Through the Smokescreen

Public Knowledge and Attitudes on Air Quality and Its Health Impacts in India

Vital Strategies

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Acknowledgments

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Executive Summary

More than 99% of India's population is exposed to air pollution levels higher than the World Health Organization's guidance of 10µg/m^3 annual mean for fine particulate matter ($PM_{2.5}$), contributing to more than 12 lakh (1.2 million) deaths each year from cardiovascular and lung diseases, diabetes, cancer and other health harms such as low birth weight. A concerted, multisectoral approach is needed to address this major health and environmental challenge. Public demand for effective, sustainable solutions will be a critical part of the solution. Influencing the public's understanding of air pollution begins with knowing about existing knowledge and perceptions of air quality and its impacts. Toward this end, Vital Strategies conducted research to: 1) examine social media conversations and news coverage of air pollution and health in South and Southeast Asia, including India, through a comprehensive scan of social media conversations and news coverage; and, subsequently, 2) survey residents' understanding and attitudes on air pollution, its leading sources, associated health effects, short- and long-term solutions, and support for governmental clean air policies in urban India. Taken together, results will help inform strategic communication efforts to build public support and government commitment for policies, laws, regulations and investments needed to more quickly improve air quality and protect public health.

"Through the Smokescreen" describes several key findings from this research:

While awareness of air pollution is high, there is a real disconnect between the reality of air pollution and what people, including governments and media professionals, talk and post about. Many studies have found that urban air pollution is more influenced by power plants, biomass burning in household and agriculture, industry, burning of fossil fuels and waste burning, than by trucks and automobiles, yet the bulk of media articles focused on air pollution from vehicular emissions. Most people get their information about air quality from TV and radio, and these platforms mention less significant sources of air pollution, such as vehicle emissions, more frequently than those that pose a greater threat.

Content on air pollution that mentioned climate change or children's health produce more engagement than content not mentioning these topics.

Methodology

Phase 1: Vital Strategies used a social intelligence analytic platform to collect and analyze social media conversations and news articles on air pollution and health between Jan. 1, 2015 and Oct. 14, 2018. Multiple media platforms (Facebook, Twitter, Instagram, news media, blogs, etc.) were scanned for specific keywords related to air pollution. A sample of 82,235 pieces of media content from India, representing 20% of all social media and news articles, were collected and analyzed.

Phase 2: Vital Strategies led focus groups and conducted household surveys to assess general perceptions of air pollution:

- Eight focus group discussions were conducted in three cities (Delhi, Mumbai and Patna).
- In-person interviews using a standardized survey instrument were conducted with 2,340 adult residents of five cities—Delhi, Mumbai, Bengaluru, Surat and Patna—to assess knowledge, attitudes and support regarding air pollution across five cities in India with varying leading sources of air pollution.

Awareness of particulate matter is low, despite its being the pollutant of greatest health concern. Only about one in three respondents were familiar with this term.

The public's attention to air pollution is seasonal, with far more attention in the second half of the year as pollution levels rise due to agricultural burning and other seasonal factors. During other months, the volume of social media and news content on air pollution remains comparatively low, posing a challenge to maintain public demand year-round and sustain support for long-term solutions.

During peak air pollution episodes, online conversations tend to be about short-term measures to reduce exposure rather than long-term policy solutions. These include using a mask or air purifier, rather than more effective solutions such as clean energy, waste management and sustainable transportation.

Long-term solutions are gradually but steadily gaining attention, but demand for comprehensive solutions to address leading sources remain limited. Moreover, initiatives prioritized by survey participants to reduce air pollution do not align with the leading sources of pollution.

Conversations about solutions to air pollution are more focused on short-term symptoms than on long-term health risks. People tend to discuss acute symptoms of air pollution, such as eye and throat irritation, rather than the impact on chronic lung and cardiovascular disease, which is the more serious health threat. Starting in 2018, there is a trend toward more of a focus on chronic disease.

In summary, misperceptions of air pollution are widespread, and this can result in ineffective action taken against the issue. Social media is an increasingly important way for people to access news and share beliefs and perceptions. Depending on the reliability of the information shared, social media can either raise awareness or reinforce misperceptions. Understanding the present state of discourse about air pollution in news and social media, as well as the current knowledge and attitudes about air pollution support in India, is an important step in designing communication strategies for promoting fact-based reporting and data-based clean air action that will improve air quality.

Recommendations

Based on these key findings and existing studies on perceptions of air pollution, "Through the Smokescreen" offers the following recommendations. These can be used to guide effective communication to bridge current information gaps, align reality with public and media discourse and any resulting government action, and promote support for sustained clean air action.

Correct widespread misperceptions about air pollution: Media, government and nongovernmental organizations should cite proven data to describe air pollution and any feasible and effective solutions. In addition:

- News articles should cover proven sources of air pollution and long-term solutions. The news media should be encouraged and empowered to report on credible and relevant air pollution data, emphasizing known leading sources and sustainable solutions.
- Messages and campaigns should raise awareness on the risk of long-term health effects, such as chronic illnesses and death caused by long-term exposure to air pollution.
- Mentions of air quality should emphasize particulate matter and its associated health harms, as public recognition of this key pollutant and its impacts remains low.

Engage and motivate the public: Communication strategies should use tested messages, images and themes that resonate with people across various demographic groups.

- Conversations on climate change are effective in engaging people on air pollution.
- Stories and campaigns about air pollution and health should include messaging about lasting harm to children's health. The harms of air pollution on children's future physical and economic well-being is a theme that connects with the public on an emotional level and resonates with the media.
- Seasonal variations in air pollution conversations can be leveraged. The lull in discussions during the early months of the year creates an opportunity for campaigns that emphasize the need for proactive, sustained steps to reduce emissions before peak pollution season begins.

Inspire public demand for action on air pollution: Government policy on environmental issues is often in response to demand from civil society. As such, clean air implementers should create communication designed to generate and sustain public demand and political will. In addition, clean air implementers should:

- Educate the public on the limited effectiveness of short-term exposure prevention measures, as compared to long-term sustainable measures.
- Seek input from health care professionals and encourage them to educate patients and the public about air pollution-related illnesses.
- Highlight the value of collective actions and recognize the limited capacity of individual actions to influence air quality.

Many Indian organizations are actively communicating with the public about air pollution. For maximum impact, we recommend that communicators:

Identify and engage clean air influencers: Top influencers for air pollution discourse change yearly. Monitoring the public dialogue will allow stakeholders to identify and engage key influencers.

Conduct ongoing evaluation of shifts in media and public discourse: As air pollution conversations evolve, clean air implementors must monitor the media for misperceptions, fake news, and trends that can be leveraged into conversations that inform and drive public demand for policy solutions.

Evaluate impacts of clean air communication campaigns: Implementing a rigorous monitoring and evaluation process is key to measuring actual campaign impacts, as opposed to social media likes, comments or shares.

Engage clinicians and other health professionals on clean air advocacy: To correct misperceptions and encourage public demand for clean air, clinicians must be better informed about air pollution through workshops and a common platform where medical personnel may share information, such as Inspire: Health Advocates for Clean Air (www.InspireCleanAir.org).

Train journalists to interpret air pollution and health-related data and report on it: Media trainings by air pollution implementers and stakeholders would allow journalists to better understand the current air pollution landscape, access and interpret air quality and health data, and construct thoughtful, data-driven stories on air pollution.

Boost data transparency for the media and public: By sharing current data on air pollution, clean air stakeholders can increase collaboration and reduce hurdles required to accelerate progress on policy solutions and reduce the barriers to entry into media discourse.

Encourage effective policy solutions: Improving air quality ultimately requires legislation, regulation and enforcement. Polluting will continue unless there are compelling reasons to reduce emissions via positive and negative economic incentives, regulations that are equitably enforced, and public accountability.

Overview

More than 90% of the world's population breathes polluted air, making air pollution the leading global environmental cause of death and disease. In India, more than 12 lakh (1.2 million) people die from exposure to air pollution each year (1). India alone accounts for one-quarter of all global air pollution-related deaths. Beyond deaths, air pollution causes a substantial burden of lung and heart disease, contributes to diabetes, inhibits physical activity, and negatively influences children's physical and cognitive development (2–6).

Though public awareness of air pollution is rising, major gaps remain between scientific evidence and public perception of air pollution's causes, impacts and solutions. For example, the health burden and costs of air pollution are not widely understood among policymakers or the public. This is troubling, since public concern, particularly among certain key constituent groups, can play a pivotal role in galvanizing policymaker commitment to effective, science-based and long-term clean air action.

Sustaining political will for clean air requires demand by a public informed about the risks of air pollution, its main sources, its impacts, and the locally relevant solutions to reduce emissions. Yet, strategic efforts to accelerate clean air action have been hindered by limited public awareness, widespread misperceptions and insufficient demand for action.

To address air pollution in India, Vital Strategies has been working to acquire information on public understanding, attitudes and support toward clean air action, and to increase public demand and political will for actions that will promote clean air for health.

Figure 1
Methodology
Formative research on air pollution awareness to inform strategic communication for effective clean air action

Formative Research to Inform Clean Air Campaigns

As part of Vital Strategies' work to lay the groundwork for widespread, evidence-based strategic communication on air quality and its impacts, we used innovative research approaches to:

1. Assess public and media perceptions and discourse in South and Southeast Asia, through a comprehensive scan of social media conversations and news coverage of air pollution and health from 2015 to 2018, as described in the report "Hazy Perceptions." The India-specific results from that scan are presented within this report.
2. Assess the public's understanding and perceptions about air quality, through focus group discussions and household surveys in 2019 in five cities in India (Delhi, Mumbai, Bengaluru, Surat and Patna) to acquire essential baseline information about air pollution. This included information of the public's understanding of the leading sources of air pollution, attitudes toward exposure, knowledge of the health impacts, and support for governmental clean air policies.

The insights gained through our research can inform the design and implementation of communication campaigns on air pollution to:

1. educate the public and policymakers about the most meaningful sources of air pollution and their associated health impacts; and
2. build resolve for results-focused clean air action.

See Annex A for an overview of Vital Strategies' campaign framework.

Phase 1: Audience Perception and Media Scan

A 2017 study led by Vital Strategies on online media coverage of air pollution risks and policies showed that the majority of news stories about air pollution in India during 2014 and 2015 did not include information about the major health effects caused by air pollution and vulnerable populations affected, and often failed to acknowledge leading sources of air pollution, such as power plants and waste burning (7). This coverage is likely to affect the public and policymakers' perceptions of air pollution and its impacts and may result in ineffective clean air action.

To gain a better understanding of more recent public and media discourse on air pollution, we conducted a comprehensive scan of social media conversations and news coverage of air pollution and health during 2015 to 2018 in 11 South and Southeast Asian countries, including India, where several of the world's most polluted cities are located. The detailed methodology and comprehensive set of results have been published in Vital Strategies' "**Hazy Perceptions**" report. "Through the Smokescreen" focuses in-depth on the India-specific findings.

Approach

Vital Strategies used 20twenty, a comprehensive social intelligence platform designed by Circus Social, to track, collect, augment and integrate social, online and offline conversations on air pollution and health from Jan. 1, 2015 to Oct. 14, 2018. In brief, the approach involved the following steps:

Step 1: Identify air pollution-related keywords in relevant languages

Step 2: Define topics and subtopics, including: health impacts and symptoms; air pollution sources; exposure reduction; and solutions

Step 3: Scan publicly available social media channels and news to identify relevant content

Step 4: Remove irrelevant content

Step 5: Analyze the data

Specifically, we sought to identify:

What are common themes in air pollution conversations?

Which events have the most impact on the public and media discourse?

When do these conversations occur?

How has public discourse changed over time?

The answers to these questions are used to:

- Identify gaps in public understanding of air pollution and its sources, health impacts and solutions, as reflected in social media posts
- Identify gaps in news coverage as potential areas for increased awareness
- Inform strategic communication about air pollution to clear misconceptions in the public and media discourse to advance clean air policies

The extracted content was categorized into five main topics and 27 corresponding subtopics (See Table 1). For example: air pollution-related keywords (e.g., haze, smog, smoke) and source-related keywords (e.g., household cooking, power plants) are categorized under perceived sources of air pollution.

Keyword combinations were employed (using Boolean logic) to differentiate topics, solutions and sources, and the filtered content was then manually scanned to remove irrelevant content from further analysis. The Boolean keywords (and resulting Boolean statements) were translated into 13 languages: Bihari, English, Gujarati, Hindi, Konkani, Malayalam, Manipuri, Marathi, Mizo, Oriya, Punjabi, Tamil and Telugu.

The final, filtered content was analyzed in one of four ways, including 1) **Conversation analysis,** providing an overview of likes, preferences and dislikes through social media conversations and news articles; 2) **Share of voice,** focusing on the volume of conversations and which outlet/individual has the greatest impact; 3) **Trends and influencers,** highlighting the organic influencers, promoters and detractors; and 4) **Sentiment analysis,** breaking the conversations down into three categories—solution-oriented, neutral and critical—over topic and time.

Results

A total of **82,235** pieces of content were scanned across platforms such as Facebook, Twitter, Instagram, YouTube, blogs, forums and news media, representing a 20% sample of all social media and news articles that included keywords related to air pollution.

Table 1

Air pollution topics and subtopics used to categorize content

Perceptions	Sources	Health Impacts and Symptoms	Exposure Reduction (Short-Term Measures)	Solutions (Long-Term Measures)
General Discussion on Air Pollution	Cooking	Asthma	Masks	Anti-Forest Fire Initiatives
	Desert Dust	Heart Diseases	Air Purifiers	Energy Efficient Buildings
	Natural Wildfires	Lung Diseases	Inhalers	Clean Fuels and Technology
	Volcanic Eruptions	Respiratory Diseases	Nebulizers	Waste Management
	Power Plants	Eczema		Active and Sustainable Transportation
	Man-Made Forest Fires	Dry Cough		Clean, Efficient Energy
	Burning of Waste	Itchy Eyes		
	Vehicle Pollution	Breathing Difficulties		

Commonly Mentioned Sources of Air Pollution

In general, there was a disconnect between commonly discussed sources and what is known about the actual leading sources of air pollution. The greatest focus in the scanned content was on vehicular emissions, disproportionally high relative to its contribution to air pollution. Actual leading sources of pollution based on existing emissions studies, such as power plants, burning of agricultural waste, and biomass burning, were mentioned less frequently in public and media discourse.

For example, the odd-even license plate driving restriction adopted by the Delhi government led to a spike in conversations toward the end of 2015 and beginning of 2016, which indicated a high amount of discussions on this particular issue. In 2016 and 2017, the media focus on air pollution was largely critical (negative), due to the air pollution crisis in Delhi, which dominated news coverage in addition to the odd-even number plate rule.

Seasonal Variation in Air Pollution Conversations

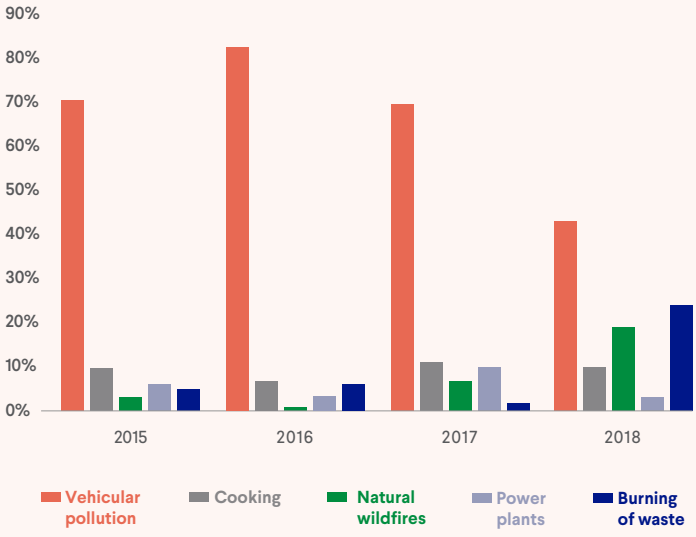
There was strong seasonal variation in the number of air pollution stories and conversations each year. From a relatively low volume in the first half of the year, news coverage and conversations increased in the second half of the year in India due to seasonal increases in crop burning, wildfires and firecracker-laden festivals such as Diwali. The content of most end-of-the-year conversations included mentions of the above sources of air pollution, as well as publicly proposed government initiatives to address them.

Figure 4 shows the trend and volume of conversations on air pollution in 2015 and 2018, as well as significant events that seemed to influence discussion.

Figure 2

Five most commonly discussed sources of air pollution, 2015 to 2018

Data collected and presented to factor in 5%-10% margin of error



Most discussed source: Vehicular pollution was discussed up to four to five times more than other sources, partly due to the odd-even number plate rule in Delhi.

Actual leading sources are less often mentioned: Power plants, burning of fossil fuels, agricultural burning, open **waste burning.**

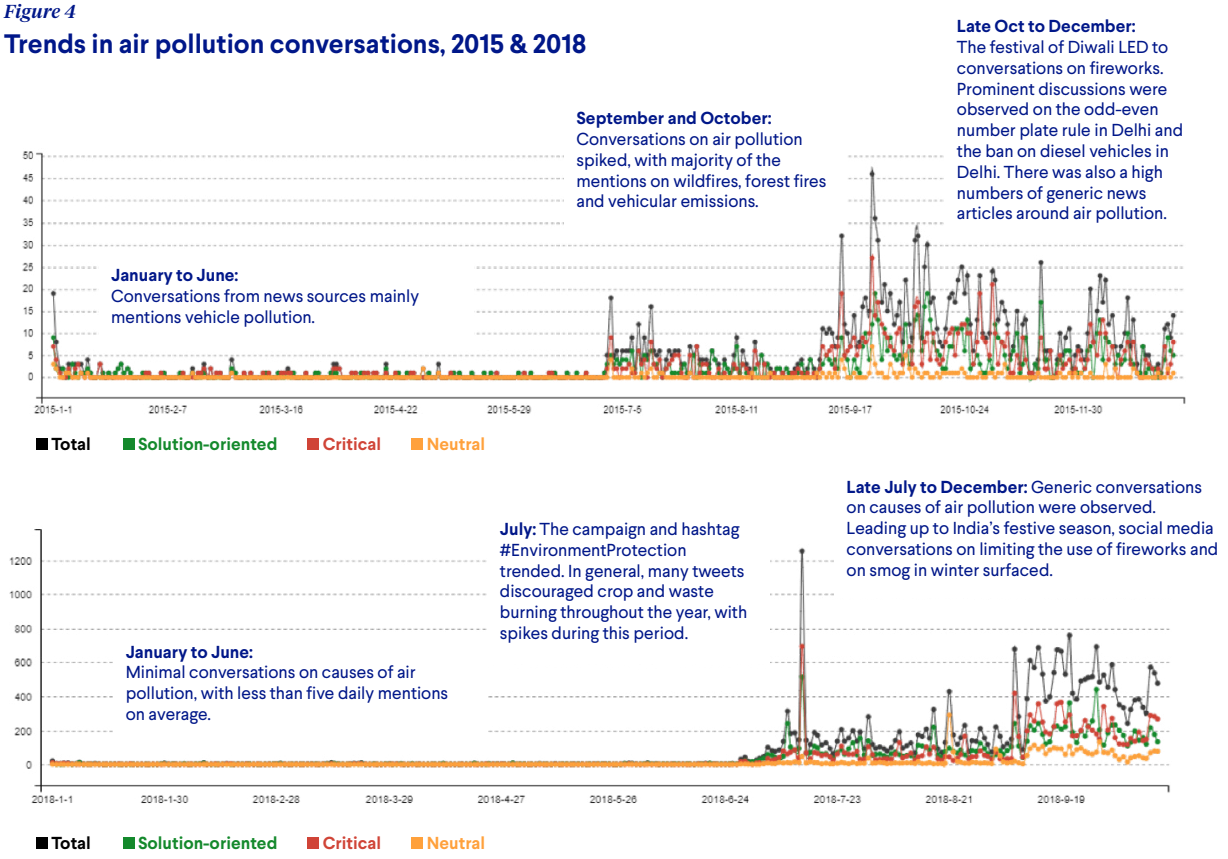
As limited historic data were available between 2015 and 2018, in total 82,235 pieces of content were scanned. This is a representative sample of 20% of all social media and news articles during the reported time period.

Figure 3

Sample posts: most commonly discussed sources of air pollution

Figure 4

Trends in air pollution conversations, 2015 & 2018



Perceived Health Symptoms and Impacts

Most health-related conversations focused on acute symptoms and illnesses, such as breathing difficulties, respiratory issues, itchy eyes, dry cough, eczema and asthma (see Figure 5). Through 2017, chronic illness was mentioned far less frequently, even though chronic disease, namely cardiovascular and lung disease, accounted for the vast majority of deaths from air pollution. In 2018, however, more public conversations on air pollution–related lung diseases took place on social media, indicating higher awareness levels about chronic illness associated with air pollution.

Conversations About Children's Health

While only a modest percentage (14%-17% each year) of posts mentioned children's health, these discussions resulted in far higher engagement (likes, comments, shares) than other posts. For example, posts by Indian actress Dia Mirza related to children's health and air pollution received four times the engagement compared to her other posts (see Figure 6).

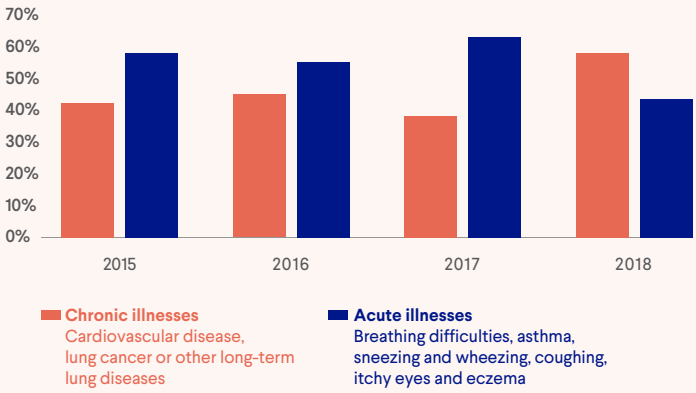
Overall Sentiments About Air Pollution

As noted above under "Approach," the sentiment analysis divided conversations into three categories—solution-oriented, neutral and critical. The percentage of both solution-oriented and critical conversations about air pollution declined over the study period while the number of neutral conversations more than doubled (see Figure 7). Based on the comprehensive scan conducted on media coverage and social media conversations, this increase in neutral conversations could potentially be attributed to a general increase of media coverage on air pollution issues and, subsequently, increased shares of those articles on social media (see Figure 8). In general, critical conversations, while lower in 2018 than in 2015, still form the majority of all air pollution conversations.

Figure 5

Perceived health symptoms and impacts mentioned in the media and public discourse, 2015 to 2018

Data collected and presented to factor in 5%-10% margin of error



As limited historic data were available between 2015 and 2018, in total 82,235 pieces of content were scanned. This is a representative sample of 20% of all social media and news articles during the reported time period.

Figure 6

Sample posts: Links between children's health and air pollution

Solutions to Air Pollution

The term "individual measures" refers to immediate, short-term measures taken by individuals to reduce exposure to the current air quality, such as using a mask or air purifier, while "policy solutions" refers to long-term, sustainable policy measures to improve air quality, including: waste management to prevent trash burning; clean, efficient energy; and active and sustainable transportation. Policy solutions mentioned in the media to promote air quality included: forest fire prevention initiatives, green buildings, efficient energy, active and sustainable transportation, waste management, and clean fuels and technology.

During peak air pollution episodes such as Diwali festivals or forest fires, conversations tended to mention measures individuals can take to reduce exposure to air pollution. At other times some conversations were about the "power of the crowd" and using collective action to call for long-term solutions.

In 2015, individual measures to reduce exposures were mentioned more than four times as often as policy solutions. However, between 2016 and 2018, posts mentioning long-term policy solutions gradually increased, suggesting a growing understanding of air pollution. Despite this trend, in 2018, there were still more conversations about individual measures than about policy solutions (see Figure 9).

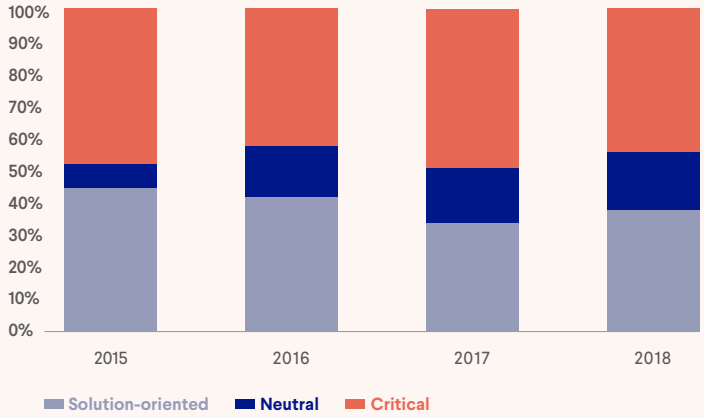
Long-term solutions discussed:

We measured the "share of voice" to analyze social media and news articles and identify the most-mentioned policy solutions. The solution with the largest share of voice was "clean energy and fuels," which had the most news articles and social media conversation mentions. The second most commonly mentioned solution was "active and sustainable transportation." Conversely, important air pollution controls that were mentioned least frequently included preventing intentional fires and wildfires, and better waste management to reduce trash burning. The limitations of this search strategy precluded examination of specific solutions, such as clean household fuels and controlling industrial emissions.

Figure 7

General sentiments toward air pollution, 2015 to 2018

Data collected and presented to factor in 5%-10% margin of error



Legend:
Critical conversations: complaints and criticisms.

Solution-oriented conversations: discussions on ways to curb or fight air pollution or advising others to stay safe from pollution. For example, posts that advised wearing a mask during the haze crisis.

Neutral conversations: generic statements on air pollution. For example, people sharing images on social media of the view from their window.

As limited historic data were available between 2015 and 2018, in total 82,235 pieces of content were scanned. This is a representative sample of 20% of all social media and news articles during the reported time period.

Figure 8

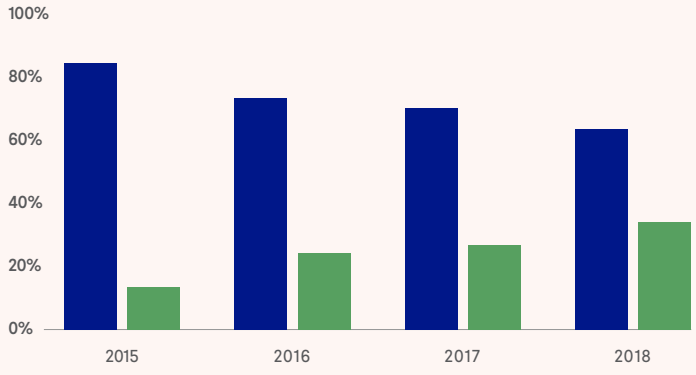
Sample posts: Sentiments on air pollution

Figure 9

Conversations on individual measures vs. long-term policy-oriented solutions, 2015 to 2018

The chart indicates the percentage of media articles and social media posts from 2015 to 2018 that were about exposure reduction as compared to solutions.

Data collected and presented to factor in 5%-10% margin of error



Individual measures short-term measures taken by individuals to reduce exposure to the current air quality, such as using a mask or air purifier.

Policy-oriented long-term, sustainable policy measures to improve air quality such as waste management to prevent trash burning; clean, efficient energy; and active and sustainable transportation.

As limited historic data were available between 2015 and 2018, in total 82,235 pieces of content were scanned. This is a representative sample of 20% of all social media and news articles during the reported time period.

Phase 2: Focus Group Discussions and Household Surveys in Five Indian Cities

Building on the results from "Hazy Perceptions," as well as other recently conducted work (8) (9), Vital Strategies conducted qualitative and quantitative analyses through focus groups and household surveys to understand the knowledge, attitudes and behaviors related to air pollution in urban India. This study was conducted in five major Indian cities—Delhi, Mumbai, Bengaluru, Surat and Patna—chosen to represent tier 1 and tier 2 cities as classified by the Government of India, as well as different geographies with different leading sources of pollution. As such, we were able to identify similarities and differences in public opinion on air pollution across these characteristics.

Approach

Focus Group Discussions

Eight focus group discussions took place across three cities (three groups in Delhi and Mumbai, respectively, and two in Patna).

Quantitative Household Surveys in Urban India

Male and female adult Indian residents of five urban centers (Mumbai, Delhi, Bengaluru, Surat and Patna) were selected via multistage random sampling. A survey was conducted by i3RC Insights, a research agency based in India, among selected respondents via face-to-face household interviews in the respondent's language of choice (Hindi, Gujarati, Marathi, Punjabi or Kannada).[1]

The interviews, lasting 20 to 30 minutes each, were conducted to assess:

1. Knowledge and awareness of the sources and health impacts of air pollution
2. Attitudes toward exposure
3. Levels of support for clean air actions
4. Solutions and agents of change

Study Demographics

Focus Group Discussions: A total of 64 participants took part in the focus group discussions. They were either young, unmarried adults aged 18 to 25, or married adults aged 30 to 45 years old; and all belonged to the upper (A) or upper-middle (B) socioeconomic groups.

1 The study protocol was reviewed and declared exempt from human subjects research by both the Sigma Institutional Review Board in India and Vital Strategies' Internal Human Subjects Research Committee.

Household Surveys: A total of 2,340 respondents aged 18 and older residing in Delhi (630), Mumbai (630), Bengaluru (360), Surat (360), and Patna (360) were interviewed in household surveys. The split between male and female survey respondents was fairly even, and the vast majority of respondents were between 18 and 40 years of age. Respondents from the upper (A) and upper-middle (B) classes accounted for 85% of this survey. About 18% of survey respondents had attended primary school (or less), and 44% had attended secondary school. Nearly a third of all respondents had completed college or some postgraduate education. (See Figure 10 for full description of household survey participant demographics.)

The majority of respondents (66%) regularly rely on public transportation, with buses being the most frequently used mode of transport (See Figure 11). Only 5% almost never use any form of public transportation. About 61% of respondents also list walking as a main method of getting around.

More than half of respondents' households owned at least one vehicle (overwhelm-

Figure 10

Demographics of household survey respondents

A total of 2,340 respondents were surveyed in 2019 in five major Indian cities—Delhi, Mumbai, Patna, Surat and Bengaluru. The chart below indicates the gender, age, education and socioeconomic classifications of these respondents.

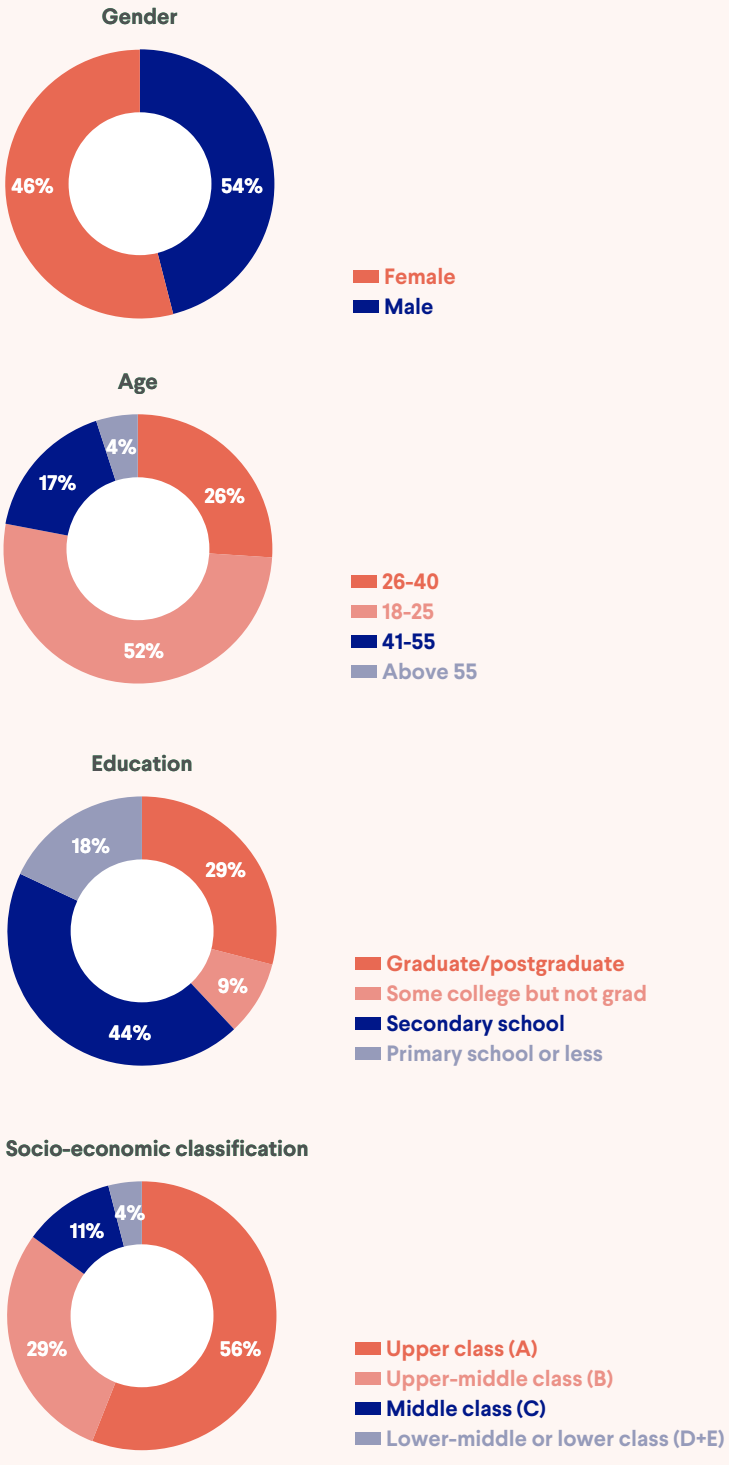
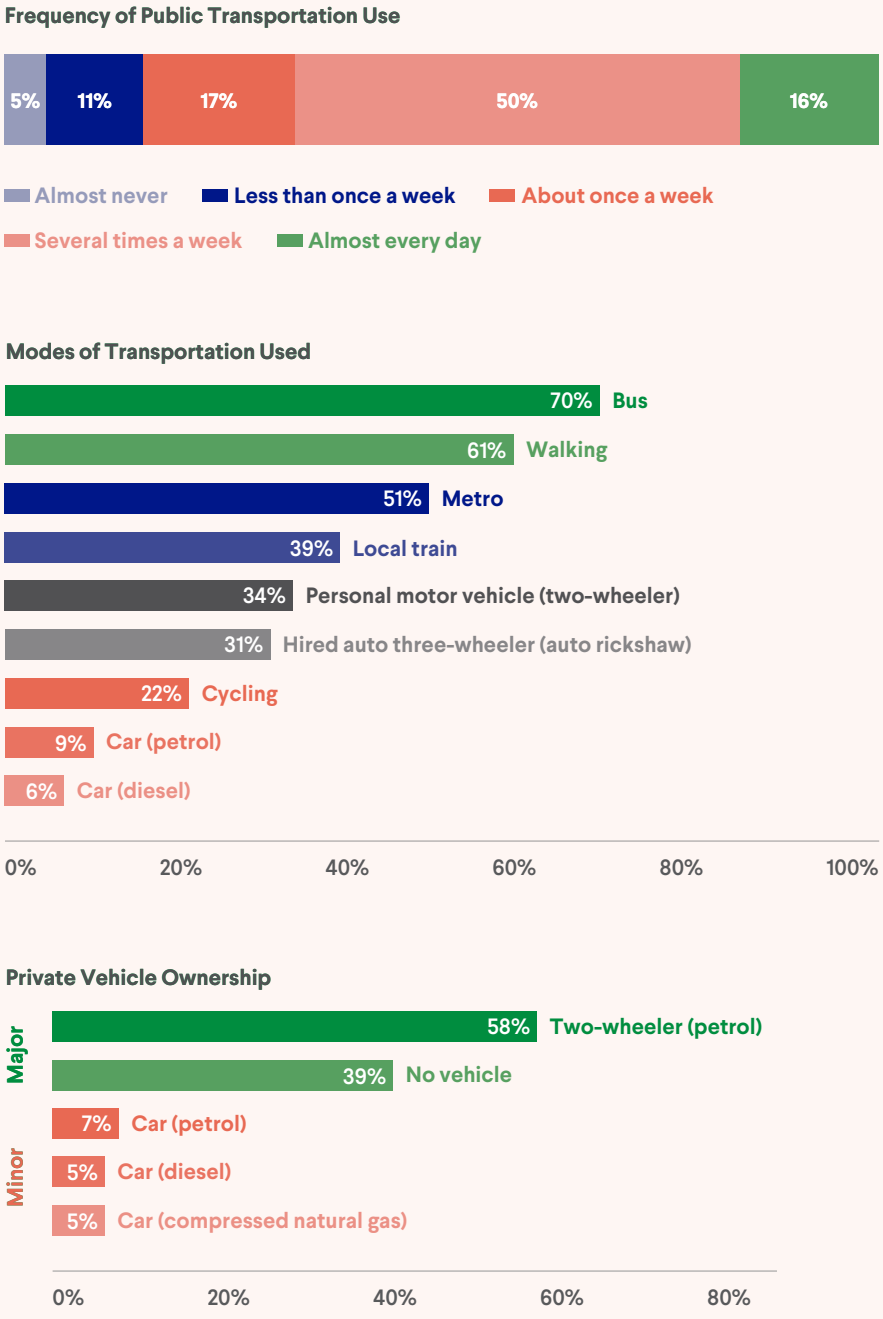


Figure 11

Respondents' Use of Transportation



ingly two-wheelers).

Note:

Population-level information on age and socioeconomic status was only available at the district, not city level, limiting our ability to weight city-specific results. In the absence of this information, we have shared city-specific distributions are available on the website to illustrate the extent to which the data are skewed differently by age and socioeconomic group.

Key Perceptions of Air Pollution and Its Impacts: Results of Household Surveys in Five Indian Cities

Are residents aware of air pollution?

The vast majority (88%) of survey respondents were aware of air pollution. TV and radio broadcasts were the single greatest source of news and information on air pollution (87%) across all demographic groups (see Figure 12). This was followed by friends and peers (64%) and family members (57%). Forty percent (40%) of survey respondents obtained their information on air pollution from social media. Most of those in this group were aged 18 to 25 years old, followed by 26 to 40 years old. Only 19% of respondents above 55 years old obtained any information from social media. Print media was a source for 40% of respondents.

In Surat, where every respondent was aware of air pollution, a far higher percentage of survey respondents (98%) relied on TV and radio, as well as social media (91%) as a source for information about air pollution compared to other cities (27% to 40%).

More than one in five (22%) survey respondents said they learned about air pollution in school or university settings, but this response varied widely by city. In Mumbai, only 11% of respondents said they learned about air pollution at school or university. In Patna and Delhi those figures rose to 23% and 24%, respectively, while in Surat it was 54%.

For a snapshot of perceptions in each of the five cities, see the individual city profiles on the Vital Strategies website
www.vitalstrategies.org/through-the-smokescreen

What are people saying about air pollution?

Overall, about 55% of survey respondents discussed air pollution, largely with family members (84%) and friends (71%), and less so with co-workers (28%). However, wide variations were observed across the five cities (see Figure 13): In Surat, 98% of respondents discussed air pollution, while in Bengaluru just 39%. Nearly half (47%) of the people who said they dis-

Figure 12

Respondents' sources of information on air pollution

88% of respondents were aware of air pollution.
They obtained their information through the following channels:

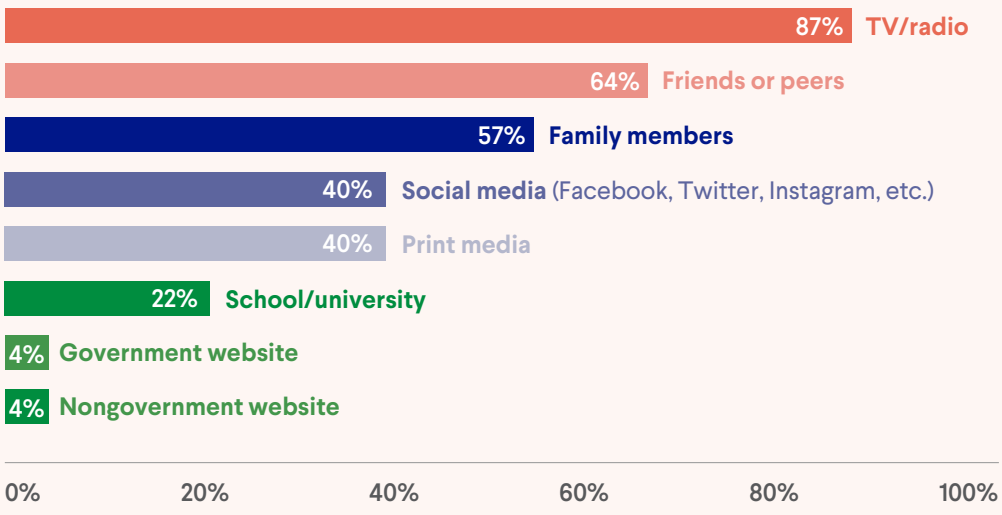
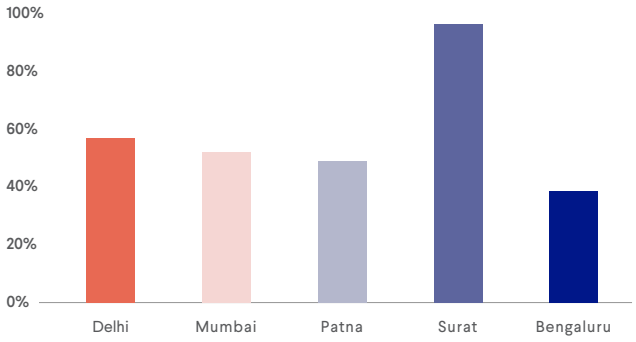


Figure 13

Respondents who discussed air pollution in five Indian cities, 2019

The graph indicates the percentage of respondents who discussed air pollution in each city. A total of 2,340 respondents were surveyed in 2019 in five major Indian cities—Delhi (630), Mumbai (630), Patna (360), Surat (360) and Bengaluru (360).



cussed air pollution said those discussions happened within a month before the survey, while an additional 26% discussed air pollution at least once in the one to three months before the survey. Only 26% of respondents did not discuss air pollution at least once in the three months before the survey.

Among the respondents who discussed air pollution, the three most prominent topics discussed were air pollution's impact on health (54%), the sources of air pollution (51%), and pollutant concentrations in air (51%). Discussion topics related to personal health or that of a family member were most common in Surat (82%) and Patna (66%), followed by Mumbai (52%). Meanwhile, more than half of the respondents in Patna (54%) and Bengaluru (61%) did not discuss air pollution.

Air pollution and its impact on the climate was the fourth most commonly discussed topic (33%). This was discussed more frequently in Surat (59%) and Patna (46%), compared to Bengaluru (32%), Mumbai (31%) and Delhi (23%). Patna residents were also far more likely to discuss air pollution response strategies and policies (27%) than residents of the other four cities (5% to 15%). Only 5% of Delhi respondents and 6% of Mumbai respondents said they talked about the government's responses or policies to air pollution (see Figure 14).

What air pollution terms do people know?

In general, specific knowledge of various air pollution terms was moderate to low. The most familiar air pollution terms were "ozone" (48%) and "carbon dioxide or carbon monoxide" (36%). Most respondents were not familiar with the pollutants "nitrogen oxides" (12%) and "sulfur dioxide" (9%).

Only 31% of respondents had heard of any term related to particulate matter—including the general term "particulate matter" (17%), "PM_{10}", "respiratory suspended particulate matter" (16%), and "$PM_{2.5}$" (15%). One in five (19%) of respondents were also unfamiliar with all the listed air pollution terms (see Figure 15 and Figure 16 for breakdown on awareness of particulate matter by city).

In Delhi, 27% of respondents had heard of particulate matter terms, with only 15% aware of $PM_{2.5}$, the most harmful air pollutant to health. Consistent with the overall results in Figure 15, the pollutant most familiar to Delhi residents was ozone (59%). Nitrogen oxides (6%) and sulfur dioxide (2%) were less understood while 21% were not familiar with any of the air pollution terms listed in Figure 15.

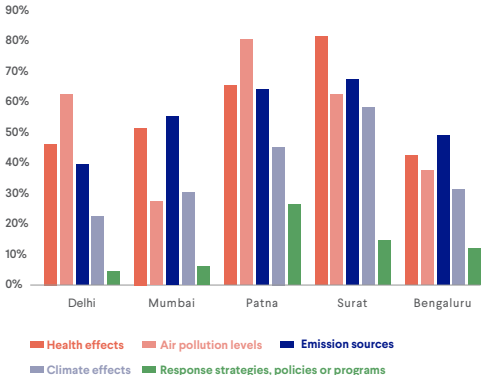
Mumbai respondents were most familiar with carbon dioxide and monoxide (47%) as compared to nitrogen oxides (13%) and sulfur dioxide (16%). Only 24% of Mumbai respondents were familiar with any particulate matter terms, with 15% aware of $PM_{2.5}$. Importantly, of the 51% of residents who discussed air pollution in Mumbai, 35% of them were not familiar with any of the air pollutants listed in Figure 15.

Patna residents were most likely to be aware that ozone is an air pollutant (64%). Half (52%) of the respondents in Patna were also aware of at least one particulate matter term—the highest across all five cities—with 21% aware of $PM_{2.5}$. Familiarity with nitrogen oxides (16%) and sulfur dioxide (10%) remained low, and 16% of respondents in Patna were not aware of any of the terms listed in Figure 15.

In Surat, where 98% of respondents discussed air pollution (see Figure 13), only 23% were aware of any particulate matter terms—the lowest in across all five cities. Just 8% of Surat respondents had heard of $PM_{2.5}$

Figure 14

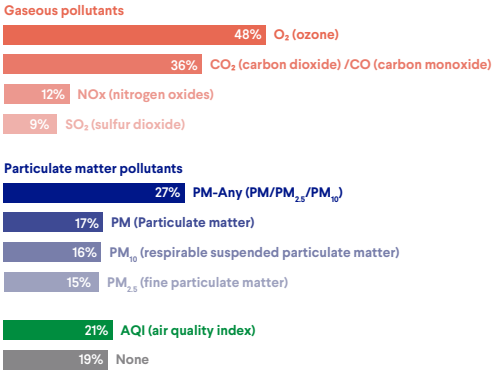
Air pollution topics discussed among the respondents in five Indian cities, 2019



The figure indicates the percentage of respondents in each city who discuss various topics of air pollution, such as its health impacts, the air quality, emission sources, links to climate change, and response strategies, policies or programs that can alleviate air pollution. The 1,329 participants who responded that they discuss air pollution were surveyed in 2019 in five major Indian cities—Delhi (350), Mumbai (322), Patna (164), Surat (352) and Bengaluru (141).

Figure 15

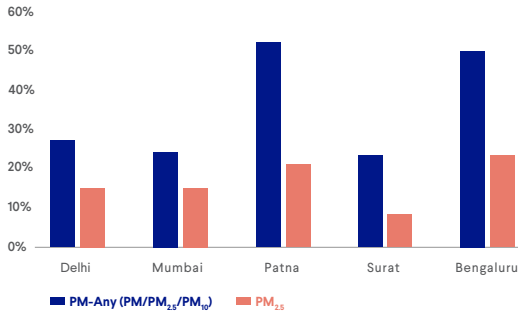
Awareness of specific pollutants and Air Quality Index in five Indian cities, 2019



The graph indicates the percentage of respondents in each city who have heard various air pollution terms. 1,329 participants who responded that they discuss air pollution were surveyed in 2019 in five major Indian cities—Delhi (350), Mumbai (322), Patna (164), Surat (352) and Bengaluru (141).

Figure 16

Percentage of respondents who are aware of any PM terms and specifically $PM_{2.5}$ in five Indian cities, 2019



The graph indicates the percentage of respondents in each city who have heard of the terms $PM_{2.5}$ and PM_{10}. 1329 participants who responded that they discuss air pollution were surveyed in 2019 in five major Indian cities —Delhi (350), Mumbai (322), Patna (164), Surat (352) and Bengaluru (141).

prior to the survey. Surat respondents were extremely aware of carbon dioxide and monoxide (81%) and ozone (74%)—the highest awareness of any type of air pollutant across all five cities–and only 3% did not know any of the terms in figure 15.

In Bengaluru, 50% of respondents had heard of any particulate matter terms before. A total of 23% of Bengaluru respondents were aware of $PM_{2.5}$. In contrast, only 36% were aware of ozone. There is also low to no awareness of nitrogen oxides (6%), sulfur dioxide (0%) or carbon dioxide and monoxide (13%). Only 4% were not aware of any of the terms listed in Figure 15.

Only 21% of respondents were aware of the term "Air Quality Index," with the lowest awareness in Bengaluru (6%), Mumbai (16%), Delhi (19%), followed by Patna (24%). The highest awareness of this term was seen in Surat (44%).

Across cities, the awareness of particulate matter terms increases with lower socioeconomic groups (data not shown). However, none of the respondents in the lowest socioeconomic groups were aware of the term $PM_{2.5}$. Younger respondents were more familiar with particulate matter terms overall (34%). Only 7% of respondents aged above 55 years were aware of $PM_{2.5}$.

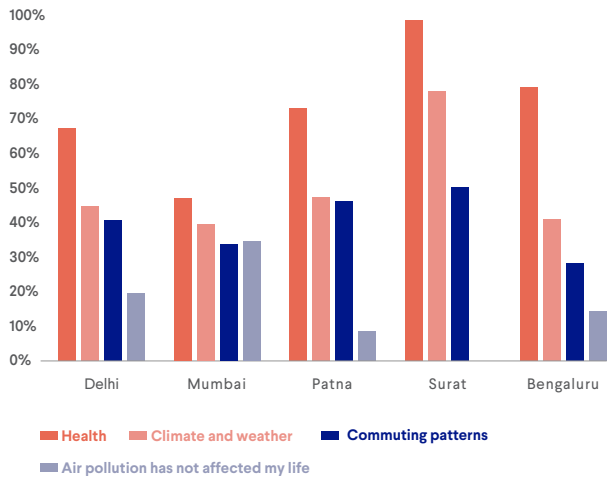
How does air pollution affect lives?

Two-thirds of survey respondents said that air pollution negatively affected their health or that of their family members. Less than half believed that it affected climate and weather (45%), and that the quality of air had an impact on the way they planned their commutes (37%) (see Figure 17).

Figure 17

Aspects of life affected by air pollution in five Indian cities, 2019

The graph indicates the percentage of respondents in each city who have had various aspects of life changed or affected in any way by air pollution. A total of 2,340 respondents were surveyed in 2019 in five major Indian cities—Delhi (630), Mumbai (630), Patna (360), Surat (360) and Bengaluru (360).



Interestingly, 20% of respondents said that air pollution had no impact on their lives. This response varied considerably among the five cities (34% in Mumbai, 19% in Delhi, 14% in Bengaluru, 8% in Patna and none in Surat).

Is air pollution affecting health?

More than half (54%) of the survey respondents reported health complications as a result of air pollution, and 43% reported health problems experienced by family members. Alarmingly, six in 10 (59%) said that these negative health consequences are severe. These respondents reported that they or their family member experienced lung (61%) and heart (52%) problems. The most commonly cited lung issues are breathing difficulties (36%), asthma (24%) and lung cancer (17%), whereas the two most commonly named cardiovascular problems are heart attacks (35%) and high blood pressure (14%). Among respondents who reported lung and heart conditions, 32% and 34% were unable to pinpoint specific diagnoses. Half (52%) also reported eye irritation.

Furthermore, half (51%) of all respondents said that their health or their family members' health was *always* affected by air pollution, and an additional third (33%) reported they were sometimes affected. These overall figures fluctuated considerably across the five cities.

In general, health impacts were greater in cities with poorer air quality. More respondents in Surat (76%) and Delhi (63%), where pollution levels are relatively high, said that air pollution had a negative impact on their health (see Table 2). In contrast, only around 20% of residents in Bengaluru and Mumbai, where air pollution levels are substantially lower, reported consistent adverse effects on health.

In Patna, where air pollution levels are second only to Delhi, 46% of respondents reported constant negative health effects, with 42% experiencing them less often. Of the Patna residents who experienced any form of negative impacts, they most often reported lung issues (76%) and organ damage (39%) across all five cities. In Bengaluru, 39% said their health was *never* affected by air pollution—far higher than any of the other cities. Of those in Bengaluru who said their health suffered as a result of air pollution, the major complaint was eye irritation (62%), followed by lung problems (46%).

Table 2

Respondents reporting the impact of air pollution on health

Other group that forms the minority is those sometimes reporting negative health effects (21-53%).

City	2018 Annual $PM_{2.5}$ level (µg/m³)	Respondents reporting constant negative health effects (%)	Respondents reporting no negative health effects (%)
Delhi	134µg/m³	63%	15%
Mumbai	24µg/m³	29%	18%
Patna	117µg/m³	46%	12%
Surat	88µg/m³	76%	0%
Bengaluru	28µg/m³	22%	39%

What exposure prevention methods do respondents take?

Survey respondents were asked about the ways they might attempt to limit their exposure when air quality is poor. Notably, 24% of survey respondents took no precautions at all during periods of poor air quality. Among those who did:

- 48% went out only if necessary
- 37% kept doors and windows closed at home
- 26% did not go out at all
- 32% wore a mask whenever going out

- 24% used an air purifier
- 22% used air conditioning at home
- 19% used air conditioning in vehicles
- 10% left the city

There are differences in these responses by socio-economic class and location. Upper-class survey respondents are more likely than any other socio-economic group to avoid going out at all when the air quality is perceived to be bad. They are also more likely to wear masks (41%), use air purifiers (31%), rely on air conditioning (30%), or leave the city (14%).

In Surat, a far greater percentage of residents took precautions against air pollution. Surat respondents ranked the highest in every category, from going out only if necessary (78%; other cities, 36% to 46%) to leaving the city (28%; other cities, 3% to 23%), wearing masks (75%; other cities, 26% to 39%) and using air purifiers (54%; other cities, 18% to 24%). The rates of respondents from Surat reporting wearing masks or using air purifiers are more than double the rates of residents in other cities.

How does their air quality compare to other cities?

While the majority (54%) of survey respondents said that the air quality in their city had worsened in the previous 10 years (data not shown), their outlook on air quality in their city compared to other cities within India and around the world remained positive. More than a quarter (29%) believe the air quality in their city was excellent compared to other cities. An additional 40% said that the quality of the air they breathe was above average, compared to other cities in India. This is regardless of the city respondents lived in, despite the variations in air quality levels across the five cities. The comparisons to other cities in the world showed similar results. Residents in all five cities expressed their belief that their city's air quality was better than China's (data not shown).

Only 10% of respondents said the air quality in their city was very poor or below average in comparison to others (see Table 3). Of the five cities, Delhi residents were more likely than those in other cities to rate their air quality as very poor (17% in Delhi vs. 3% in Patna, for example). None of the respondents in Mumbai, Surat and Bengaluru felt the air quality in their cities was very poor relative to other Indian cities.

Table 3

Respondents who believe air quality is excellent or above average in their city as compared to other India cities

Respondent Responses (%)

City	Air in my city is better	Air in my city is poorer
Overall	69%	10%
Delhi	57%	23%
Mumbai	82%	0%
Patna	72%	15%
Surat	79%	2%
Bengaluru	68%	0%

These findings reveal a tendency for respondents to believe that they lived under better air quality conditions than others, despite evidence to the contrary, and despite their acknowledgment that their air quality makes them and their families very sick.

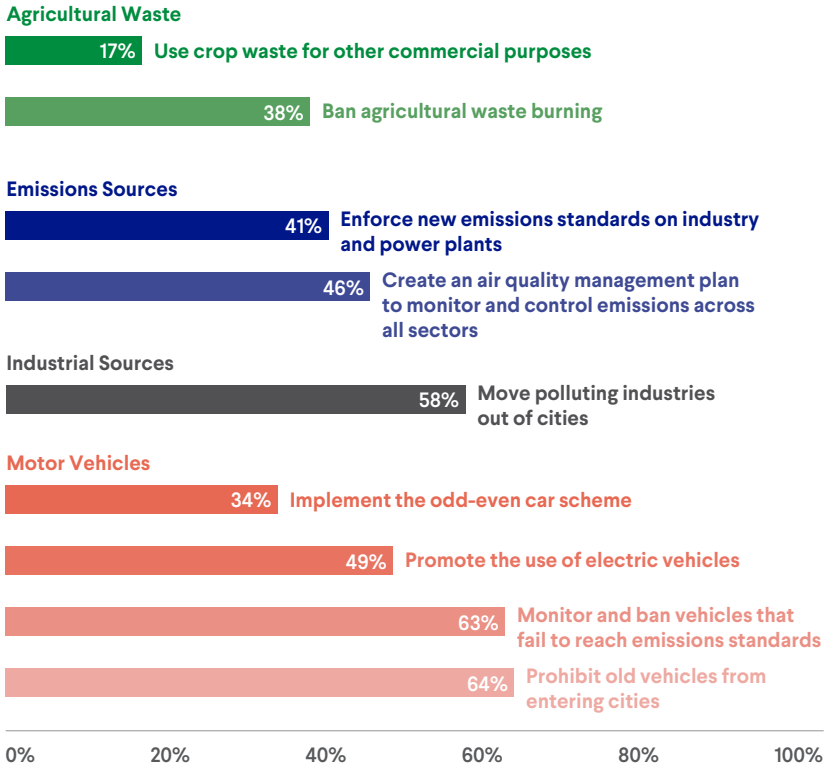
Who is responsible for improving air quality?

Overall, nearly six in ten (57%) respondents believed that it is the responsibility of national (29%) or state and local (28%) governments to address the air pollution problem. Slightly fewer (22%) believed it is the responsibility of industry to do so. Just one in 10 (11%) said it was the duty of individual citizens.

The government versus industry divide varied considerably across the five cities (see Table 4). In Bengaluru, for example, five times as many people felt solutions were the responsibility of government (73%) compared to industry (15%). In Surat, in contrast, twice as many respondents said industry (65%) should solve air pollution compared to government (29%). Across all five cities, respondents older than 55 years of age and those in the middle class were more likely to believe that it is the responsibility of individuals to take action against air pollution, as compared to younger and lower-income respondents.

Figure 18

Top policy initiatives supported by urban residents in five Indian cities, 2019



The graph indicates the top policy initiatives prioritized by urban residents, and the percentage of respondents who felt that specific policies on motor vehicles, industrial sources, comprehensive air quality management and agricultural waste were critical to reducing air pollution in their respective cities. A total of 2,340 respondents were surveyed in 2019 in five major Indian cities—Delhi (630), Mumbai (630), Patna (360), Surat (360) and Bengaluru (360).

Table 4

Government vs. Industry—whose responsibility is it to implement air pollution solutions?

The table indicates the percentage of respondents who feel either national, state and local governments or industry are most responsible for implementing air pollution solutions. Other groups that form the minority include community groups (4%-15%) or individual citizens (8%-13%).

City	Government	Industry
Delhi	55%	16%
Mumbai	60%	20%
Patna	48%	29%
Surat	29%	65%
Bengaluru	73%	15%

What initiatives should be undertaken to improve air quality?

Survey respondents described a number of initiatives they believe will improve air quality (see Figure 18). The greatest support was for policy initiatives related to motor vehicle use.

People from middle and lower socioeconomic groups are less supportive than those in the wealthier groups of: prohibiting the continued use of older vehicles and banning those that fail to reach emissions standards; moving polluting industries out of cities; promoting electric vehicles; and enforcing new emissions standards on industry.

Awareness of Current Clean Air Initiatives

Overall, about half of respondents across all five cities are aware of initiatives taken by the central government (48%), state governments (51%) and municipal bodies (44%). Only 28% were aware of any nongovernmental initiatives. The initiatives that respondents were most aware of include the ban on waste burning (76%), industrial emissions regulations (52%), relocating polluting industries (52%), and the odd-even vehicle restriction scheme (52%).

Surat respondents were most aware of clean air initiatives set by the central government (69%) as opposed to respondents in Bengaluru (36%), Patna (45%), Mumbai (47%) and Delhi (50%). At the state level, Mumbai respondents were most aware (66%) of their state government's clean air initiatives. Bengaluru residents were least aware (36%) compared to those in Delhi (52%), Patna (43%) and Surat (44%). The initiatives introduced by municipal bodies gained most traction in

Surat (63%) and Mumbai (60%). In Delhi (37%), Patna (41%) and Surat (25%), these initiatives were less known.

Perceived vs. Actual Sources of Air Pollution

In India, the major sources of $PM_{2.5}$ pollution—the most harmful pollutant to health and the most measured pollutant—include: coal burning for thermal power production; industry emissions; construction activity and brick kilns; transport vehicles; road dust; residential and commercial biomass burning; waste burning; agricultural stubble burning; and diesel generators (10). These sources are responsible for varying levels of pollution across different parts of India.

Figure 19

Perceived versus actual sources of air pollution in Delhi

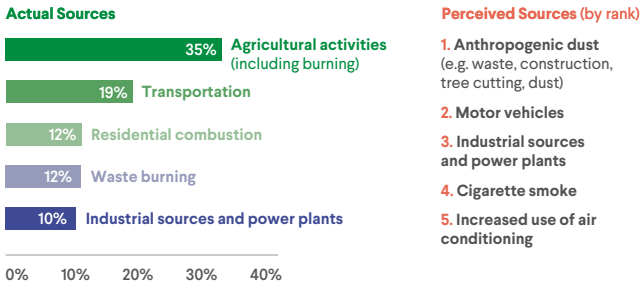
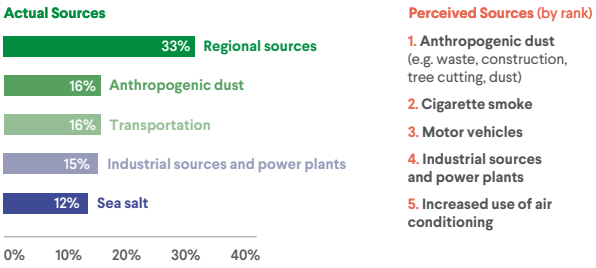


Figure 20

Perceived versus actual sources of air pollution in Mumbai



The above perceived sources of air pollution were obtained based on the percentage of respondents who identified these sources as a "main source of air pollution." Transportation includes motor vehicles (both two- and four-wheeled) and other forms of commuting. Residential combustion refers to residential cooking, lighting, heating and water heating that contribute to ambient air pollution exposure, but not cooking with coal inside of homes. Actual sources contributing to the ambient $PM_{2.5}$ concentration in an area were estimated with input data from emission inventory and meteorology using chemical transport/dispersion model. The resultant source distribution using this approach, which may be different from that of emission inventory alone, better captures the impacts of non-local emissions and transported pollution. The data for actual sources do not include natural emissions sources (like dust storms and lightning) and seasonal open (agricultural and forest) fires.

Figures 19-23 show breakdown of the perceived vs. actual sources of pollution in the five cities.

Respondents were able to accurately identify the most common sources of air pollution including anthropogenic dust (in four cities), transportation (in five cities), and industrial sources and power plants (in four cities).

However, other sources with little impact on ambient (outdoor) air pollution were also mistaken as significant sources of ambient air pollution. Two insignificant sources of air pollution were perceived to be main pollutants: 1. Cigarette smoke was perceived as a main ambient air pollution source by 70% of respondents across all five cities; and 2. In four cities (except Surat), the increased use of air conditioning was ranked among the five most perceived pollutants. In fact, though smoking is a significant contributing source of indoor air pollution, it has little impact on ambient air pollution. Air conditioning itself does not release many air pollutants but rather greenhouse gases. However, the increased electricity demand on power plants associated with increased use of air conditioning may play a direct role in higher levels of air pollutant emissions.

The sharpest disparities between perceived and actual sources of pollution occur in Delhi, where 90% of respondents cited anthropogenic dust as the leading source of pollution in the city (see Figure 19). In fact, Delhi is the only one of the five cities where man-made dust was not among the top five sources of air pollution. The leading cause of air pollution in Delhi is related to agriculture—including crop burning in neighboring regions—which accounts for 35% of the city's air pollution (11). However only 46% of Delhi respondents correctly identified this. Similarly, residential biomass and waste burning are also leading sources, but less than half of Delhi respondents identified these sources.

Respondents based in Mumbai accurately perceived anthropogenic dust (93%), motor vehicles (65%), and industrial sources and power

plants (83%) as leading sources of pollution (see Figure 20). However only 31% of respondents recognized pollution from neighboring cities and states, which is the top source of $PM_{2.5}$ emissions in Mumbai (12).

Patna residents correctly identified anthropogenic dust (93%), industrial sources and power plants (86%), and transportation (80%) as significant sources of pollution in their city (see Figure 21), yet they were more likely than other city dwellers to name cigarette smoke (75%), air conditioning (70%) and brick kilns (59%) as a significant source of air pollution, although they are not. The leading contributors of $PM_{2.5}$, emissions from outside of the city and residential biomass (13), were only mentioned by 61% and 64% of respondents.

In Surat, industry and power plants are the leading source of pollution, accounting for nearly a third of $PM_{2.5}$ in the air (14) (see Figure 22). However, fewer survey respondents (65%) identified this as a threat compared to anthropogenic dust (98%), cigarette smoke (94%), and motor vehicles (66%). While anthropogenic dust accounts for 20% of the city's air pollution, the contribution of cigarette smoke to ambient air pollution is insignificant. In Surat, 58% of respondents also correctly identified that neighboring cities and states contribute significantly to pollution levels in their city.

Bengaluru residents (60%) perceived that industry and power plants play a significant role in air quality levels, although those emissions are not among the top five sources of pollution within the city (15) (see Figure 23). While 89% of residents correctly identified anthropogenic dust and 63% identified transportation as leading pollution sources, other actual sources of pollution were not as widely known—such as pollution from neighboring cities or states (25%), residential biomass (28%), and diesel generators (28%).

Figure 21

Perceived vs. actual sources of air pollution in Patna

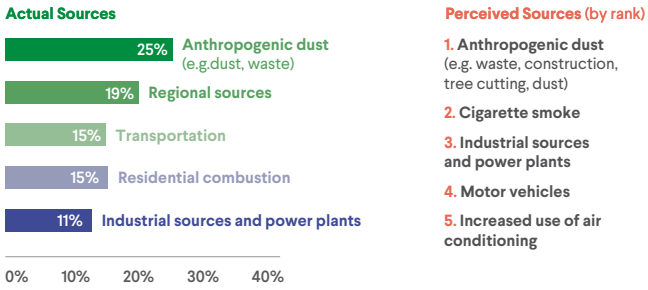


Figure 22

Perceived vs. actual sources of air pollution in Surat

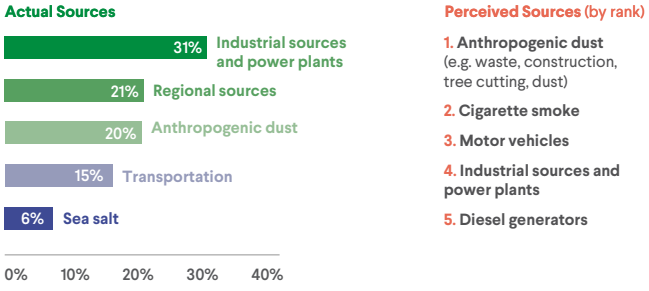
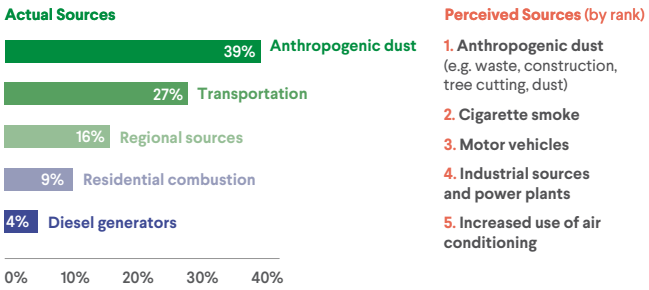


Figure 23

Perceived versus actual sources of air pollution in Bengaluru



The above perceived sources of air pollution were obtained based on the percentage of respondents who identified these sources as a "main source of air pollution". Transportation includes motor vehicles (both two and four wheeled) and other forms of commuting. Regional sources refers to pollutants emitted outside the city that affect air quality within the city. Residential combustion refers to residential cooking, lighting, heating and water heating that contribute to ambient air pollution exposure, but not to biomass burning inside of homes. Actual sources contributing to the ambient $PM_{2.5}$ concentration in an area were estimated with input data from emission inventory and meteorology using chemical transport/dispersion model. The resultant source distribution using this approach, which may be different from that of emission inventory alone, better captures the impacts of non-local emissions and transported pollution. The data for actual sources do not include natural emissions sources (like dust storms and lightning) and seasonal open (agricultural and forest) fires.

Insights:
Key Perceptions of Air Pollution and Its Health Impacts

While awareness about air pollution in India in general is high, there is a real disconnect between the reality of air pollution and what people, including government and media professionals, are talking about. As our "Hazy Perceptions" report indicates, air pollution coverage in the news media does not always reflect the current evidence and science about the actual sources and their impacts. While social media is an increasingly important way for people to access news and share their views, these platforms have the potential—depending on the accuracy of the information—to reinforce misunderstandings and myths or to improve the public's understanding of the issue.

There are consistent misperceptions and recurrent themes observed in our comprehensive scan of social media conversations and media coverage, and in the focus group discussions and household survey.

There are several misperceptions about the leading sources of air pollution.

Less significant sources of air pollution are mentioned in news coverage and social media discussions more frequently than sources that pose a greater threat. The bulk of media articles attributed air pollution to vehicular emissions, with a disproportionate amount of focus given to Delhi's odd-even license plate scheme, designed to reduce the numbers of cars on the road each day. This trend continued in the household survey where at times, less than half of respondents were able to correctly identify the actual sources of air pollution in their city. In addition, cigarette smoke and the use of air conditioners are erroneously believed to be significant sources of ambient air pollution.

Awareness on particulate matter, the pollutant of greatest concern, is low.

Only about one in three respondents is familiar with the term "particulate matter," despite its devastating health impact. The awareness of particulate matter was also much less in lower socioeconomic groups as compared to upper socioeconomic groups. Younger Indians tended to be more familiar with particulate matter as a pollutant than those aged above 55.

People link air pollution to health impacts, but worry more about short-term effects.

While most people believe that air pollution causes negative health effects, with three out of five reporting severe health impacts, the focus is usually placed on short-term health effects rather than the risks associated with long-term exposure. There is more discussion on the acute symptoms of air pollution, such as asthma, throat irritation and itchy eyes, rather than chronic diseases such as diabetes, cardiovascular disease or lung disease. That said, 2018 saw a rise in social media conversations related to lung diseases caused by air pollution.

Conversation on air pollution is seasonal, with emotionally appealing content generating higher levels of engagement.

Discussions on air pollution vary throughout the year, with a significant increase in news coverage and social media conversations from July to December, and especially during times of severe air pollution episodes (e.g. the agricultural burning season), the announcement of major air pollution policies or the occurrence of public events related to air pollution. During other months, the volume of social media and news content on air pollution was comparatively very low, posing a challenge to maintain public engagement year-round. The seasonality of expressed public concern tends to reinforce short-term rather than long-term actions.

Themes focused on children's health and climate change resonate with audiences.

Posts that mentioned children's health and climate change typically had higher engagement levels in terms of likes, comments and shares. These topics resonate strongly with our audiences, as opposed to air pollution-only posts, and should be leveraged in our communication strategies when highlighting the harms of air pollution.

Solutions tend to focus on personal protection, like masks; however, there is an increase in discussion around long-term solutions.

During peak air pollution episodes, media conversations focused on personal prevention measures to reduce exposure to air pollution in the short term—such as using a mask or air purifier—rather than long-term policy solutions, such as clean energy, waste management, and sustainable transportation. Survey respondents also reported taking precautions to protect themselves from poor air quality when warranted, including avoiding going outdoors, keeping doors and windows closed, and wearing a mask when going outdoors, although the majority felt that the government should be responsible for providing long-term solutions.

Long-term solutions are gradually gaining attention, but demand remains limited for comprehensive solutions to address leading sources of air pollution.

Conversations on severe health impacts and long-term solutions increased from 2016 to 2018, a reflection of India's growing awareness of the air pollution problem. While survey respondents said that it is critical for the government to implement policies to improve air quality, the policies and practices perceived to be needed were not well aligned with the leading sources of pollution, indicating a stronger need for data-driven communication and engagement. The majority supported regulations affecting motor vehicles, while less than half (46%) supported a comprehensive air quality plan to control emissions at their sources.

Recommendations: Informing Strategic Communication on Air Pollution

The research in this report shows that while general awareness about air pollution is high in India, there are major gaps in the people's understanding of its most significant sources, health impacts and feasible solutions. Simply put, there is a disconnect between the reality of air pollution and what the public, government and media are talking about. To align reality and public discourse will require strategic and sustained communication approaches to a variety of audiences.

Correcting Misperceptions: Communication should promote known, feasible solutions for common, significant sources of air pollution**.** To correct the many misperceptions in our current discourse, all professional organizations, including media, government and nongovernmental organizations, should cite reliable data to describe air pollution and propose feasible and effective solutions.

- **News articles should cover proven sources of air pollution and long-term solutions. The media should seek and be given access to credible and relevant data on air pollution.** Journalists and editors should aim to cover air pollution stories based on proven credible air pollution data from the Central Pollution Control Board (https://cpcb.nic.in/) or programs such as the Air Pollution Knowledge Assessments (APnA) city program (http://www.urbanemissions.info/india-apna/), emphasizing proven leadingknown sources and sustainable solutions.
- **Messages and campaigns should raise awareness on the risk of serious health effects, such as chronic illnesses and death caused by long-term exposure to air pollution.** Closing this concern gap through fact-based communication and news coverage is important to elevate clean air as a health priority and to drive demand for long-term improvements.
- **Mentions of air quality should emphasize particulate matter and its associated health harms.** As the public understanding of particulate matter is low—even though it is the most measured and most important pollutant of concern—the media should emphasize the nature of the pollutant and reasons for its devastating health impact.

Engaging and Motivating the Public: Messages that link air pollution to children's health and climate change are perceived to have more of an impact on the public.

- **Climate change is an effective means of engaging people on air pollution.** With policy and public discourse on climate change impacts growing, there is an opportunity to increase awareness of the shared causes and solutions for climate change and air pollution.
- **Stories and campaigns about air pollution and health should include messaging about lasting harm to children's health.** The harms of air pollution on children's future physical and economic health connects with the public on an emotional

level and as such, resonates with the media. Concerns about air pollution could be increased by raising awareness of the lifelong consequences of air pollution on children.

- **Leverage seasonal variations in air pollution conversations when engaging the media and public.** Seasonal trends should be considered in the timing of any strategic communication campaigns. For example, the peak air pollution season, when engagement is high, presents an opportunity to improve awareness of sources. The lull in discussions during the early months of the year could be an opportunity for campaigns that emphasize the need for planning and for proactive, sustained emissions reduction measures before the severe pollution season returns.

Inspiring Public Demand for Action: Government policy on environmental issues is often created in response to demand from civil society. Clean air implementing partners should therefore create communication campaigns that maximize public demand and political will to ensure sustained progress. The research results may be used to craft campaigns that will inspire individuals and communities to take action on air pollution, starting with those issues that have already been identified as the most likely to inspire a change of behavior.

Governments, who are responsible for implementing clean air policies, and various polluting industrial sectors, are sensitive to demands from civil society and the public. Developing strategic communication campaigns based on audience-tested messages may boost audience reach and engagement, and as such inspire more individuals and communities to demand action on air pollution.

- **Educate the public on the limited effectiveness of short-term exposure prevention measures, as compared to long-term sustainable measures.** Media discourse should emphasize sustainable solutions rather than short-term exposure prevention to achieve improved air quality that will result in less illness and death in the long term.
- **Health care professionals have a role to play in educating patients about air pollution-related illness, and raising awareness of the links between air pollution and chronic disease**—especially within vulnerable populations, who studies have proven are more susceptible to the health effects of polluted air.
- **The public should be encouraged to understand the value of collective action and recognize the limited capacity of individual actions to influence air quality.** As there is limited effectiveness on personal prevention measures (such as masks and air purifiers), the public must learn that policy change is the most effective way of improving air quality. Such changes can occur from strategic and collective public demand for cleaner air.
- **Strategic communication must be used to enable effective government action** to control the most important sources of air pollution, including building robust government capacity for monitoring, enforcement and data sharing to demonstrate progress.


KEEP
DELHI
CLEAN

The Future

Air quality levels will only improve through a sustained and concerted effort to reduce emissions from key sources of pollution. Strategic communication, especially mass media and digital campaigns, will help push the political needle, and are most effective when carefully developed using sophisticated message testing and production, then monitored and evaluated for specific outcomes and impacts, and then re-adapted based on the evaluation to further connect with audiences.

Vital Strategies recommends the following steps to be taken by clean air stakeholders and implementers across all sectors (government, nongovernmental, media, health care, epidemiology and others).

Identify and Engage Clean Air Influencers

To influence the air pollution discourse, dispel current air pollution myths, and keep the focus on credible current data, it is important to identify the key organizations or personalities who are influencing or can shape air pollution discourse in India. Influencers have thus far included political figures, photographers, nonprofit organizations and even celebrities. Monitoring the public discourse on an ongoing basis will allow clean air stakeholders to quickly identify key influencers and engage them, both publicly (e.g. through a social media post) and privately.

Conduct Ongoing Evaluation of Shifts in Media and Public Discourse

Air pollution conversations will continue to evolve over the years. It is critical that clean air communicators and implementors monitor the media and public discourse for misperceptions, fake news, and general trends, and that they consider this information in creating content that drives public demand for policy solutions.

Evaluate Impact of Clean Air Communication Campaigns

There are several clean air implementers conducting communication campaigns in India. Implementing a rigorous monitoring and evaluation process is key to measuring actual campaign impacts (for example, monitoring for increased public demand for action, or actual policy change) as opposed to likes, comments or mentions of social media posts. Communicators must not lose sight of the ultimate goal: improved air quality. (See Annex A for Vital Strategies' campaign framework, which includes a robust monitoring and evaluation component.)

Engage Clinicians and Other Health Professionals on Clean Air Advocacy

To correct misperceptions and encourage public demand for clean air, clinicians must be better trained and informed about air pollution. Workshops, grand rounds and other tried-and-true methods of clinical education should be encouraged through the provision of materials and a common platform where these professionals may share their thoughts on advocating for clean air, such as Inspire: Health Advocates for Clean Air (www.InspireCleanAir.org).

Train Journalists to Interpret Air Pollution and Health-Related Data, and Incorporate Into Stories

As influencers of public discourse and investigators of complex issues, the press must play a role in correcting the current misperceptions on air pollution sources, health effects and solutions. Media trainings by air pollution implementers and stakeholders would allow journalists to better understand the current air pollution landscape, access and interpret air quality and health data globally and locally, and accurately construct thoughtful, data-driven stories on air pollution.

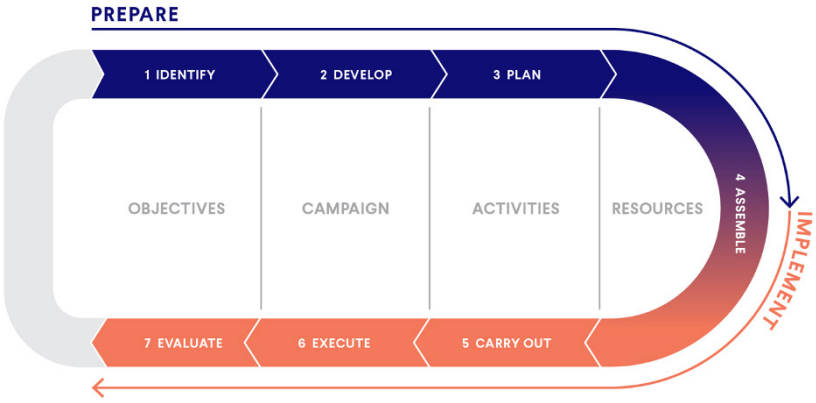
Boost Data Transparency for the Media and the Public

By sharing current data on air pollution and health, and understanding where true gaps in monitoring air pollution lie, clean air stakeholders can increase collaboration and reduce hurdles to accelerate progress on policy solutions. This will lead to lower emissions and as a result, lower economic and health costs due to air pollution. The availability of monitoring, source and health impact data will also reduce barriers to entry in terms of their use in the media discourse, and promote investigative air pollution journalism.

Encourage Policy Solutions

Improving air quality ultimately requires regulation and legislation from governments. It has been proven that policy solutions are the most effective ways to improve air quality and health. Pollution will continue unless there is compelling reason to reduce emissions, via positive and negative economic incentives, regulations that are enforceable and equitably enforced, and public accountability. As such, all effective clean air communication should ultimately lead to conversations on policy solutions by the relevant government bodies to meaningfully improve air quality.

Annex A: Vital Strategies' Campaign Framework



The Breakthrough model is Vital Strategies' approach for developing communication campaigns for public health programs that seek to change behaviors among different audiences and to create supportive environments for policy change. It emphasizes a research- and evidence-driven approach to communication, ensuring that resources are maximized, and that practitioners are the most likely to achieve meaningful objectives. Our process has been used in hundreds of campaigns in more than 40 countries that combine social media strategies, digital and mass media, public relations and live events.

1. IDENTIFY OBJECTIVES
The first phase of this model builds a foundation for effective communication. By defining the public health problem and identifying a long-term goal and target audience(s), planners can identify sharp (SMART) campaign objectives.

2. DEVELOP CAMPAIGN
With clear campaign objectives, it's simpler to develop strong, evidence-based campaign messages and decide which media channels are best, given the target audience and available resources.

3. PLAN ACTIVITIES
Next, develop a plan for what will be necessary to carry out a campaign. This includes identifying necessary resources, mapping partners and stakeholders, developing materials, and preparing for message testing, production and media planning.

4. ASSEMBLE RESOURCES
This includes the monetary, human and material resources necessary to execute a campaign and the accompanying media and research activities.

5. CARRY OUT ACTIVITIES
Before launching, engage with vendors for the research, production, media planning, and public relations work. This includes pretesting and production of materials, baseline research, negotiation of the media buy, and collaboration with media partners on launch preparation materials and activities.

6. EXECUTE CAMPAIGN
In this step, the campaign is launched and aired, with media engagement to extend campaign reach, accompanied by monitoring of campaign implementation, media coverage, and any social media activity. Campaign planners should have identified appropriate process metrics that demonstrate the campaign is being properly carried out.

7. EVALUATE BASED ON OBJECTIVES
Process and outcome evaluations are key to analyzing the successes and areas for improvement of a campaign. Outcome evaluations, when compared to baseline data, provide the information necessary to fine-tune objectives for further campaigns. The evaluation also provides critical evidence to communicate the value of health campaigns in the future.

For further assistance in planning strategic health communication campaigns, or to get in touch with Vital Strategies regarding workshops on this topic, please contact info@vitalstrategies.org.

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Bengaluru

Population:
8 million

Annual mean $PM_{2.5}$ level[1]:
28 µg/m³ (2018)

1 Central Pollution Control Board - India

Where do Bengaluru residents get information on air quality?

Awareness
85% of respondents were aware of air pollution
39% have discussed air pollution with family and/or friends

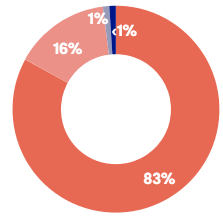
TV/radio	Friends of peers	Family members	Social media (Facebook, Twitter, etc)	Public display boards
78%	73%	58%	35%	20%

School/ university	Print media	Home/office air purifier and/ or monitor	Non-government website
18%	13%	11%	2%

Demographics

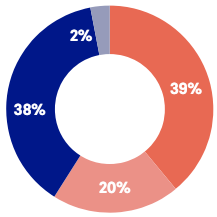
360 residents surveyed
59% Men; 41% Women | Mean Age = 33

Socioeconomic classification



- Upper class (A)
- Upper-middle class (B)
- Middle class (C)
- Lower-middle or lower class (D+E)

Education status



- Graduate/post graduate
- Some college but not graduate
- Secondary school
- Primary school or less

Transportation Patterns

Leading modes of transporation

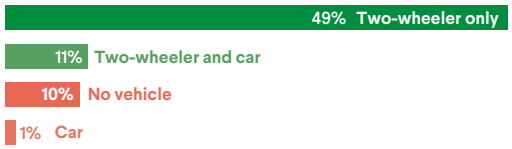
Bus	Metro	Walking	Two-wheeler	Local train
88%	74%	72%	53%	48%

The use of public transportation is common

Almost never | Less than once a week | About once a week | Several times a week | Almost daily

77% of residents own a two-wheeler. Only 1% reported owning cars.

Vehicle ownership

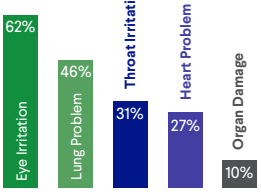


Are Bengaluru residents aware of air pollution's impacts?

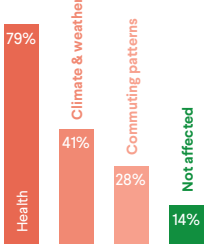
Awareness of health effects is relatively low

Residents believe air pollution health effects are greatest for the eyes, lungs and throat.

How do residents think air pollution affects health?



Residents are also concerned about other impacts of air pollution



Awareness of air pollution-related health effects

Effect on health

Yes, always | Yes, sometimes | No, never

Personal effect on health

Yes | No | Don't know/can't say

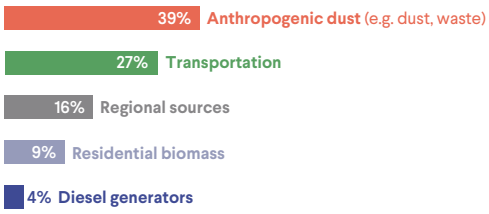
Severity of effect on personal health

Somewhat affected | Severely affected | Don't know/can't say

Most residents are misinformed about the leading sources of air pollution

Top 5 sources of air pollution

Actual Sources



Perceived sources (by rank)

1. Anthropogenic dust (e.g. waste, construction, tree cutting, dust)
2. Cigarette smoke
3. Motor vehicles
4. Industrial sources and power plants
5. Increased use of air conditioning

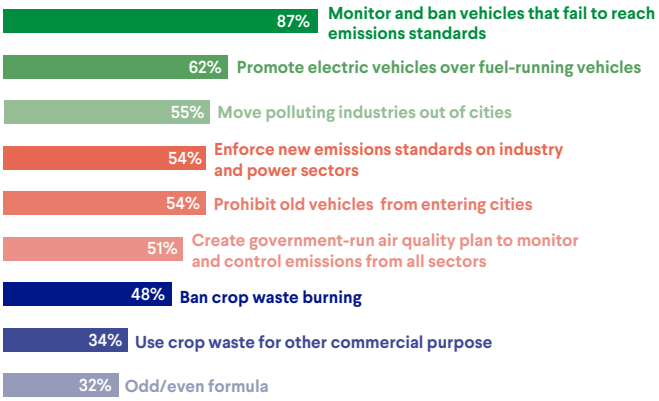
The above perceived sources of air pollution were obtained based on the percentage of respondents who identified these sources as a "main source of air pollution." Transportation includes motor vehicles (both two and four wheeled) and other forms of commuting. Regional sources refers to pollutants emitted outside the city that affect air quality within the city. Residential biomass refers to residential cooking, lighting, heating and water heating that contribute to ambient air pollution exposure, but not to biomass burning inside of homes. Actual sources contributing to the ambient PM2.5 concentration in an area were estimated with input data from emission inventory and meteorology using chemical transport/dispersion model. The resultant source distribution using this approach, which may be different from that of emission inventory alone, better captures the impacts of non-local emissions and transported pollution. The data for actual sources do not include natural emissions sources (like dust storms and lightning) and seasonal open (agricultural and forest) fires.

What do residents think about how to improve air quality?

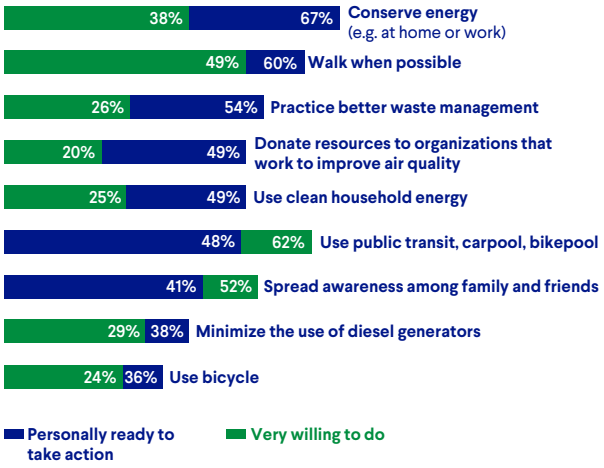
The level of awareness of government vs. civil society clean air initiatives is pretty even.

36% Central government; 30% state government; 24% municipal government; 28% NGOs

Bengaluru residents are calling for government action on multiple fronts.



Residents are willing to do their part to improve air quality.



Delhi

Population:
25 million

Annual mean $PM_{2.5}$ level[1]:
134 µg/m³ (2018)

1 Central Pollution Control Board - India

Where do Delhi residents get information on air quality?

Awareness

85% of respondents were aware of air pollution

56% have discussed air pollution with family and/or friends

TV/radio	Family members	Social media (Facebook, Twitter, etc)	Print media	Friends of peers
85%	60%	56%	55%	52%

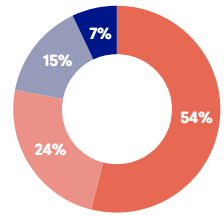
School/ university	Public display boards	Non-government website	Home/office air purifier and/ or monitor	Government website
45%	24%	22%	10%	6%

Demographics

630 residents surveyed

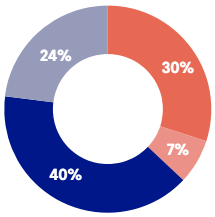
53% Men; 47% Women | Mean Age = 33

Socioeconomic classification



- Upper class (A)
- Upper-middle class (B)
- Middle class (C)
- Lower-middle or lower class (D+E)

Education status



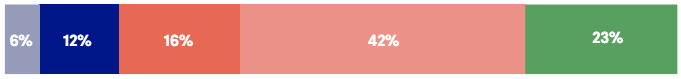
- Graduate/post graduate
- Some college, did not graduate
- Secondary school
- Primary school or less

Transportation Patterns

Leading modes of transporation

Bus	Metro	Walking	Two-wheeler	Local train
78%	64%	61%	28%	21%

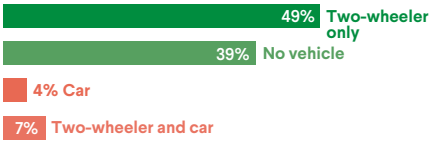
The use of public transportation is common



Almost never | Less than once a week | About once a week | Several times a week | Almost daily

49% of residents own a two-wheeler. Only 4% reported owning cars.

Vehicle ownership

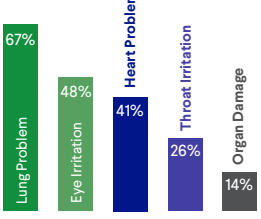


Are Delhi residents aware of air pollution's impacts?

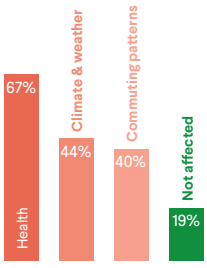
Awareness of health effects is relatively low

Residents believe air pollution health effects are greatest for the lungs, eyes and the heart.

How do residents think air pollution affects health?



Residents are also concerned about other impacts of air pollution



Awareness of air pollution-related health effects

Effect on health

Yes, always | Yes, sometimes | No, never

Personal effect on health

Yes | No | Don't know/can't say

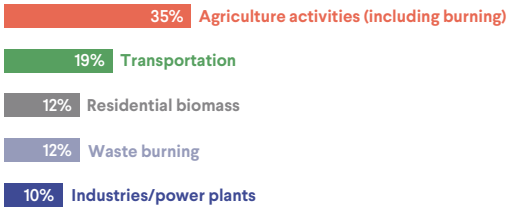
Severity of effect on personal health

Minor effect | Somewhat affected | Severely affected | Don't know/can't say

Most residents are misinformed about the leading sources of air pollution

Top 5 sources of air pollution

Actual Sources



Perceived sources (by rank)

1. Anthropogenic dust (e.g. waste, construction, tree cutting, dust)
2. Motor vehicles
3. Industrial sources and power plants
4. Cigarette smoke
5. Increased use of air conditioning

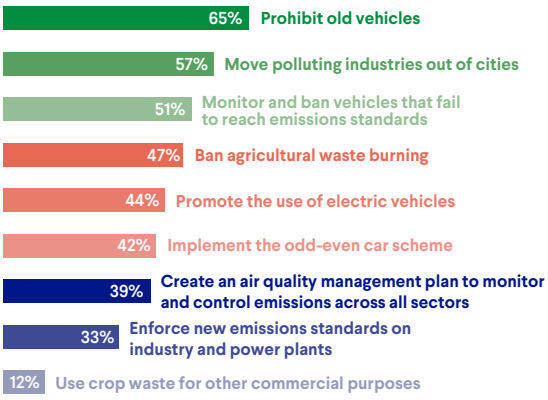
The above perceived sources of air pollution were obtained based on the percentage of respondents who identified these sources as a "main source of air pollution." Transportation includes motor vehicles (both two and four wheeled) and other forms of commuting. Regional sources refers to pollutants emitted outside the city that affect air quality within the city. Residential biomass refers to residential cooking, lighting, heating and water heating that contribute to ambient air pollution exposure, but not to biomass burning inside of homes. Actual sources contributing to the ambient PM2.5 concentration in an area were estimated with input data from emission inventory and meteorology using chemical transport/dispersion model. The resultant source distribution using this approach, which may be different from that of emission inventory alone, better captures the impacts of non-local emissions and transported pollution. The data for actual sources do not include natural emissions sources (like dust storms and lightning) and seasonal open (agricultural and forest) fires.

What do residents think about how to improve air quality?

The level of awareness of government vs. civil society clean air initiatives is pretty even.

36% central government; 30% state government; 24% municipal government; 28% NGOs

Delhi residents are calling for government action on multiple fronts.



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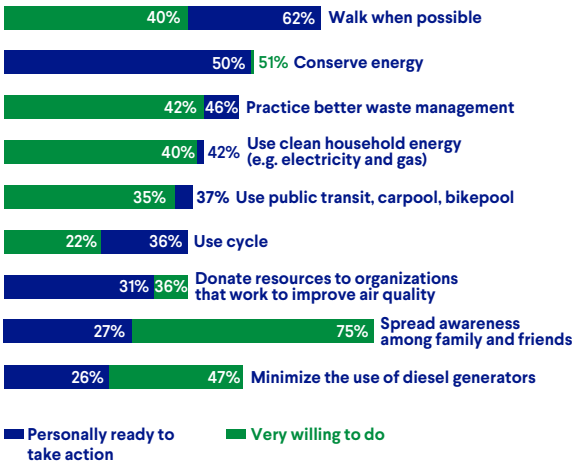


Mumbai

Population:
18 million

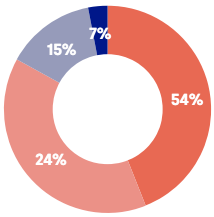
Annual mean $PM_{2.5}$ level[1]:
24 µg/m³ (2018)

1 Central Pollution Control Board - India

Demographics

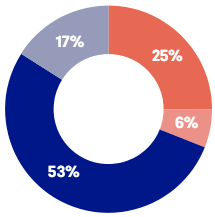
630 residents surveyed
50% Men; 50% Women | Mean Age = 34

Socioeconomic classification



- Upper class (A)
- Upper-middle class (B)
- Middle class (C)
- Lower-middle or lower class (D+E)

Education status



- Graduate/post graduate
- Some college, did not graduate
- Secondary school
- Primary school or less

Transportation Patterns

Leading modes of transporation

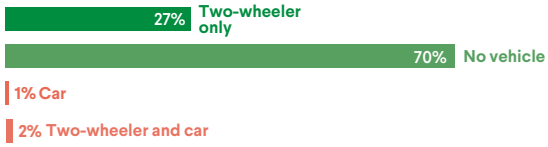
Local train	Walking	Bus	Public transportation	Hired auto 3-wheeler
70%	53%	52%	41%	38%

The use of public transportation is common

- Almost never
- Less than once a week
- About once a week
- Several times a week
- Almost daily

27% of residents own a two-wheeler. Only 1% reported owning cars.

Vehicle ownership



Where do Mumbai residents get information on air quality?

Awareness
92% of respondents were aware of air pollution
51% have discussed air pollution with family and/or friends

TV/radio	Friends of peers	Social media (Facebook, Twitter, etc)	Family members	Print media
93%	49%	44%	38%	29%

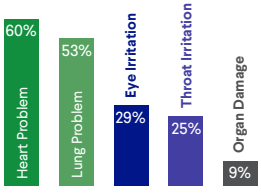
School/ university	Public display boards	Home/office air purifier and/ or monitor	Non-government website	Government website
15%	14%	8%	5%	3%

Are Mumbai residents aware of air pollution's impacts?

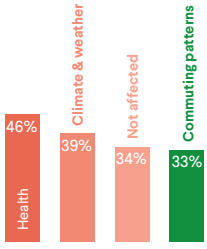
Awareness of health effects is relatively low

Residents believe air pollution health effects are greatest for the heart and lungs.

How do residents think air pollution affects health?



Residents are also concerned about other impacts of air pollution



Awareness of air pollution-related health effects

Effect on health

- Yes, always
- Yes, sometimes
- No, never

Personal effect on health

- Yes
- No
- Don't know/can't say

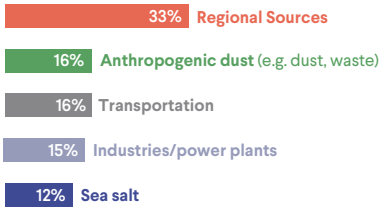
Severity of effect on personal health

- Minor effect
- Somewhat affected
- Severely affected

Most residents are misinformed about the leading sources of air pollution

Top 5 sources of air pollution

Actual Sources



Perceived sources (by rank)

1. Anthropogenic dust (e.g. waste, construction, tree cutting, dust)
2. Cigarette smoke
3. Motor vehicles
4. Industrial sources and power plants
5. Increased use of air conditioning

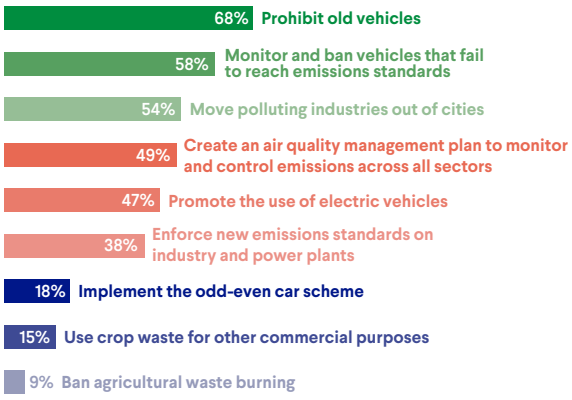
The above perceived sources of air pollution were obtained based on the percentage of respondents who identified these sources as a "main source of air pollution." Transportation includes motor vehicles (both two and four wheeled) and other forms of commuting. Regional sources refers to pollutants emitted outside the city that affect air quality within the city. Residential biomass refers to residential cooking, lighting, heating and water heating that contribute to ambient air pollution exposure, but not to biomass burning inside of homes. Actual sources contributing to the ambient PM2.5 concentration in an area were estimated with input data from emission inventory and meteorology using chemical transport/dispersion model. The resultant source distribution using this approach, which may be different from that of emission inventory alone, better captures the impacts of non-local emissions and transported pollution. The data for actual sources do not include natural emissions sources (like dust storms and lightning) and seasonal open (agricultural and forest) fires.

What do residents think about how to improve air quality?

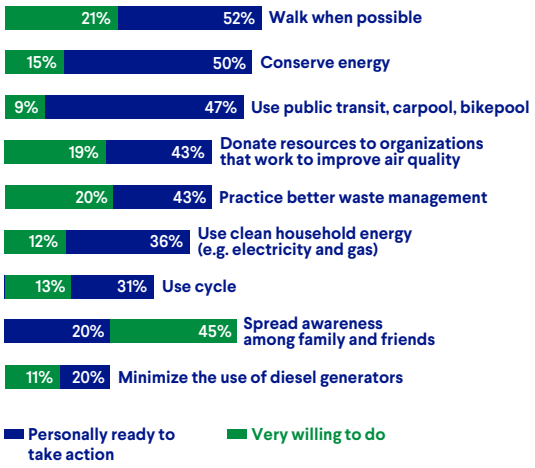
The level of awareness of government vs. civil society clean air initiatives is pretty even.

36% Central government; 30% state government; 24% municipal government; 28% NGOs

Mumbai residents are calling for government action on multiple fronts.



Residents are willing to do their part to improve air quality.



Patna

Population:
2 million

Annual mean $PM_{2.5}$ level[1]:
117 µg/m³ (2018)

1 Central Pollution Control Board - India

Where do Patna residents get information on air quality?

Awareness

94% of respondents were aware of air pollution

46% have discussed air pollution with family and/or friends

TV/radio	Print media	Friends of peers	Social media (Facebook, Twitter, etc)	School/ university
92%	70%	56%	53%	43%

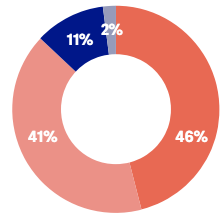
Family members	Public display boards	Non-government website	Home/office air purifier and/or monitor	Government website
41%	23%	19%	9%	8%

Demographics

360 residents surveyed

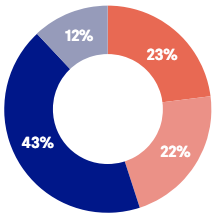
52% Men; 48% Women | Mean Age = 32

Socioeconomic classification



- Upper class (A)
- Upper-middle class (B)
- Middle class (C)
- Lower-middle or lower class (D+E)

Education status



- Graduate/post graduate
- Some college, did not graduate
- Secondary school
- Primary school or less

Transportation Patterns

Leading modes of transporation

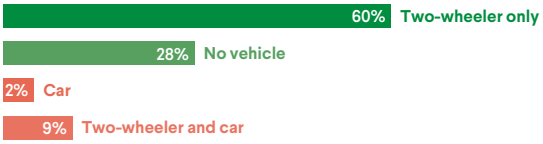
Walking	Bus	Cycling	Local train	Two-wheeler
62%	60%	54%	51%	50%

The use of public transportation is common

Almost never | Less than once a week | About once a week | Several times a week | Almost daily

60% of residents own a two-wheeler. Only 2% reported owning cars.

Vehicle ownership

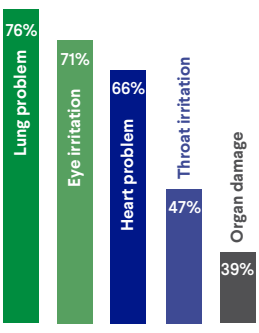


Are Patna residents aware of air pollution's impacts?

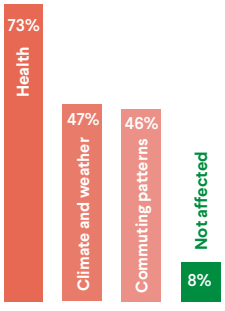
Awareness of health effects is high

Residents believe air pollution health effects are greatest for the lungs, eyes, and heart.

How do residents think air pollution affects health?



Residents are also concerned about other impacts of air pollution



Awareness of air pollution-related health effects

Effect on health

Yes, always | Yes, sometimes | No, never

Personal effect on health

Yes | No | Don't know /can't say

Severity of effect on personal health

Minor effect | Somewhat affected | Severely affected | Don't know/can't say

Most residents are misinformed about the leading sources of air pollution

Top 5 sources of air pollution

Actual Sources

- 25% **Anthropogenic dust** (e.g. dust, waste)
- 19% **Regional sources**
- 15% Transportation
- 15% Residential combustion
- 11% **Industrial sources and power plants**

Perceived sources (by rank)

1. Anthropogenic dust (e.g. dust, waste)
2. Cigarette smoke
3. Industrial sources and power plants
4. Motor vehicles
5. Increased use of air conditioning

The above perceived sources of air pollution were obtained based on the percentage of respondents who identified these sources as a "main source of air pollution." Transportation includes motor vehicles (both two and four wheeled) and other forms of commuting. Regional sources refers to pollutants emitted outside the city that affect air quality within the city. Residential biomass refers to residential cooking, lighting, heating and water heating that contribute to ambient air pollution exposure, but not to biomass burning inside of homes. Actual sources contributing to the ambient PM2.5 concentration in an area were estimated with input data from emission inventory and meteorology using chemical transport/dispersion model. The resultant source distribution using this approach, which may be different from that of emission inventory alone, better captures the impacts of non-local emissions and transported pollution. The data for actual sources do not include natural emissions sources (like dust storms and lightning) and seasonal open (agricultural and forest) fires.

What do residents think about how to improve air quality?

The level of awareness of government vs. civil society clean air initiatives is pretty even.

45% central government; 43% state government; 41% municipal government; 39% NGOs

Patna residents are calling for government action on multiple fronts.

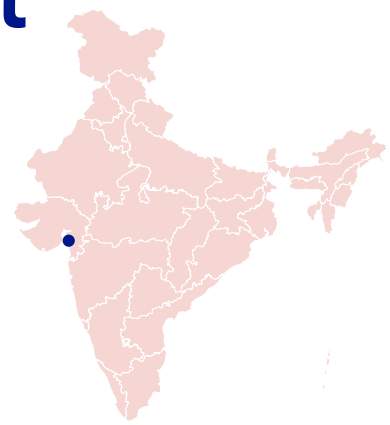
- 70% **Monitor and ban vehicles that fail to reach emissions standards**
- 65% **Prohibit old vehicles from entering cities**
- 63% Move polluting industries out of cities
- 62% **Promote electric vehicles over fuel-running vehicles**
- 61% **Create government-run air quality plan to monitor and control emissions from all sectors**
- 47% **Ban crop waste burning**
- 46% **Enforce new emissions standards on industry and power sectors**
- 36% **Odd/even formula**
- 22% Use crop waste for other commercial purpose

Residents are willing to do their part to improve air quality.

1%	75%	**Conserve energy** (e.g. at home or work)
3%	61%	**Use bicycle**
3%	61%	**Walk when possible**
2%	52%	**Use public transit, carpool, bikepool**
4%	52%	**Practice better waste management**
4%	48%	**Use clean household energy**
5%	45%	**Donate resources to organizations that work to improve air quality**
3%	38%	**Minimize the use of diesel generators**
10%	22%	**Spread awareness among family and friends**

Personally ready to take action — **Very willing to do**

Surat



Population:
4.5 million

Annual mean $PM_{2.5}$ level[1]:
88 µg/m³ (2018)

1 Central Pollution Control Board - India

Where do Surat residents get information on air quality?

Awareness
100% of respondents were aware of air pollution
98% have discussed air pollution with family and/or friends

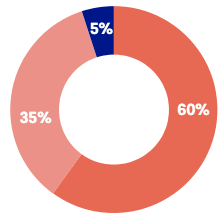
TV/radio	Social media (Facebook, Twitter, etc)	Family members	Friends of peers	School/ university
95%	86%	70%	69%	52%

Public display boards	Print media	Home/office air purifier and/ or monitor	Non-government website	Government website
49%	49%	17%	16%	9%

Demographics

360 residents surveyed
68% Men; 32% Women | Mean Age = 34

Socioeconomic classification



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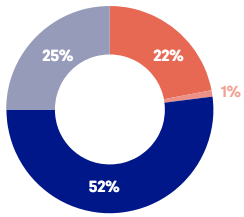


- Graduate/post graduate
- Some college, did not graduate
- Secondary school
- Primary school or less

Transportation Patterns

Leading modes of transporation

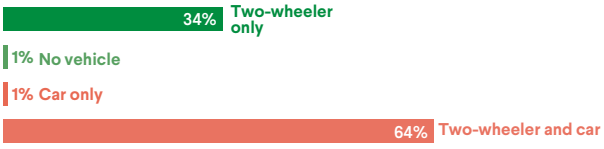
Cycling	Two-wheeler	Walking	Bus	Car
85%	78%	68%	62%	56%

The use of public transportation is common

Almost never | Less than once a week | About once a week | Several times a week | Almost daily

The majority of residents own a vehicle. 64% own a 2-wheeler and a car.

Vehicle ownership



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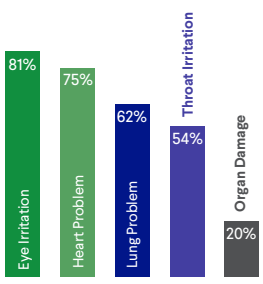

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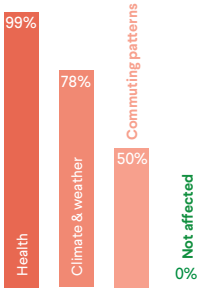

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Top 5 sources of air pollution

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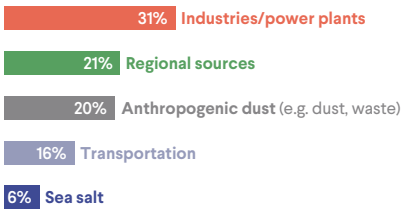

Perceived sources (by rank)

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2. Cigarette smoke
3. Motor vehicles
4. Industrial sources and power plants
5. Diesel generators

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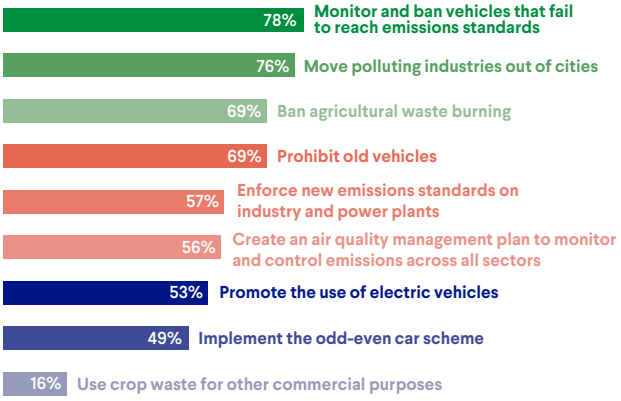
What do residents think about how to improve air quality?

There is a greater level of awareness about government vs civil society clean air initiatives.

69% Central government; 44% state government; 63% municipal government; 38% NGOs

Surat residents are calling for government action on multiple fronts.



Residents are willing to do their part to improve air quality.