1 Perception Survey results

Government of India and different state governments have taken several steps to combat air pollution. However, "unless people can participate meaningfully in events and processes that shape their lives, national human development paths will neither be desirable nor sustainable" (UNDP, 2013). Keeping this in mind, TERI conducted a nationwide random survey to understand the perception of common people of the country towards the air pollution scenario and different abatement strategies to combat air pollution.

About 69% of the total population of the country lives in the rural areas. However, research, policies and abatement strategies for air pollution have focused mainly in the urban areas. The survey was conducted in different rural, semi-urban and urban areas spread across the country. 53% of the surveyed population was from the rural areas (Figure 6), whereas 11% and 36% belonged to the semi-urban and urban areas respectively.

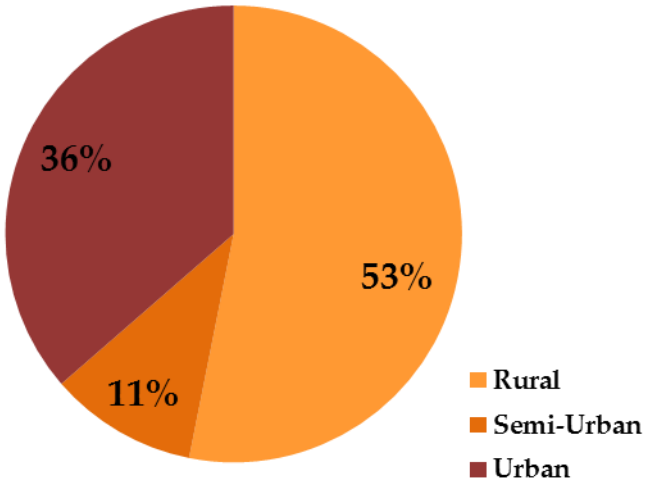

Figure 1: Distribution of the surveyed population among different settlement categories

Average education level of the surveyed population was college graduate and most of them were employed (53%). More than 90% of the surveyed population were aware about the impact of air pollution. The study indicates that among their effects on climate, agricultural productivity, building materials etc., the most important perceived effect of air pollution is on human health particularly on the respiratory systems (Figure 7). However, air pollution also has strong effects on cardiovascular system and moderate effects on eye and skin (Figure 7).

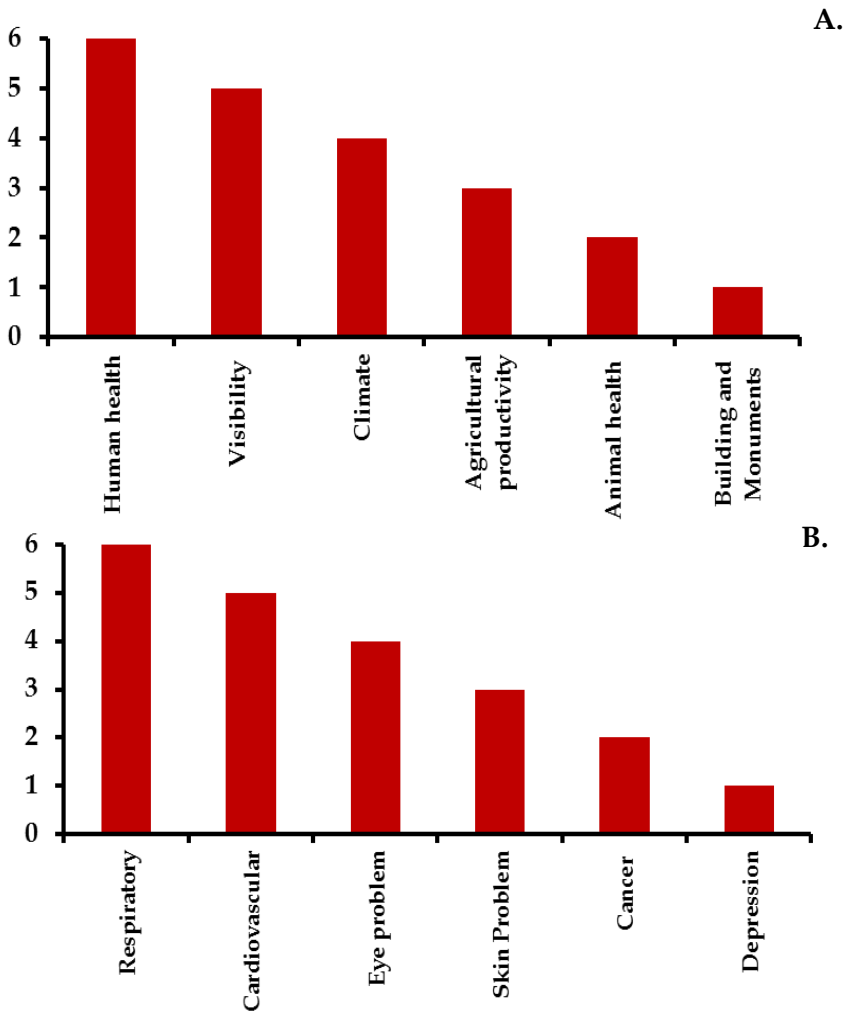

Figure 2: Ranking of the effects of air pollution (A) and its effect on human health (B).

Ranking is based on a scale of 0-6, where 0 indicates less important effect and 6 indicates most important effect

According to the perception of the surveyed population, diesel generators are the major source of air pollution in the country, followed by mining and industrial activities (Figure 8).

Extremely Important

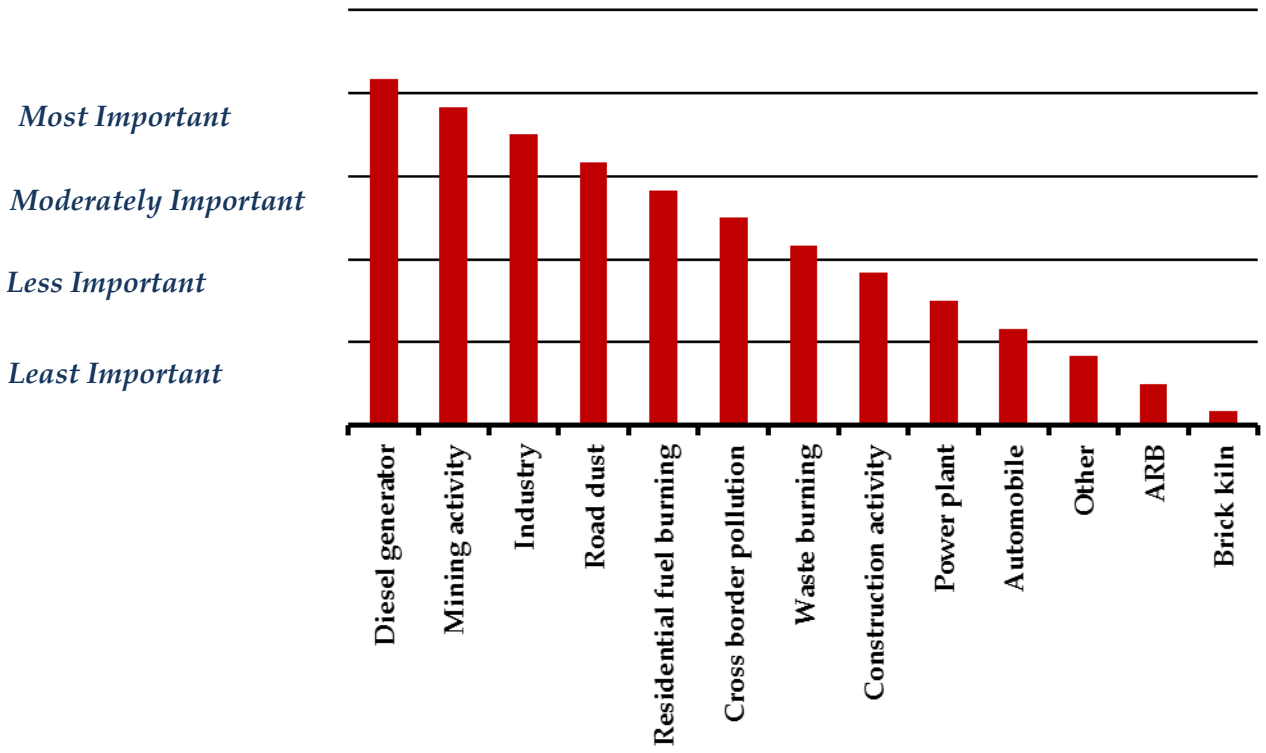

Figure 3: People perception on different sources of air pollution in India.

ARB: Agriculture Residue Burning

The survey indicates that the industrial emission control and road cleaning and management are the most important strategies to control air pollution of the country (Fig 9). Additionally, the survey indicates that the LPG penetration in the residential sector and ban on fire crackers are perceived having least effect on controlling the air pollution all over the country (Figure 9).

The survey population unanimously indicated that enhancement of public transport system needs to be prioritized all over the country to effectively control air pollution. It is a general belief among the policy makers that the creating public awareness about air pollution should be a priority among other abatement strategies. However, the present survey indicates that this should be medium or low priority of the policy makers to control the air pollution (Figure 10).

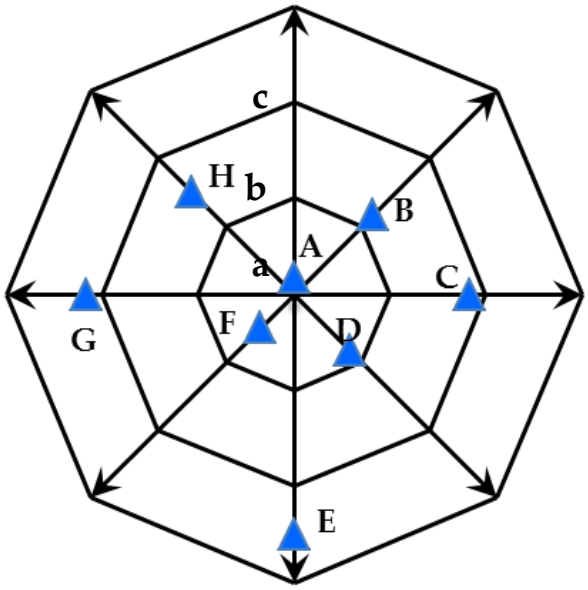

Figure 4: People perception on effectiveness of different air pollution abatement strategies in the country.

A = ban on crackers; B = Controlling dust emission from construction activities; C = r Controlling open burning of waste/agro-residues; D = controlling the use of diesel generators; E = Industrial emission control; F = LPG/PNG penetration in the residential sector; G = Road cleaning & management; H = Transport emission control. a = Less effective; b = Moderately effective; c = Highly effective

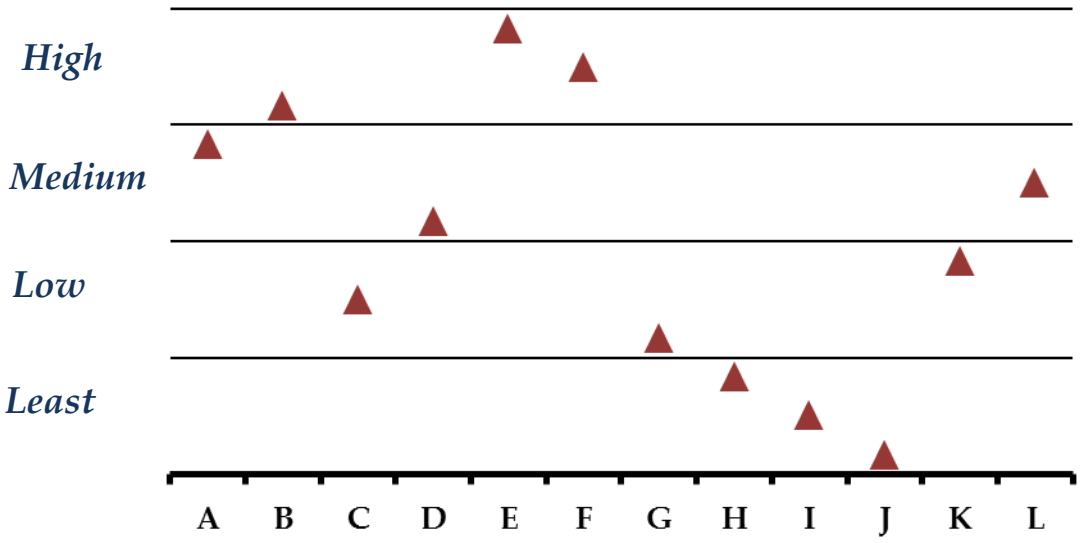

Figure 5: Prioritization in implementation of different air pollution abatement strategies.

A. Clean Air Mission; **B.** Encourage waste to energy conversion; **C.** Encouraging car pool; **D.** Enhancement electric mobility; **E.** Enhancement of public transport; **F.** Enhancement of the use of renewable energy; **G.** Improved automobile engine technology; **H.** Introduction of clean fuel in automobile; **I.** Introduction of cleaner industrial process; **J.** Introduction of congestion pricing; **K.** Public awareness building; **L.** Strengthening the Pollution Under Control (PUC) program

Rural-Urban disparity in air pollution perception

The survey results of urban and semi-urban areas were clubbed together before comparing the responses of the surveyed people in rural and urban areas. According to the perception of the surveyed people, the overall air quality of the rural area is better than that of the urban area (Figure 11). Study indicates that there was not much disparity in the awareness of people in both rural and urban (Urban+Semi-urban) areas about the impact of air pollution.

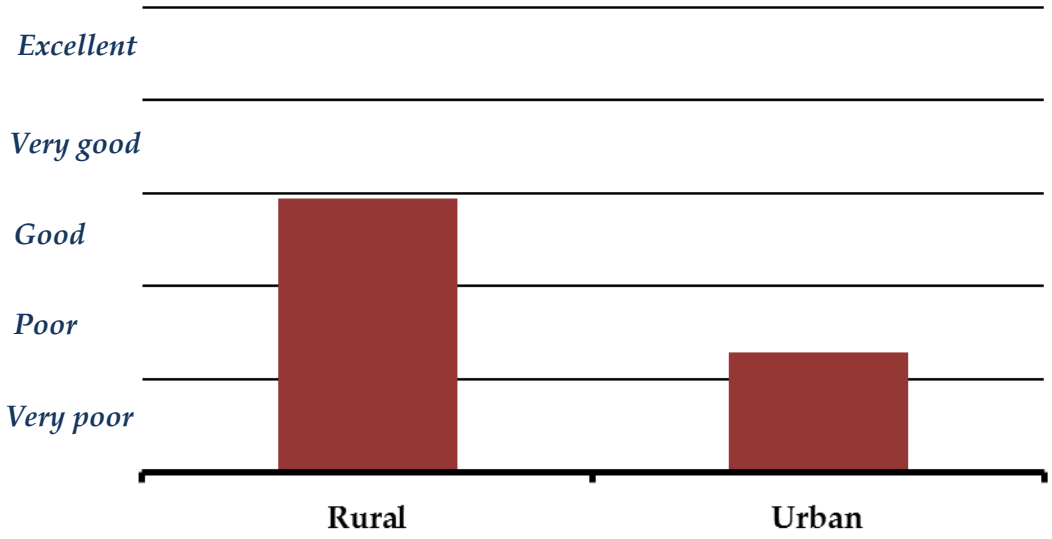

Figure 6: Air quality in rural and urban area of India according to the perception of people.

In both areas people believe that that the major impact of air pollution is on human health (Figure 12). However, perception on impact of air pollution does not follow the same order in rural and urban areas. Survey indicates that in rural areas the second most important impact of air pollution is on agricultural productivity, whereas impact on visibility is the second most important one in the urban areas (Figure 12). This may be attributed to higher agricultural activity in the rural areas.

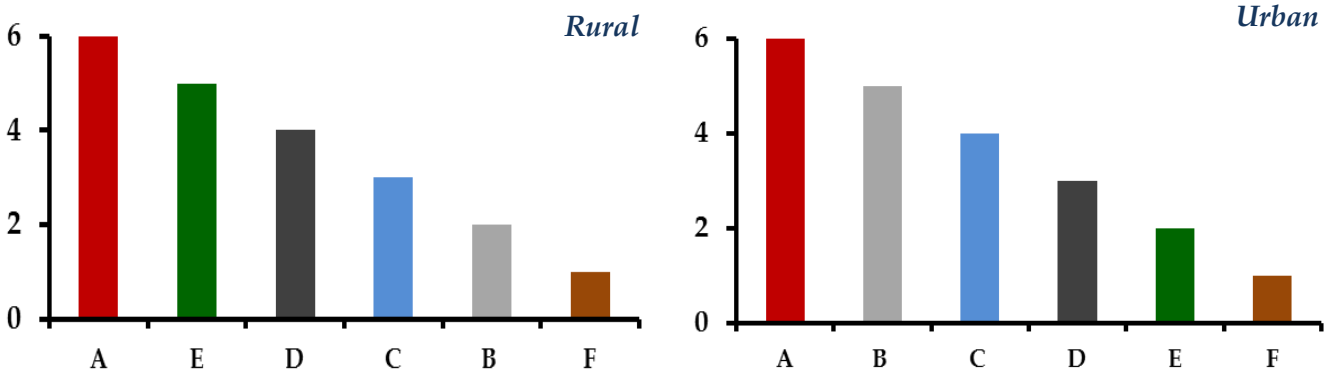

Figure 7 : Impact of air pollution in rural and urban areas.

0-2: Low; 2-4: Medium and 4-6: Strong. A. Human health; B. Visibility; C. Climate; D. Animal health; E. Crop productivity; F. Buildings & Monuments

In both rural and urban areas, the critical impact of air pollution on human health is on the respiratory system (Figure 13). The impact of air pollution on the cardiovascular system of the humans is higher in the rural areas compared to that in the urban area; whereas, the impact on eyes is higher in the urban areas compared to others (Figure 13).

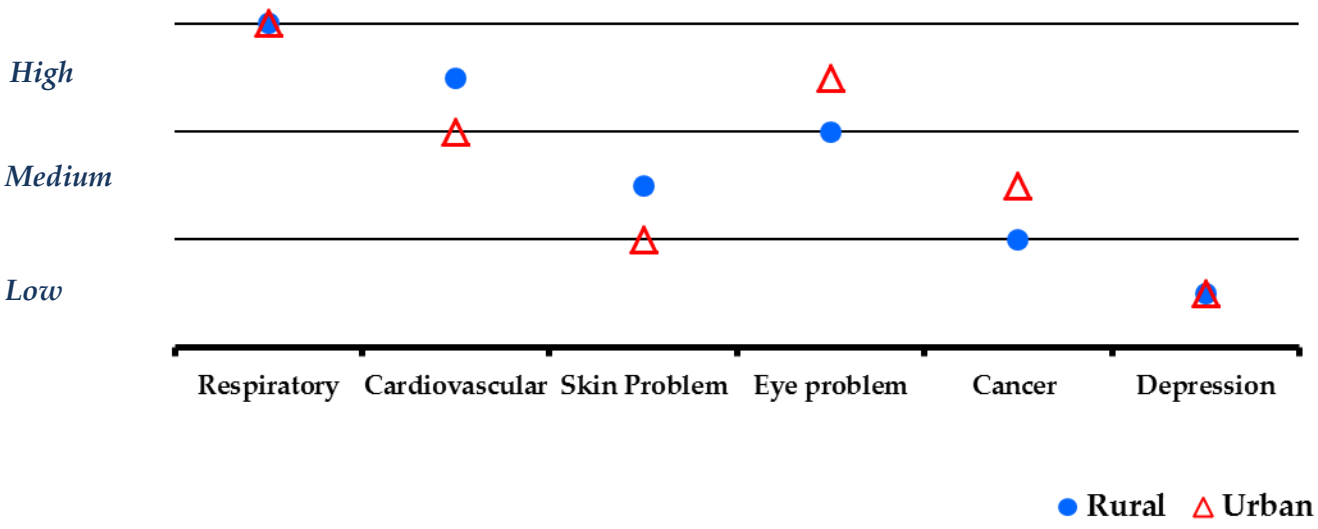

Figure 8: Perception of the impact of air pollution on human health in rural and urban areas.

The respondents were asked to rank thirteen activities based on the impact of the activities on air pollution. Respondents from both urban and rural areas believe that activities like agricultural residue burning, emissions from brick kilns and automobiles are least important source of air pollution (Figure 14). While respondents from urban areas believe that mining, industrial emissions and burning in the residential sector have high negative impact on the air quality, the respondents from rural areas believe that they only moderately affect the air quality. Similarly, respondents from rural areas believe that emissions from road dust, waste

burning and cross border pollution have high impact on the air quality but the respondents from urban areas do not hold the same opinion.

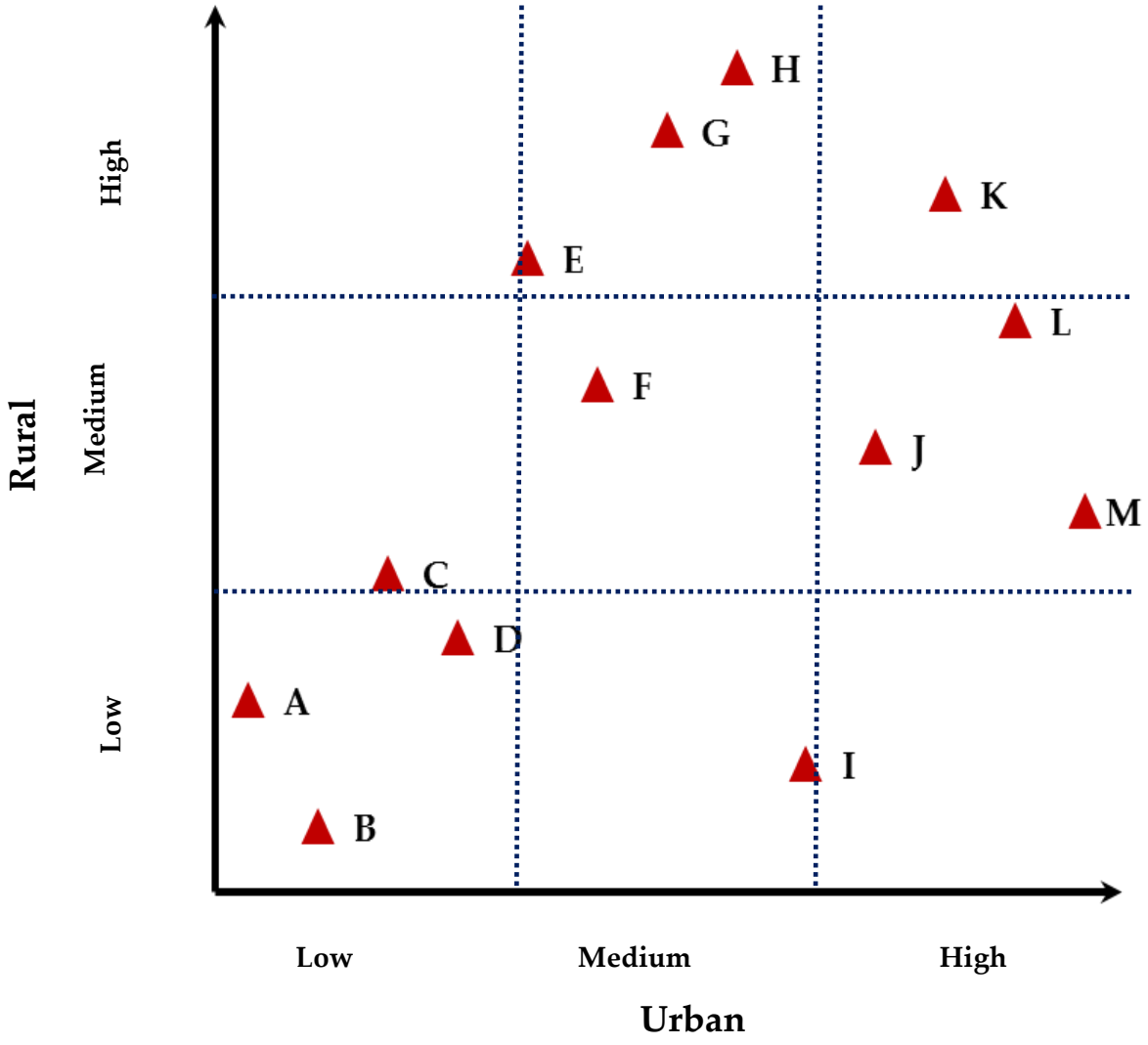

Figure 9: The relative impact of activities on air quality in perception of respondents from rural and urban areas.

A = agricultural Burning; B = brick kiln; C = others; D = automobiles; E = waste burning; F = construction activity; G = cross border pollution; H = road dust; I = power plant; J = residential burning; K = DG set; L = mining; M = industry

The study indicates that only 22% people in the rural area and 32% people in the urban area have knowledge about the national ambient air quality (NAAQ) standard of India (Figure 14). The average education level of the surveyed population in both rural and urban areas was college graduation. This indicates that the level of knowledge of air quality standards among the educated Indians is very poor.

Local air quality changes with meteorological conditions. It is important to get updated information about the local air quality to avoid its adverse impact on health. The information

should be easy to find and understand as the weather forecast. Government has developed Air Quality Index (AQI) as a key tool to provide such information related to air quality to the people. AQI is calculated based on eight major pollutants: Particulate matter, Oxides of nitrogen, Sulphur dioxide, carbon monoxide, Lead particulate, ammonia and

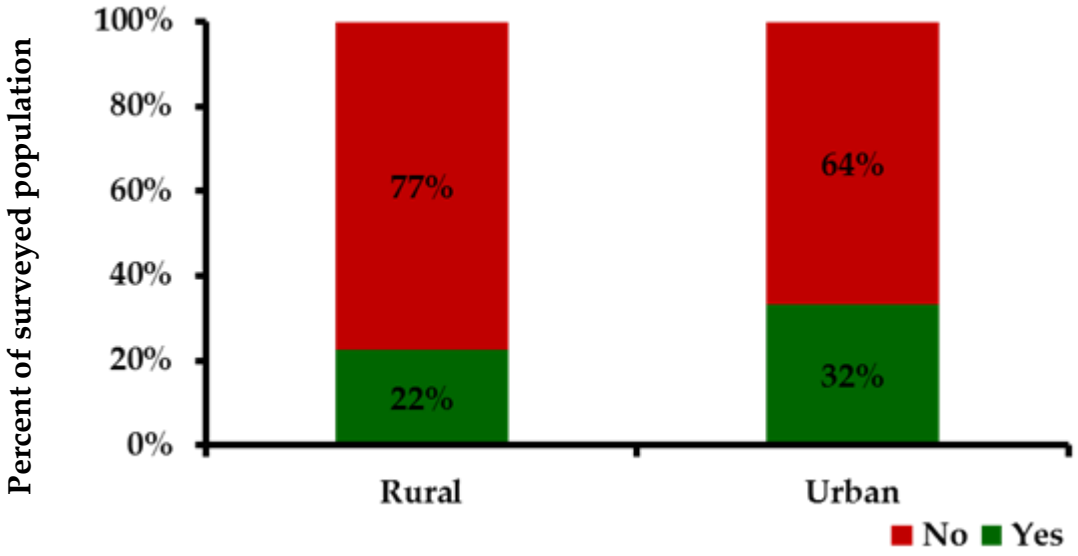

Figure 10 Knowledge of NAAQ standard among the surveyed population

ground level ozone. However, the perception survey indicates that significant number of people in both rural (90%) and urban (77%) areas have no knowledge about the AQI (Figure 16a). Again, there are significant numbers of people (in both rural and urban areas) who have the knowledge of NAAQ standard but no knowledge of AQI (Figure 16b). This suggests that the AQI is not popular enough in both rural and urban areas of the country. The understandability and display of AQI is poor in the rural area (Figure 15). Again, even in the urban areas the display of the AQI is not sufficient (Figure 16). However, the color coding of the AQI is well understood in the urban areas compared to the rural areas (Figure 17).

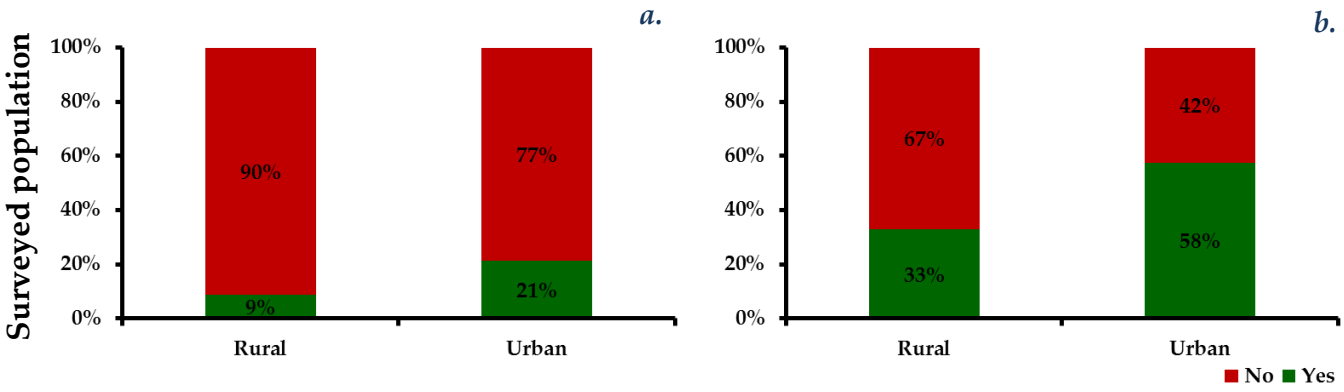

Figure 11: Knowledge of AQI in the surveyed population of rural and urban area

(a) and knowledge of AQI among the surveyed population with the knowledge of NAAQ (b)

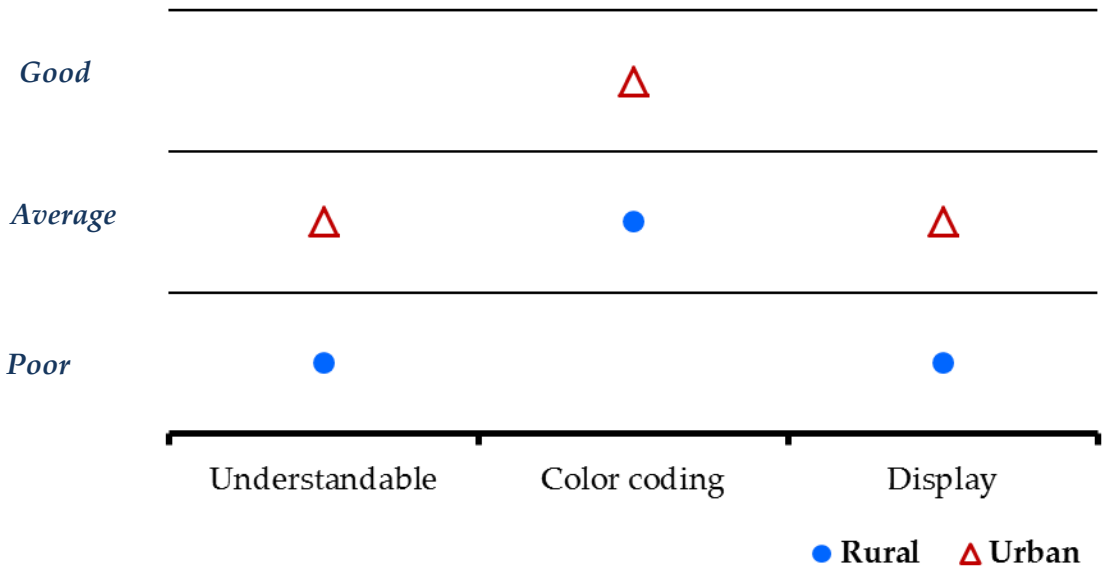

Figure 12: Status of AQI program in rural and urban areas.

The AQI was launched in India during 2014 under the Swaach Bharat Abhiyan program of the Govt. of India with the vision of "One Number-One Colour-One Description" for the common man to judge the air quality within his vicinity. However, present survey indicates that majority of the people in both urban and rural areas are unaware about the AQI. AQI is poorly displayed in the rural areas compared to that in the urban areas.

Although the AQI is not widely known among the people, it is important to communicate the air quality to the common people to help them to take adequate steps to protect their health and livelihood from adverse air quality. The survey indicates that television is the most popular media in both rural and urban areas to disseminate air quality information, followed by newspaper (Figure 18). The study indicates that CPCB, SPCB and SAFAR websites have failed to publicize the real-time air quality information among the common people of the country.

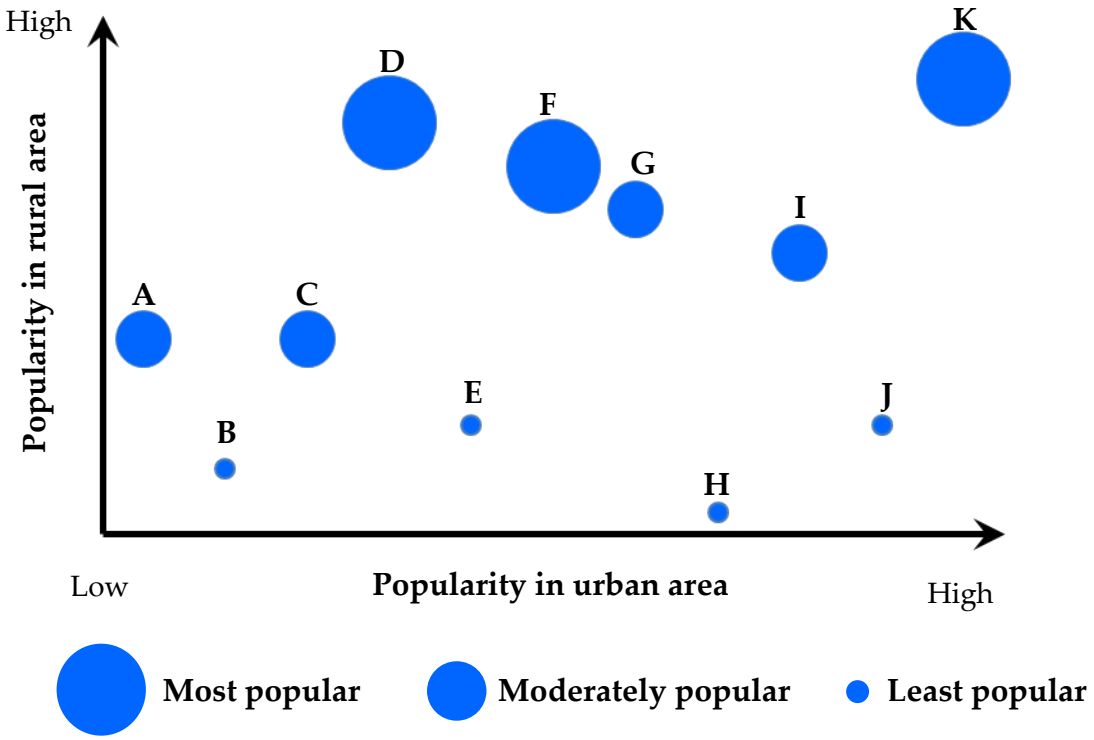

Figure 13: Popular air quality information media in Urban and Rural areas

A. CPCB website; **B.** Local NGO; **C.** Mobile App; **D.** Newspaper; **E.** Others; **F.** Own perception; **G.** Radio; **H.** SAFAR website; **I.** Social media; **J.** SPCB website; **K.** Television

Figure 19 represents the effectiveness, in the perception of respondents, of various strategies used in the past for control air pollution. It was found in the survey that the respondents from rural areas believe that all the eight strategies implemented in the past - ban on crackers, control dust from construction, reduction in open burning; control DG sets, control industries, LPG penetration, road cleaning, control transport emissions were effective in controlling air pollution . However, respondents from urban areas were more selective in rating these strategies. While they believed that strategies like reduction in open burning, control transport emissions, road cleaning, and control on emissions from industries were highly effective; strategies like ban on crackers, control dust from construction, and control on DG sets were believed to be only moderately effective.

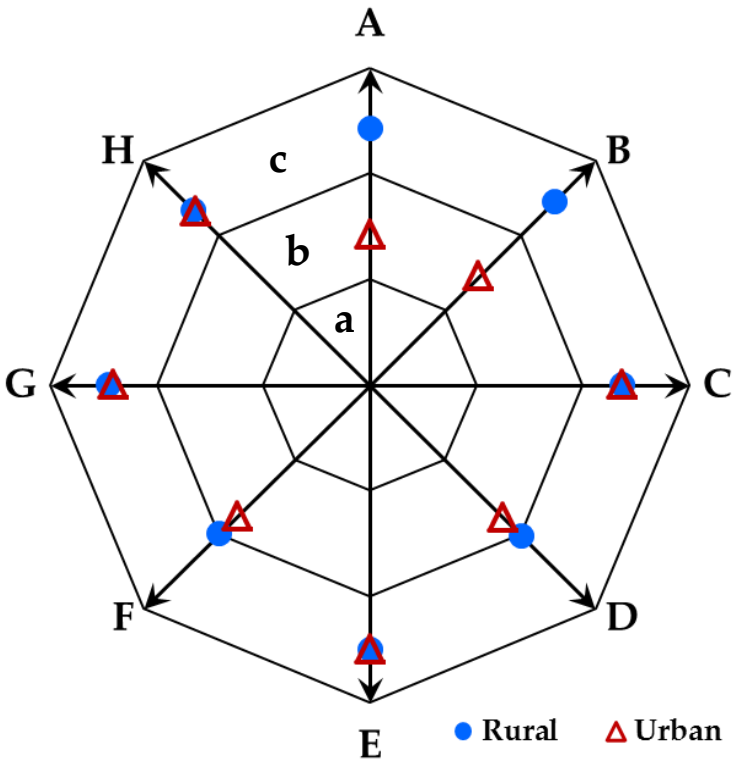

Figure 14: Perception of the surveyed people on the effectiveness of strategies used in past to control air pollution.

A = ban on crackers; B = Controlling dust emission from construction activities; C = r Controlling open burning of waste/agro-residues; D = controlling the use of diesel generators; E = Industrial emission control; F = LPG/PNG penetration in the residential sector; G = Road cleaning & management; H = Transport emission control. a = Less effective; b = Moderately effective; c = Highly effective

Respondents suggested that the public transport system should be improved with high priority followed by encouraging people to use renewable energy in both urban and rural areas for effectively controlling air pollution (Figure 20). According to the perception of people in both rural and urban areas, the introduction of congestion pricing and encouraging car pool will have no or low effect in reducing air pollution (Figure 20).

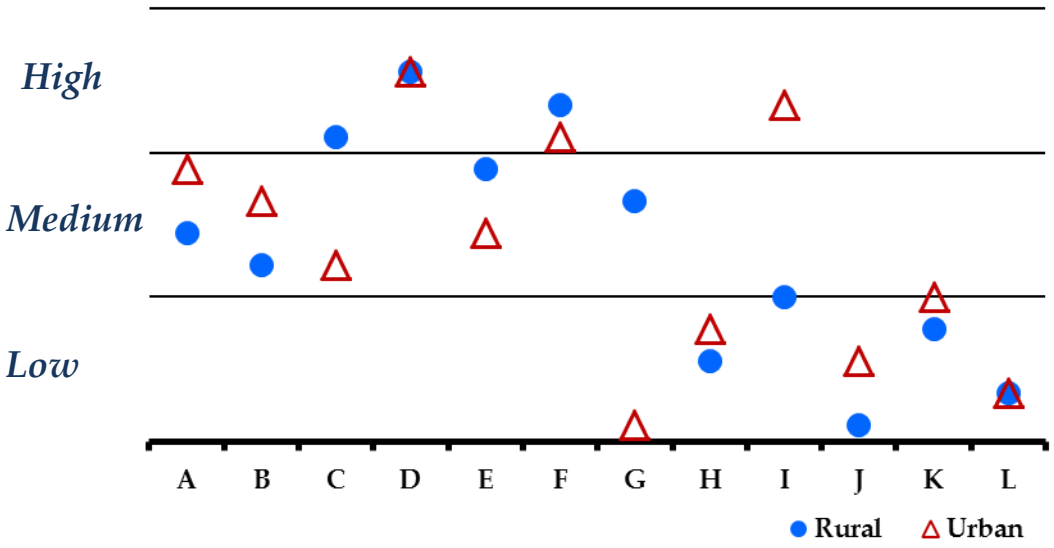

Figure 15: People perception on prioritization of different mitigation strategies to control air pollution

A. Clean air mission; **B.** Public awareness building; **C.** Encourage waste to energy conversion; **D.** Enhancement of public transport; **E.** Enhancement electric mobility; **F.** Enhancement of the use of renewable energy; **G.** Improvement of automobile engine technology; **H.** Introduction of clean fuel in automobile; **I.** Strengthening the Pollution Under Control (PUC) program; **J.** Introduction of cleaner industrial process; **K.** Encouraging car pool; **L.** Introduction of congestion pricing.

Conclusion

According to the perception of the surveyed people air quality in the rural areas of the country is 'good' whereas it is 'poor' in the urban areas. Study indicates that there is no disparity related to the awareness of people in the rural and urban area of the country related to air pollution. However, awareness related to NAAQ and AQI is comparatively higher in the urban areas than the rural. Diesel generators are perceived to be the major source of air pollution across the country. However, present emission controlling strategies for the diesel generators will have low impact in controlling air pollution if not modified. The study indicates that the CPCB, SPCB and SAFAR websites are not popular in dissipating real-time air quality information to the common people of the country. They rather depend on the newspaper and television to get the air quality information. People in both rural and urban areas believe that enhancement of public transport should be prioritized in the government policies to control the air pollution of the country.