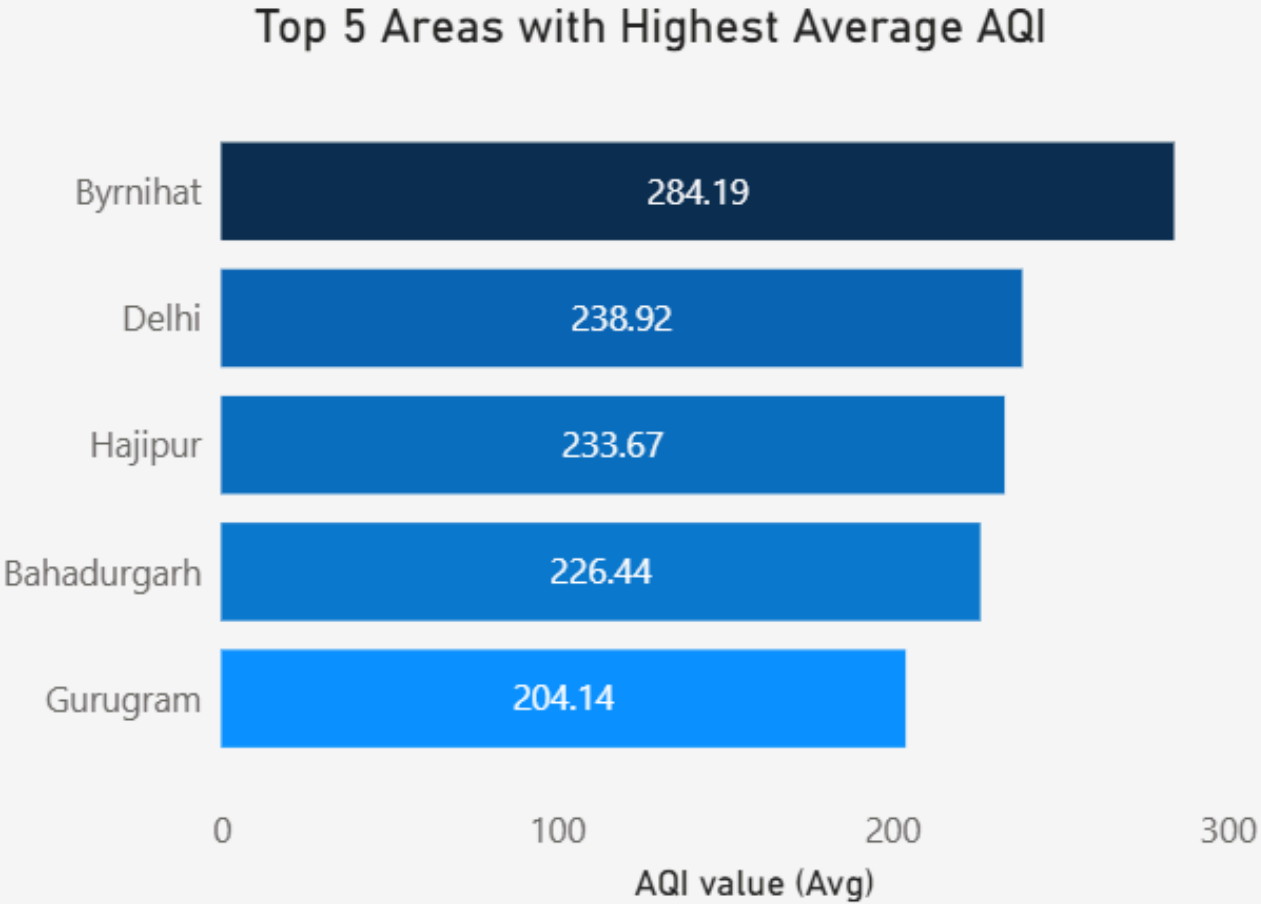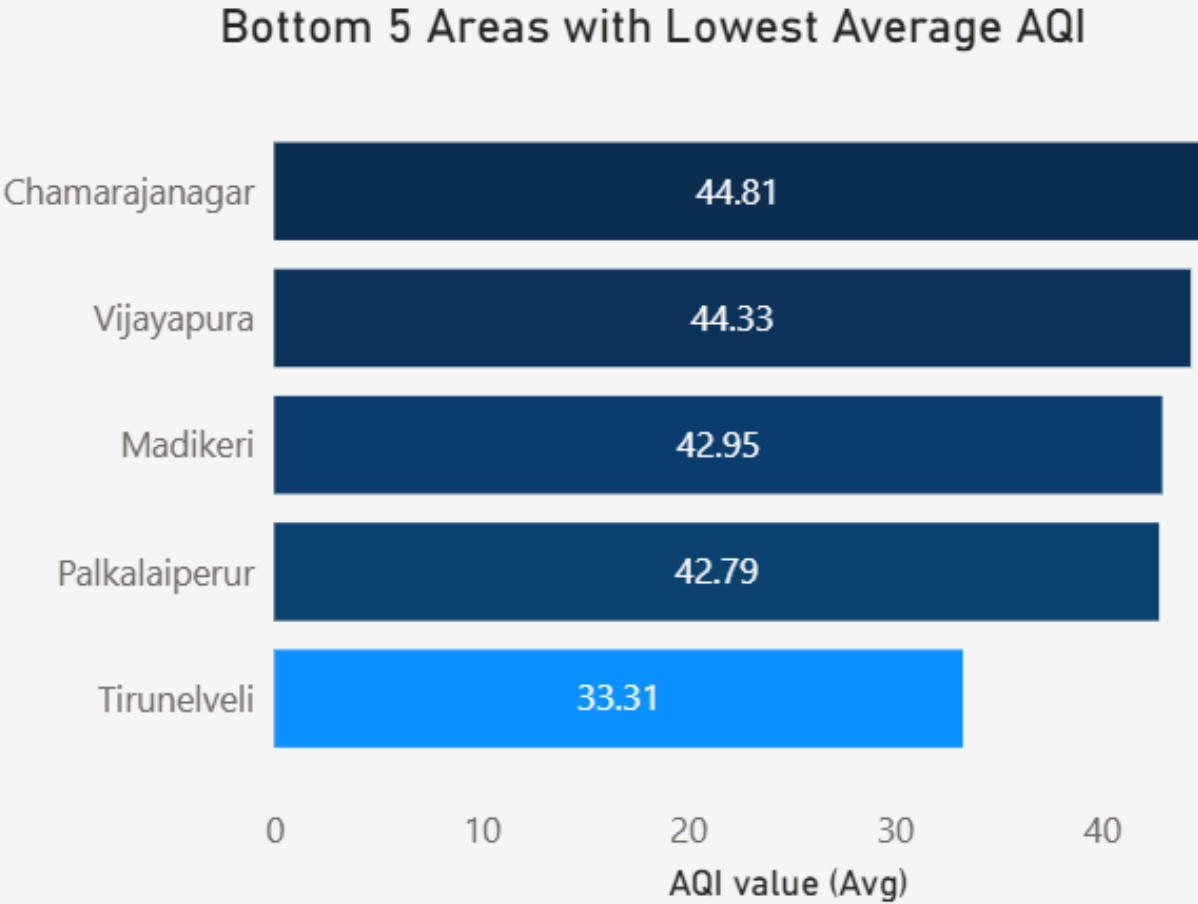
# INFORMATION GATHERING

To gain insights about the market a reliable dataset platform Dataful is used which provides a real time AQI dataset.
Below are the datasets used for analysis :

- Day-wise, State-wise Air Quality Index (AQI) of Major Cities and Towns in India

- State, District, and Disease-wise Cases and Deaths reported due to Outbreak of Diseases as per Weekly reports under IDSP

- State, Vehicle Class and Fuel Type-wise Total Number of Vehicles Registered in Each Month in India

- Population Projection of India: State- and Gender-wise Yearly Projected Urban Population (2011-2036)

# PRIMARY ANALYSIS

# List the top 5 and bottom 5 areas with highest average AQI. (Consider areas which contains data from last 6 months: December 2024 to May 2025)



**Bottom 5 Areas with Lowest Average AQI**

| Area | AQI value (Avg) |
|------|-----------------|
| Chamarajanagar | 44.81 |
| Vijayapura | 44.33 |
| Madikeri | 42.95 |
| Palkalaiperur | 42.79 |
| Tirunelveli | 33.31 |

**Top 5 Areas with Highest Average AQI**

| Area | AQI value (Avg) |
|------|-----------------|
| Byrnihat | 284.19 |
| Delhi | 238.92 |
| Hajipur | 233.67 |
| Bahadurgarh | 226.44 |
| Gurugram | 204.14 |

# List out top 2 and bottom 2 prominent pollutants for each state of southern India. (Consider data post covid: 2022 onwards)

## Top 2 Prominent Pollutants of Southern States

| Southern state | Prominent Pollutants | Pollutant Count |
|---|---|---|
| Andhra Pradesh | PM10 | 3606 |
| Andhra Pradesh | PM2.5 | 2244 |
| Karnataka | CO | 3456 |
| Karnataka | PM10 | 14572 |
| Kerala | PM10 | 3538 |
| Kerala | PM2.5 | 1344 |
| Puducherry | O3 | 303 |
| Puducherry | PM10 | 413 |
| Tamil Nadu | PM10 | 7187 |
| Tamil Nadu | PM2.5 | 3016 |
| Telangana | PM10 | 1002 |
| Telangana | PM2.5 | 590 |

## Bottom 2 Prominent Pollutants of Southern States

| Southern state | Prominent Pollutants | Pollutant Count |
|---|---|---|
| Karnataka | SO3 | 1 |
| Kerala | SO2 | 7 |
| Kerala | NH3 | 10 |
| Andhra Pradesh | SO2 | 11 |
| Tamil Nadu | NH3 | 11 |
| Karnataka | NH3 | 34 |
| Telangana | NO2 | 119 |
| Puducherry | CO | 148 |
| Telangana | O3 | 152 |
| Puducherry | PM2.5 | 206 |
| Andhra Pradesh | NO2 | 259 |
| Tamil Nadu | NO2 | 500 |

Does AQI improve on weekends vs weekdays in Indian metro cities (Delhi, Mumbai, Chennai, Kolkata, Bengaluru, Hyderabad, Ahmedabad, Pune)? (Consider data from last 1 year)
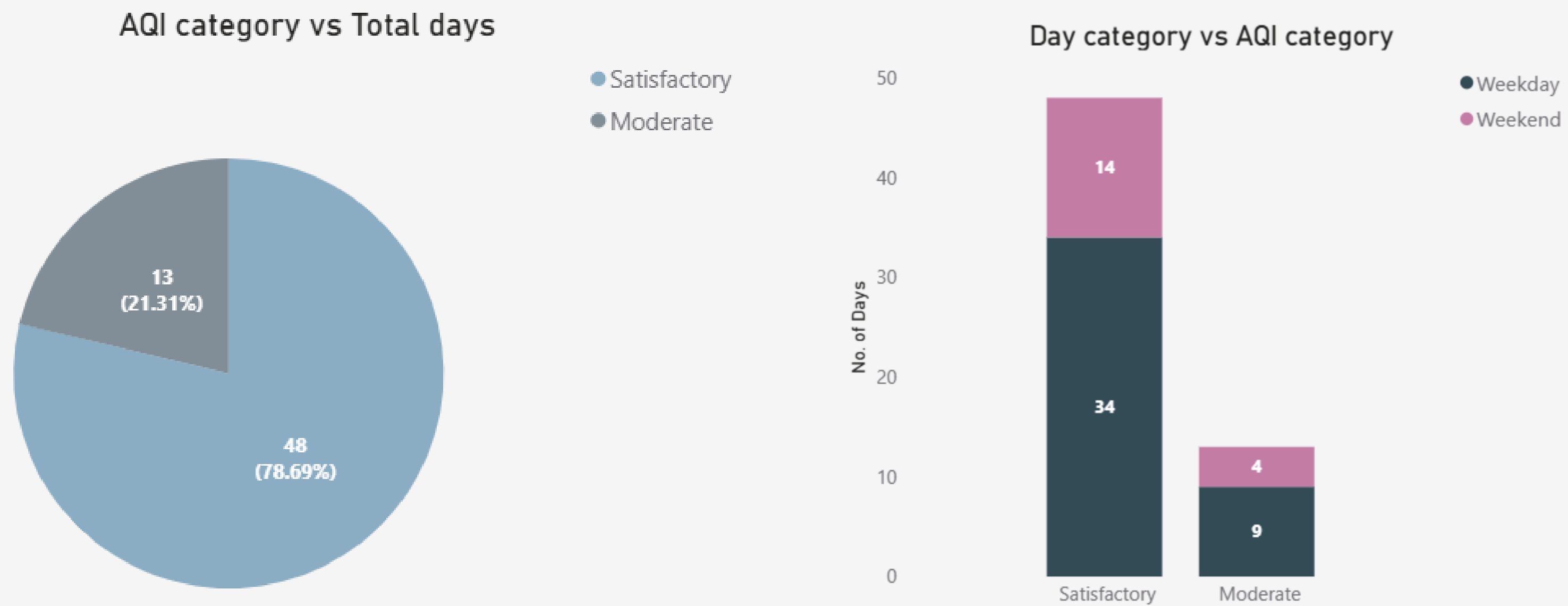


AQI Improvement on Weekends vs Weekdays in Indian Metro Cities
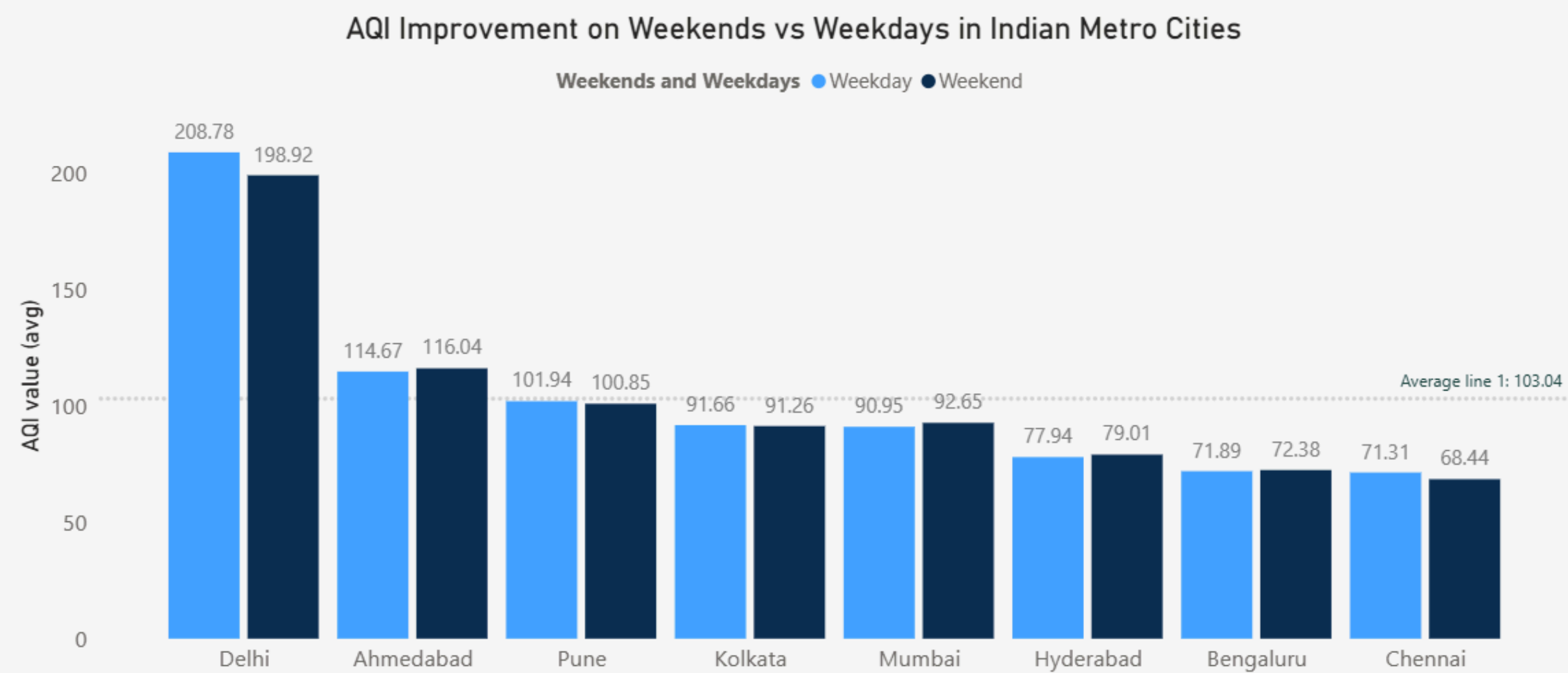
# Which months consistently show the worst air quality across Indian states ? (Consider top 10 states with high distinct areas)

| State | AQI value (avg) | Total Distinct Areas | Worst Months |
|---|---|---|---|
| Bihar | 157.16 | 25 | December, January, November |
| Haryana | 140.85 | 25 | November |
| Rajasthan | 127.99 | 34 | November, December, January |
| Uttar Pradesh | 126.42 | 20 | November, December, January |
| Odisha | 124.88 | 16 | January, December, November |
| Madhya Pradesh | 108.72 | 15 | November, December, January |
| Maharashtra | 103.64 | 31 | November, January, December |
| Andhra Pradesh | 77.51 | 9 | January, December, November |
| Tamil Nadu | 67.76 | 26 | January, February, December |
| Karnataka | 62.67 | 27 | February, January, November |

# For the city of Bengaluru, how many days fell under each air quality category (e.g., Good, Moderate, Poor, etc.) between March and May 2025?



## AQI category vs Total days

- Satisfactory
- Moderate

13 (21.31%)

48 (78.69%)

## Day category vs AQI category

- Weekday
- Weekend

No. of Days

| | Satisfactory | Moderate |
|---|---|---|
| Weekend | 14 | 4 |
| Weekday | 34 | 9 |

# List the top two most reported disease illnesses in each state over the past three years, along with the corresponding average Air Quality Index (AQI) for that period.

| States | Average AQI | Disease 1 | Total cases 1 | Disease 2 | Total cases 2 |
|---|---|---|---|---|---|
| Delhi | 208.85 | Dengue | 40 | Measles | 0 |
| Jharkhand | 165.85 | Malaria | 5795 | Acute Diarrheal Disease | 1609 |
| Himachal Pradesh | 161.01 | Acute Diarrheal Disease | 2181 | Hepatitis A | 559 |
| Bihar | 153.26 | Acute Diarrheal Disease | 1316 | Fever with Rash | 830 |
| Chandigarh | 145.12 | Cholera | 16 | '- | 0 |
| Haryana | 136.86 | Cholera | 972 | Acute Diarrheal Disease | 696 |
| Assam | 116.73 | Acute Diarrheal Disease | 2683 | Food Poisoning | 1984 |
| Gujarat | 109.19 | Acute Diarrheal Disease | 4826 | Food Poisoning | 3008 |
| Madhya Pradesh | 108.76 | Acute Diarrheal Disease | 5752 | Dengue | 2207 |
| Chhattisgarh | 79.58 | Acute Diarrheal Disease | 7818 | Cholera | 745 |
| Andhra Pradesh | 78.53 | Acute Diarrheal Disease | 3189 | Cholera | 1081 |
| Jammu And Kashmir | 69.71 | Dengue | 1474 | Hepatitis A | 1140 |
| Kerala | 69.43 | Food Poisoning | 9342 | Acute Diarrheal Disease | 4756 |
| Karnataka | 63.51 | Acute Diarrheal Disease | 6332 | Cholera | 3616 |
| Andaman And Nicobar Islands | 57.71 | Acute Diarrheal Disease | 94 | Fever with Rash | 8 |
| Arunachal Pradesh | 55.96 | Acute Diarrheal Disease | 290 | Mumps | 133 |

| States | Average AQI | Disease 1 | Total cases 1 | Disease 2 | Total cases 2 |
|---|---|---|---|---|---|
| Maharashtra | 103.44 | Acute Diarrheal Disease | 6815 | Food Poisoning | 4558 |
| Manipur | 107.44 | Dengue | 3072 | Food Poisoning | 173 |
| Meghalaya | 73.54 | Measles | 586 | Chickenpox | 318 |
| Mizoram | 51.52 | Food Poisoning | 361 | Scrub Typhus | 233 |
| Nagaland | 83.43 | Dengue | 1244 | Acute Diarrheal Disease | 72 |
| Odisha | 124.6 | Acute Diarrheal Disease | 5495 | Cholera | 3427 |
| Puducherry | 56.65 | Acute Diarrheal Disease | 80 | Dengue | 72 |
| Punjab | 117.09 | Acute Diarrheal Disease | 889 | Cholera | 715 |
| Rajasthan | 128.22 | Acute Diarrheal Disease | 1185 | Dengue | 836 |
| Sikkim | 59.2 | Jaundice | 136 | Typhoid | 111 |
| Tamil Nadu | 68 | Acute Diarrheal Disease | 3028 | Mumps | 1430 |
| Telangana | 81.91 | Acute Diarrheal Disease | 604 | Food Poisoning | 41 |
| Tripura | 143.62 | Acute Diarrheal Disease | 390 | Dengue | 259 |
| Uttar Pradesh | 123.69 | Acute Diarrheal Disease | 4140 | Food Poisoning | 2303 |
| Uttarakhand | 88.1 | Dengue | 1092 | Acute Diarrheal Disease | 626 |
| West Bengal | 117.82 | Acute Diarrheal Disease | 3276 | Food Poisoning | 2360 |

# List the top 5 states with high EV adoption and analyse if their average AQI is significantly better compared to states with lower EV adoption.

## Higher EV Adoption States

| State | Total Registration EV Vehicles | Average AQI |
|---|---|---|
| Rajasthan | 305605 | 127.99 |
| Uttar Pradesh | 921471 | 126.42 |
| Maharashtra | 650823 | 103.64 |
| Tamil Nadu | 329634 | 67.76 |
| Karnataka | 480191 | 62.67 |

| EV Adoption of States with Higher AQI value | EV Adoption of States with Lower AQI value |
|---|---|
| **101.27** | **119.53** |

## Lower EV Adoption States

| State | Total Registration EV Vehicles | Average AQI |
|---|---|---|
| Bihar | 280947 | 157.16 |
| Gujarat | 251194 | 110.63 |
| Delhi | 245938 | 206.42 |
| Madhya Pradesh | 238701 | 108.72 |
| Kerala | 226600 | 68.07 |
| Assam | 183428 | 114.12 |
| Odisha | 153213 | 124.88 |
| Andhra Pradesh | 128600 | 77.51 |
| Chhattisgarh | 117666 | 78.99 |
| Haryana | 115076 | 140.85 |
| Punjab | 100630 | 117.85 |
| West Bengal | 98668 | 114.19 |
| Jharkhand | 67695 | 164.94 |
| Uttarakhand | 55704 | 87.9 |

| State | Total Registration EV Vehicles | Average AQI |
|---|---|---|
| Jammu and Kashmir | 30785 | 69.5 |
| Tripura | 22631 | 126.7 |
| Chandigarh | 17888 | 141.56 |
| Puducherry | 10136 | 56.51 |
| Himachal Pradesh | 4963 | 160.26 |
| Manipur | 1394 | 100.93 |
| Meghalaya | 1175 | 62.73 |
| Mizoram | 1095 | 47.25 |
| Arunachal Pradesh | 195 | 54.49 |
| Andaman and Nicobar Islands | 165 | 57.71 |
| Nagaland | 84 | 80.46 |
| Sikkim | 29 | 53.69 |

States EV Adoption vs Average AQI
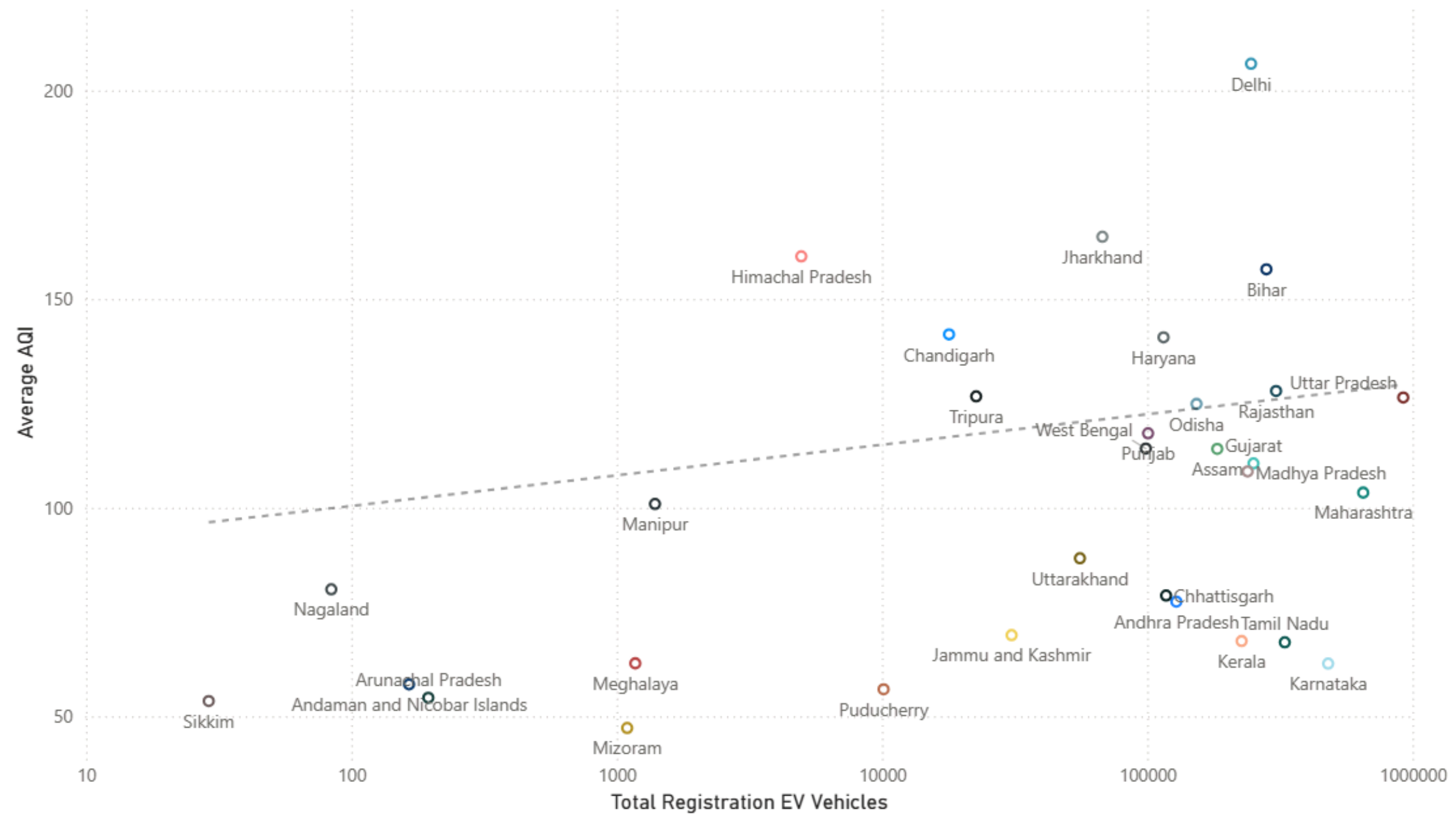
# SECONDARY ANALYSIS

# Which age group is most affected by air pollution-related health outcomes — and how does this vary by city?

**Source 1: Air Pollution and Mortality in India: Investigating the Nexus of Ambient and Household Pollution Across Life Stages ( Research paper )**

This report examines the adverse health effects of PM2.5 pollutants originating from household kitchens in India. Analysis indicates that in urban areas, every 10-unit rise in PM10 levels is associated with a 6% increase in neonatal mortality and an 8% rise in premature deaths.

Geographical Distribution of PM2.5 Concentrations
High levels: The Indo-Gangetic Plain, including the National Capital Region (NCR) and parts of southern West Bengal.
Low levels: Northern high-elevation states such as Arunachal Pradesh, Sikkim, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, and Ladakh, as well as Kerala, western Karnataka, and selected southern districts of Tamil Nadu.

**Source 2: Times of India Report - Air Pollution Impact on Young children in India**

Air pollution has been identified as the second most significant health risk factor in India, following hypertension. According to the State of Global Air (SoGA) 2024 ( by an US based organization Health Effects Institute ) in 2021, an estimated 2.1 million deaths in India were attributable to air pollution, out of a global total of 8.1 million.

Health Impacts in 2021

- Cardiovascular diseases: 40% of heart disease deaths are linked to air pollution.
- Respiratory diseases: 33% of lung cancer deaths and 70% of chronic obstructive pulmonary disease (COPD) deaths associated with air pollution.
- Metabolic diseases: 20% of type 2 diabetes deaths related to air pollution exposure.
- Neurological impacts: 41% of stroke deaths connected to air pollution.

Impact on Children
In 2021, over 700,000 deaths among children under five years of age were attributed to air pollution. Pneumonia and asthma were identified as the most prevalent illnesses affecting children in this age group.

# Who are the major competitors in the Indian air purifier market, and what are their key differentiators (e.g., price, filtration stages, smart features)?

| | | | Major Competitors of Air Purifiers in India | | | |
|---|---|---|---|---|---|---|
| Brand | Coverage area (Sq.ft) | Category | Filtration stages | Smart Features | Price Ranges (In Rupees) | Product name |
| Eureka Forbes | 200 - 500 | • Quick Cleaning & Ionization<br>• Living Rooms upto 480 sq. ft.<br>• Bedrooms | Pre-Filter + Activated Carbon Filter + True H13 HEPA Filter + Plasma Filter | • WiFi Enabled<br>• PM 2.5 value Digital Display<br>• Activated Carbon Filter<br>• Purifies air within 10 mins | Rs. 500 - Rs 20K | Eureka Forbes Smart Air Purifier 355 |
| Philips Smart Air Purifier AC1715 | 300 - 800 | Medium and Large Rooms, Workspace | Pre-Filter + Nano Protect HEPA Filter + Carbon Filter | • Sleep Mode<br>• Real Time AQI display<br>• Shows PM2.5 level in numerical form<br>• Long Lasting filters upto 3 yrs | Rs. 22K - 32K | Philips Air Purifier 1000i Series |
| Dyson Purifier Hot+Cool Gen1 (Black/Nickel) | 400 - 650 | • Livings Rooms<br>• Small Conferences<br>• Bedroom | HEPA H13 Filter + Activated Carbon + Formaldehyde Filter | • Night Mode<br>• Real Time AQI value<br>• Oscillation & Air Projection(350 deg rotation) | Rs. 33K - Rs. 68K | Dyson Purifier Big+Quiet |
| Honeywell | 235 - 1000 | Home and Office Purifiers , Car Purifiers | Anti-Bacterial Filter ( Silver Ion ) + Anti H1N1 Layer + H13 HEPA Filter + Cold Catalyst + Activated Carbon Filter | • Purifies air every 12 mins<br>• Real time AQI display<br>• 9000 Hrs Filter life<br>• Alexa control<br>• Wifi + Smart app control | Rs. 5K - Rs. 28K | Honeywell Air Touch U2 |
| Blue Star | 299 - 915 | Home Purifiers | High Density Pre - Filter + H13 HEPA Filter + Active Carbon Filter + Microbe DeActive Filter ( To deactivate air borne microbes) | • Real Time AQI display<br>• Alert for filter change<br>• Child Lock<br>• Sleep Mode | Rs. 8K - Rs. 27K | Blue Star AP700DAI |

What is the relationship between a city's population size and its average AQI — do larger cities always suffer from worse air quality? (Consider 2024 population and AQI data for this)



Total Population in 2024 by AQI value (avg) and State
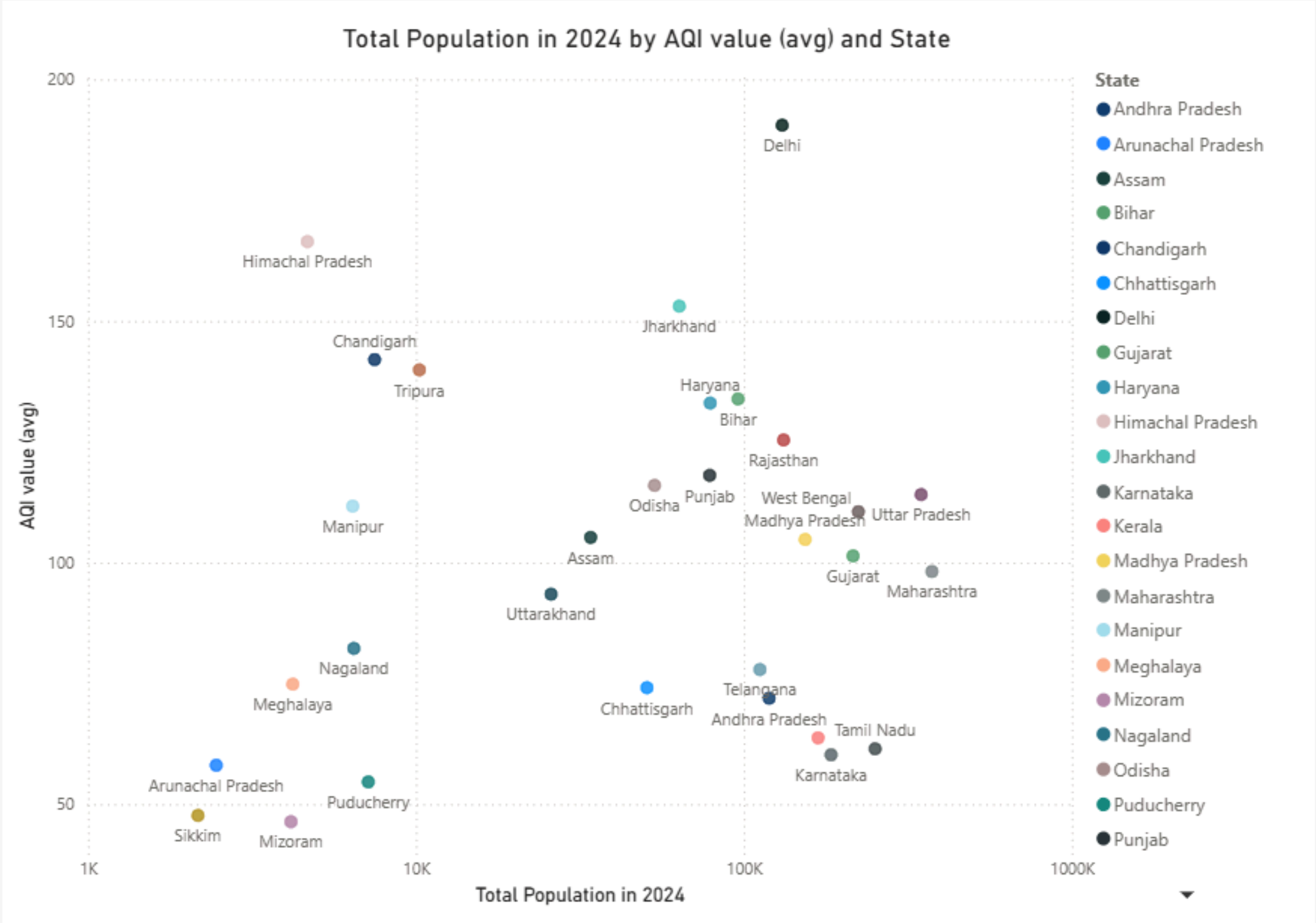
| State | Total Population in 2024 | AQI value (avg) |
|---|---|---|
| Andhra Pradesh | 119394 | 71.95 |
| Arunachal Pradesh | 2460 | 58.08 |
| Assam | 34097 | 105.23 |
| Bihar | 95956 | 133.88 |
| Chandigarh | 7480 | 142.02 |
| Chhattisgarh | 50604 | 74.13 |
| Delhi | 130818 | 190.54 |
| Gujarat | 215160 | 101.41 |
| Haryana | 78904 | 133.03 |
| Himachal Pradesh | 4666 | 166.45 |
| Jharkhand | 63547 | 153.1 |
| Karnataka | 184409 | 60.24 |
| Kerala | 168352 | 63.75 |
| Madhya Pradesh | 153710 | 104.81 |
| Maharashtra | 374436 | 98.18 |

| State | Total Population in 2024 | AQI value (avg) |
|---|---|---|
| Manipur | 6413 | 111.69 |
| Meghalaya | 4210 | 74.87 |
| Mizoram | 4158 | 46.39 |
| Nagaland | 6467 | 82.26 |
| Odisha | 53376 | 116.01 |
| Puducherry | 7155 | 54.63 |
| Punjab | 78640 | 118.07 |
| Rajasthan | 132113 | 125.39 |
| Sikkim | 2163 | 47.7 |
| Tamil Nadu | 251217 | 61.48 |
| Telangana | 111856 | 77.89 |
| Tripura | 10238 | 139.9 |
| Uttar Pradesh | 346948 | 114.11 |
| Uttarakhand | 25826 | 93.49 |
| West Bengal | 223357 | 110.54 |

# How aware are Indian citizens of what AQI (Air Quality Index) means — and do they understand its health implications?

**Google Trends -**
Term: Todays AQI
Term: AQI near me

As per the problem statement the term AQI search in India was increased when a public figure named bryan johnson has left the podcast mid way due to bad AQI according to this report there is a surge in the web search of term AQI in each year between October to December.

Related queries they have search like
- weather aqi
- aqi delhi today
- air quality index delhi
- what is aqi in weather
- imd
- highest aqi ever recorded
- aqi of my location
- aqi near me

Which pollution control policies introduced by the Indian government in the past 5 years have had the most measurable impact on improving air quality — and how have these impacts varied across regions or cities?

## National Clean Air Program by Indian Goverment

- Ministry of Environment, Forest and Climate Change (MoEFCC) launched National Clean Air Programme (NCAP) in January, 2019
- Its aim was to improve air quality in 131 cities (non-attainment cities and Million Plus Cities) in 24 States/UTs by engaging all stakeholders.
- The programme goal was to achieve reductions up to 40% or achievement of National Ambient Air Quality Standards for Particulate Matter10 (PM 10) concentrations by 2025-26.

Below shows the report where government has used 2019-2020 average PM10 concentration value as a benchmark. The third column shows the PM10 concentration of 2021 - 2022 which tells that whether there is an improvement in the PM10 Level.

| State | Annual Average PM10 Concentration (2019-2020) ▼ | Actual Annual Average PM10 (2021 - 2022) |
|---|---|---|
| Uttar Pradesh | 197.20 | 144.50 |
| Delhi | 178.00 | 184.00 |
| Uttarakhand | 142.33 | 123.00 |
| Jammu & Kashmir | 134.00 | 126.00 |
| Rajasthan | 127.50 | 116.00 |
| Punjab | 102.29 | 97.14 |
| Bihar | 101.50 | 120.00 |
| Orissa | 100.29 | 92.29 |
| West Bengal | 100.00 | 125.50 |
| Meghalaya | 98.00 | 183.00 |
| Chandigarh | 88.00 | 92.00 |
| Tamil Nadu | 84.00 | 67.00 |
| Madhya Pradesh | 83.00 | 87.00 |
| Nagaland | 81.50 | 72.50 |
| Maharashtra | 80.11 | 70.11 |
| Himachal Pradesh | 77.29 | 77.29 |
| Karnataka | 73.67 | 65.33 |
| Assam | 72.80 | 76.00 |
| Telangana | 72.00 | 74.50 |
| Andhra Pradesh | 59.45 | 59.18 |
| Chhattisgarh | 47.00 | 60.00 |

# XV Finance Commission Air Quality Grant Scheme

- Funds Allocation: ₹16,539 crores allocated to 42 Million Plus Cities (MPCs) (including 7 Urban Agglomerations) for the period FY 2020–21 to FY 2025–26.
- Purpose: To implement City Specific Action Plans (CAPs) under the National Clean Air Programme (NCAP) for performance-based air quality improvement.
- Utilization Monitoring:
  - City-wise utilization of funds tracked and provided in Annexure–I.
  - Includes details of non-utilization by non-attainment cities.
- Resource Convergence:
  - Implementation of CAPs is also supported through convergence with other urban schemes, such as:
  - Swachh Bharat Mission (Urban)
  - AMRUT (Atal Mission for Rejuvenation and Urban Transformation)
  - Smart City Mission
  - SATAT (Sustainable Alternative Towards Affordable Transportation)
  - FAME II (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles)