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# A CROSS SECTIONAL STUDY TO ASSESS THE KNOWLEDGE, ATTITUDE & PRACTICE ABOUT AIR POLLUTION, AND RELATED HEALTH HAZARDS AMONG RESIDENTS NEAR A LANDFILL IN VANIYAMBADI, TAMIL NADU, 2020

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Abstract

BACKGROUND : Air pollution is a cause of morbidity and mortality with open landfills also being major sources of air pollutants. People living near exposed landfills are at more risk of health hazards. This study aims to assess the knowledge, attitude and practice about air pollution, related health hazards and prevention among residents living near an open landfill in Vaniyambadi town. A cross sectional study from September to October 2020 among 93 residents living near an open landfill was conducted. The study revealed that the residents had good knowledge about air pollution and its health hazards and with good prevention practices. Personal Protective Equipment usage was found to reflect the positive impact of the pandemic related Information Education Communication activities with everyone using face masks. The results showed that 26% had below average knowledge about air pollution, sources and causes, which warrants the need to emphasize on addressing the gap in knowledge and practice among residents near landfill.

KEYWORDS : Residents, landfill, air pollution, health hazards.

## INTRODUCTION

The interaction between man and environment has been studied extensively with ultimately depicting that all activities related to human survival as well as evolution has had a negative impact on his surrounding environment. Among the environmental pollutions, air pollution is a very major cause for concern especially in times like Pandemic where those already suffering from air pollution related morbidities have a poorer outcome if infected [1,2].

Air pollution has various effects on the health with short term being COPD (Chronic Obstructive Pulmonary Disease) and other minor symptoms like cough, wheezing, breathlessness etc., while the long term effects are mostly related to cardiovascular and cerebrovascular pathologies in addition to various malignancies.(Manisalidis et al. 2020)[3].

There are many pollutants that are major factors in disease in humans. Among them, Particulate Matter (PM), particles of variable but very small diameter, penetrate the respiratory system via inhalation, causing respiratory and cardiovascular diseases, reproductive and central nervous system dysfunctions, and cancer [6,7].

A landfill is one of the major methods used for waste disposal. It is defined as the deposition of waste in a specially designated area, which consists of a pre-constructed 'cell' lined with an impermeable, it has been found out that Landfill operation is usually associated with contamination of surface and groundwater by leachate from the landfill (mostly if the landfill lacks adequate liners), pungent odour, loud disturbing noise from landfill bulldozers, bio-aerosol emissions; volatile organic compound[8].

Some other pollutants associated with deposition of waste on landfills include litter, dust, excess rodents, unexpected landfill fires. Complex chemical and microbiological reactions within the landfill often lead to the formation of several gaseous pollutants, persistent organic pollutants (such as dioxins, polycyclic aromatic hydrocarbons), heavy metals and particulate matter. Studies have shown that when nitrogen dioxide and sulphur dioxide are inhaled or ingested by humans, symptoms such as nose and throat irritations, bronchoconstriction, dyspnea and respiratory infections are prevalent, especially in asthmatic patients[14].

These effects can trigger asthma attacks in asthmatic patients when in contact in high proportions, heavy metals affect the nervous system which causes neurotoxicity leading to neuropathies with symptoms like memory disturbances, sleep disorders, anger, fatigue, head tremors, blurred vision and slurred speech. It can also cause kidney damage like initial tubular dysfunction, risk of stone formation or nephrocalcinosis, and renal cancer[14].

When waste such as used tires, construction debris,

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old appliances and furniture, as well as general household, commercial and industrial waste, is disposed in places without permitted and controlled facilities can provide a ready source of nutrition and shelter for rodents and consequently for their ecto-parasites[15].

In addition Industrial revolution as well as frequent change in habitat of humans such as urbanization has had an even more deleterious effect.(Manisalidis et al. 2020)[3]

Global air pollution has been noted to be a major public health issue with very little change despite an array of social, legislative and economic measures undertaken by all governments [1]. In addition to health-related effects these activities leading to air as well as environmental pollutions can also cause climate changes which in turn affect the ecological balance as well as pave way for newer and worse scenarios with the current pandemic being an eye-opener.

WHO estimates that in 2016, some 58% of outdoor air pollution-related premature deaths were due to ischemic heart disease and strokes, while 18% of deaths were due to chronic obstructive pulmonary disease and acute lower respiratory infections respectively, and 6% of deaths from lung cancer in 2016, 91% of the world population was living in places where the WHO air quality guidelines levels were not met.9 Ambient (outdoor air) pollution in both cities and rural areas was estimated to cause 4.2 million premature deaths worldwide in 2016. (Ambient (outdoor) air pollution n.d.)[11]

PM stands for Particulate Matter, it is the major pollutant among others. The major components of PM are sulfate, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water. It consists of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air [11]. While particles with a diameter of 10 microns or less, (≤ PM10) can penetrate and lodge deep inside the lungs, the most damaging are those with a diameter of 2.5 microns or less, (≤ PM2.5). PM2.5 can penetrate the lung barrier and enter the blood system.(Ambient (outdoor) air pollution n.d.)[10]

The concentrations of PM are often highest especially in the urban areas of India. Ozone is a major factor in asthma morbidity and mortality, while nitrogen dioxide and sulfur dioxide also can play a role in asthma, bronchial symptoms, lung inflammation and reduced lung function.(Ambient (outdoor) air pollution n.d.). [11]

## JUSTIFICATION

Landfills emit landfill gas that consists mostly of methane and carbon dioxide, with small amounts of volatile organic compounds from the bacterial decomposition of organic materials. Methane and carbon dioxide are both greenhouse gases, and methane is toxic and explosive in large concentrations. Other anaerobic chemical reactions also release volatile organic products. Methane and carbon dioxide are the two principal gases associated with landfill emissions, however, there is also a small amount of other volatile organic compounds (VOCs) among which are frequently substances such as arsenic and lead from various electronics disposed in the landfill. Mercury represents yet another noxious substance that usually leaks through the waste due to haphazardly discarded fluorescent light bulbs.

WHO reports have suggested that any potential exposure is likely to be limited to 1 km from landfill sites by the air pathway, and 2 km by the water pathway Paigen et al., 1987. (Swaroopanand, Mahavidyalya, and Bhilai 2015) Municipal drinking water of contaminated wells due to waste disposal site has adverse effect on spontaneous abortions, birth defects and children health concern leukemia.[13] Cancer risks in the population which was living 2 km. from landfill sites in Great Britain and found leukemia in children and adult. Brain & bladder cancer and hepatobiliary cancer in people were also reported.(Swaroopanand, Mahavidyalya, and Bhilai 2015)

To understand the risks of hazardous waste disposal within health-care establishments, one should be responsive about hygiene methods of solid waste (trash and garbage deposits) disposal. For this most important thing is creating awareness in public to improve the quality control in healthcare Local health board should play main role in awareness programs. They must also know the role of municipalities and their approach towards such landfill sites(Swaroopanand, Mahavidyalya, and Bhilai 2015)

This study aims to assess the knowledge as well as attitude among general public living near an open landfill situated in a rural area of Tamil Nadu. Also, to assess the practice of these people regarding preventive measures against air pollution as well as regarding solid waste disposal. Thereby enabling them to take up an active role in the effective self-management of preventive measures against health hazards related to air pollution.

## OBJECTIVE

To assess the knowledge, attitude and practice about air pollution, related health hazards and prevention practices among residents living near an open landfill in Vaniyambadi town, Tirupattur district.

## METHODOLOGY

A cross sectional study was conducted over a period of 2 months from September 2020 to October 2020 among the residents living in the vicinity of a landfill and Solid waste management facility near Vaniyambadi town.

$$N = \frac{Z\alpha^2 * p * q}{d^2}$$

N = Sample size

Zα/2 = 1.96 (0.05/2, upper tail probability for 0.025)

p = 30.8 prevalence of respiratory symptoms among residents near a dump- yard16

q = 1-p

d = 10, absolute precision

Substituting the values,

$$N = \frac{1.96*1.96*30.8*69.2}{10*10}$$

$$N = \frac{3.8416*2131.36}{100}$$

$$N = \frac{8187.83}{100}$$

N= 81

Adding 10% (81*10/100) as attrition rate,

81+8 = 93

**N= 93**

For this study purposive sampling was used and residents, near the municipality operated solid waste management facility which also had an open landfill in Vaniyambadi taluka, were selected. One adult resident per household was randomly selected, provided their houses were situated within a radius of 3 km from the landfill and those who gave consent were included in this study. Out of 101 households, 4 were locked and 2 families were not willing for this study and data was collected from adults in remaining households.

A pretested, semi-structured, interviewer administered questionnaire was used for data collection. Two male adults working as volunteers under the Vaniyambadi town panchayat, were recruited for establishing rapport among the local people for explaining the study's purpose. Questionnaire was explained to participants in local language as well in English and then information and consent sheet was distributed by volunteers to the participants with emphasis on getting an informed signed consent.

Participants were approached on the basis of about 10 to 15 households per day, and data collection was done only on weekends and during the daytime to ensure the presence of all family members. Difficult terms were first explained and then the participants were told to give their response independently and in an unbiased way without any undue pressure, maintaining the confidentiality of their identity. A total of 93 responses were obtained.

The questionnaire comprised of 4 sections.

Section I: Includes information on socio-demographic profile of the participants.

Section II, III and IV: includes questions regarding the knowledge about air pollution, attitude towards air pollution and various preventive practices adopted by residents as well as their take on the practices aimed at solid waste segregation.

i. 21 knowledge-related questions- Every right answer was awarded one mark and every wrong answer was awarded zero. Multiple option answers were awarded more than one mark for each correct answer. The total score of knowledge-related questions were 61. 0 to 24 was considered bad knowledge, 25 to 31 were considered average knowledge and more than 32 was considered as good knowledge.

ii. 10 attitude related questions- Maximum score was 44 and minimum score was22. The median score was taken as cut off. The ranking of respondents was done as follows: Positive (score ≥ 50%) and Negative (score < 50%).

iii. 5 questions regarding self-reported practice against air pollution another 5 related to practices on solid waste segregation and self-reported practices on hand hygiene as well as mask usage. The total score was 24 for air pollution preventing practices. The median score was taken as cut off. The ranking of respondents was done as follows: Good (score ≥ 50%) and Bad (score < 50%).

The data was entered in MS Excel and was analyzed using SPSS version 16. Descriptive statistics such as proportions, mean, and standard deviation (SD) were used and inferential statistics such as Fischer's exact test and Chi square test were used. P value < 0.05 was considered significant. Data were expressed in graphs, tables and charts wherever necessary.

## RESULTS

Out of the 93 participants, the Mean age of the study participants was found to be 42 ±11.22 Years. 73 (81.7%) were male and 20 were female. 91.4% were Hindu and 6.3% were Christians. Majority were married (88%). Regarding education, only 1% were illiterate and 28.3% had attended college. The mean duration of staying in current residence was 31 ±13.7 years. The mean distance from the landfill was 1.2 kilometers. (Table 1).

*Table 1: Socio demographic details of participants (n= 93)*

| Sociodemographic details | | Frequency (%) |
|---|---|---|
| Age (in years) | 11-19 | 2(2.1) |
| | 20-29 | 12(12.8) |
| | 30-39 | 22(23.4) |
| | 40-49 | 34(36.4) |
| | 50-59 | 17(18.1) |
| | 60-69 | 6(6.4) |
| | 70-79 | 1(1.1) |
| Gender | Male | 73(77.7) |
| | Female | 20(21.3) |
| Marital Status | Married | 84(89.4) |
| | Unmarried | 09(9.6) |
| Education | Illiterate | 1(1.1) |
| | Primary | 8(8.5) |
| | Middle | 23(24.5) |
| | High | 21(22.3) |
| | Higher Secondary | 16(17) |
| | Undergraduate | 7(7.4) |
| | Postgraduate | 17(18.1) |
| Occupation | Private Company | 39(41.5) |
| | Coolie | 21(22.3) |
| | Business | 7(7.4) |
| | Farmer | 10(10.6) |
| | Tailor | 3(3.2) |
| | Teacher | 3(3.2) |
| Fuel for Cooking | LPG | 89(94.7) |
| | Firewood | 2(2.1) |
| | Both | 2(2.1) |

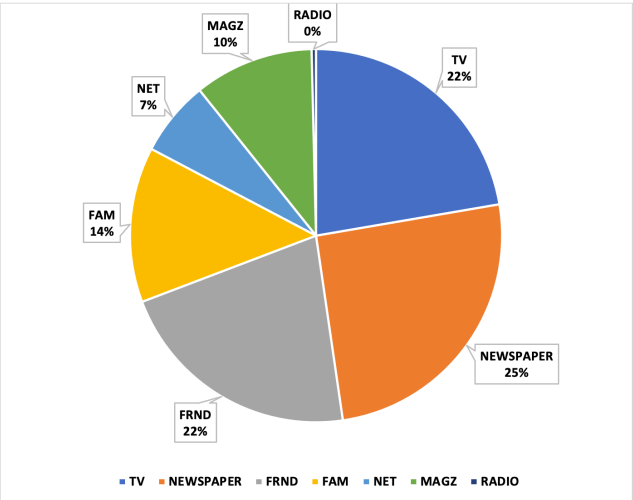


*Figure 1: Sources of information on Air pollution (Multiple responses)*

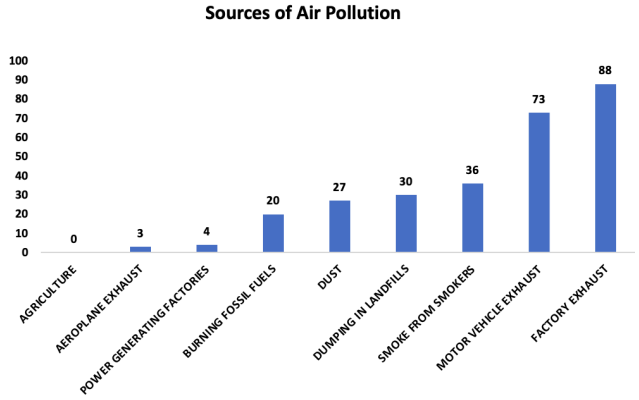


*Figure 2: Sources of Air pollution (Multiple responses)*

Among respiratory problems due to air pollution 39% stated bronchial asthma as the major respiratory health hazard due to air pollution followed by lung cancer while involvement of eyes(redness) was (91%). Only 37% were aware that air pollution was hazardous to fetus. About 82% knew about other system involvement. While 35% reported mask usage to enable reduce effects of air pollution and 47% reported that proper waste management can protect from the effects of air pollution in their area. (Table 2). Newspapers were the major source (67%) to provide knowledge about air pollution followed by television (52%) and internet (43%).

*Table 2: Knowledge regarding air pollution and its health hazards*

| Variables | Frequency (%) |
|---|---|
| **Health hazards of air pollution** | |
| Asthma | 79 (39%) |
| Lung Cancer | 46 (22.6%) |
| Pneumonia | 38 (18.7%) |
| Chronic Obstructive Pulmonary Disease | 22 (10.8%) |
| Mother to child transmission | 34 (36.1%) |
| Chronic cough | 69 (43.1%) |
| Skin conditions | 64 (68%) |
| Gastrointestinal conditions | 60 (63.8%) |
| Hypertension | 62 (37.3%) |
| Myocardial infarction | 83 (50%) |
| Diabetes mellitus | 15 (9%) |
| Stroke | 6 (3.6%) |
| Eye Irritation | 85 (90.4%) |
| **Knowledge about prevention** | |
| Wearing masks | 60 (35.5%) |
| Routine health checkups | 8 (4.7%) |
| Less work in polluted areas | 22 (13.8%) |
| Proper waste management | 79 (46.7%) |

## Knowledge :

In knowledge regarding air pollution and its health hazards, 25.8% (24) of the participants had good knowledge. 96% (225) were aware about air pollution. 57% had recognized vehicle smoke and factory exhaust as the major sources of air pollution, followed by smokers and landfill (24%) (Figure 1). 34% had reported carbon dioxide as the major constituent of air pollution followed by Sulphur dioxide (27.7%).

*Table 3: Attitude about air pollution and its preventive measures*

| Attitude based questions | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| Air in Vaniyambadi is better now compared to 5 years before | **17 18.2%** | 1 1% | 30 32.2% | **36 38.7%** | 9 9.6% |
| Individual is responsible for preventing against air pollution | 0 | 6 6.4% | 14 | **57 61.2%** | 20 21.5% |
| Routine health checkups prevent against air pollution | 4 4.3% | 17 18.8% | 44 15.1% | **42 45.1%** | 16 17.2% |
| Personal protective equipment can prevent against air pollution | 0 | 3 3.2% | 22 23.6% | **54 58%** | 14 15.1% |
| Strict legislations regarding factories can reduce air pollution | 0 | 3 3.2% | 16 17.2% | **47 50.5%** | 27 29.1% |
| Strict legislations regarding landfill operation can reduce air pollution | 2 2% | 1 1% | 25 262% | **44 47.3%** | 21 22.5% |
| Open landfill is the major cause of air pollution in their area | 0 | 1 1% | 25 26.8% | **38 40.8%** | 29 31.1% |

## Attitude :

53% (49) of participants had positive attitude towards air pollution and its prevention. While 29.1% stressed that strict legislations by Government towards factories and vehicles can reduce air pollution, 22.5% agreed that legislations regarding operation of open landfills can reduce air pollution. 72% felt that the major cause for pollution in their area was due to the landfill and lax regulations regarding solid waste management.

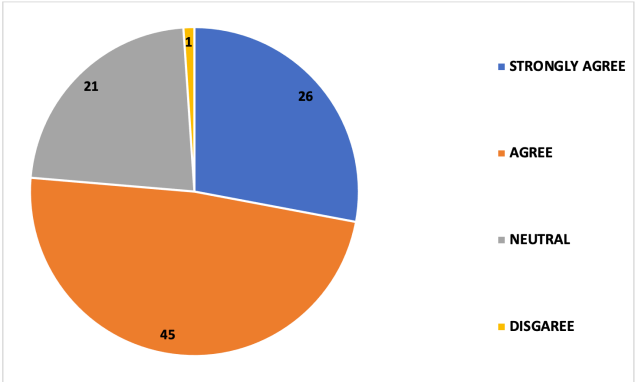


*Figure 3: More stringent measures on solid waste management as well as land fill operation*

## Practice :

Regarding self-reported practice for protection against air pollution related health hazards 62.3% (58) of the participants had good practice. Although the residents were not much inclined to usage of caps (20%). Only 70% used masks always (Table 4) which actually reflects the positive outcome of the Pandemic related IEC activities even among rural population.

About 48% had health checkups only when they develop symptoms while 22.3% reported availing health checkup regularly at least once in 6 months (Figure 4). Among the residents 41.4% reported self-medication almost always when they developed any symptoms while 57.4% opted this strategy only sometimes.

*Table 4. Use of personal protective equipment*

| | Always | Sometimes | Rarely | Never |
|---|---|---|---|---|
| Cap | 12(12.9%) | 8(8.6%) | 0 | **73(78.4%)** |
| Mask | **70 (75.2%)** | 21 (22.5%) | 1 (1%) | 1 (1%) |
| Helmet without Visor | **54 (58.1%)** | 23 (24.74%) | 2 (2.1%) | 14(15.1%) |
| Helmet with Visor | **73 (78.4%)** | 16 (17.2%) | 1(1%) | 3(3.2%) |

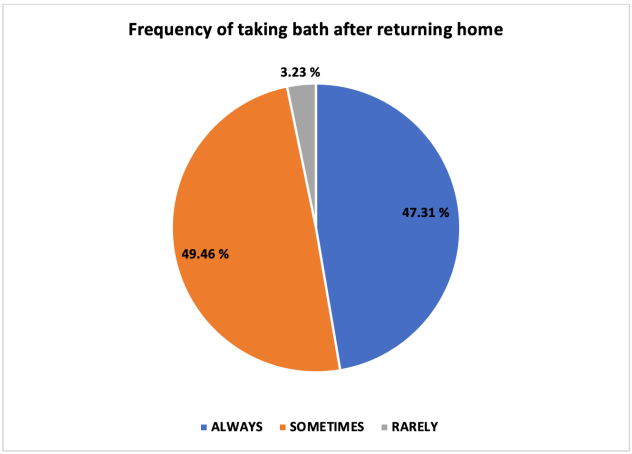


*Figure 4: Practices of residents regarding self-hygiene*

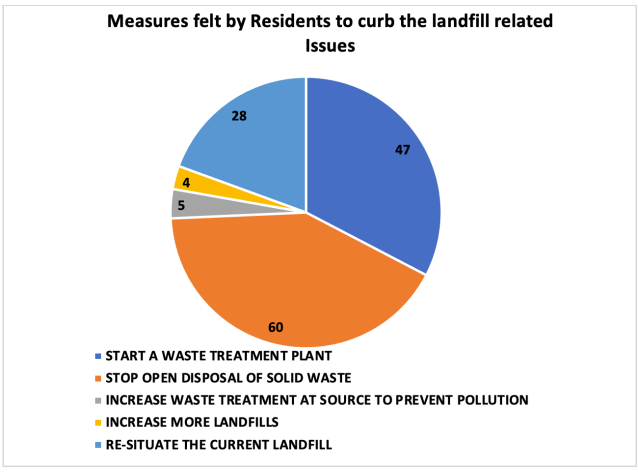


*Figure 5: Self-realized measures against landfill to curb related*

*Table 5: Association between Knowledge and Practice*

| | Good Practice | Bad Practice | P value |
|---|---|---|---|
| Good knowledge | 11 78.6% | 3 21.4% | 0.349 |
| Average knowledge | 32 58.2% | 23 41.8% | |

There was no significant association between knowledge and Practice.

*Table 6: Association between Attitude and Practice against air pollution*

| | Good Practice | Bad Practice | P value |
|---|---|---|---|
| Positive Attitude | 36 73.5% | 13 26.5% | **0.031** |
| Negative Attitude | 22 50% | 22 50% | |

There was a significant association between Attitude and Practice.

*Table 7: Association between Attitude and Practice on solid waste segregation*

| | Good Practice | Bad Practice | P value |
|---|---|---|---|
| Positive Attitude | 39 79.6% | 10 20.4% | **0.001** |
| Negative Attitude | 19 43.2% | 25 56.8% | |

There was a very significant association between Attitude and Practice on solid waste segregation.

## DISCUSSION

Ambient air pollution accounts for an estimated 4.2 million deaths per year due to stroke, heart disease, lung cancer, acute and chronic respiratory diseases [3,4]. Around 91% of the world's population lives in places where air quality levels exceed WHO limits [1]. While ambient air pollution affects developed and developing countries alike, low- and middle-income countries experience the highest-burden, with the greatest toll in the WHO Western Pacific and South-East Asia regions[11].

Vaniyambadi of Tirupattur district is a rural area with the major occupation of residents as laborer in nearby leather industries although the residences are not clustered around the landfill but about 101 residences were found to be situated within a 3 km radius around the landfill. Provided these residents live in a highly potentially polluted environment given the existing leather factories as well as near-by factories they are prone to a variety of health hazards. In our study we were able to assess the knowledge of such residents since their role is most important to prevent all landfill related health hazards not including those from air pollution due to the nearby factories.

In this study we found that 25.8% (n=24) residents had good knowledge related to causes as well as sources and potential health hazards related to air pollution in-spite of them not having formal higher education. Among the residents about 55% had average knowledge only regarding which reflected the need to establish a more intensely individual oriented approach towards IEC as well as BCC to further improve the resident's knowledge regarding air pollution as well as the role of landfills as a cause for air pollution.

In this study we found the residents' perception that ambient air pollution can be an important cause for asthma as well as lung cancer. Surprisingly 82% of the residents had a very strong knowledge that air pollution can also cause cardiovascular disease, especially Myocardial Infarction (50%) followed by Hypertension (37%). They also had the knowledge that air pollution can cause skin diseases (70%) with majority believing mostly-dermatitis (57%) followed by rashes (38%). Above 85% residents had the knowledge that air pollution caused eye irritation as well as nose and throat irritations. Among these residents 80% knew that landfills and living or working in proximity to landfills can be a major cause of air pollution and related health hazards in addition to other hazards due to the waste from landfills. On a similar note this study reflects the findings of a similar study done among residents near a landfill in Chennai (Effects of ambient air pollution on respiratory and eye illness in population living in Kodungaiyur, Chennai - ScienceDirect n.d.) .

Only 35% of residents believed in usage of masks as a useful measure for preventing air pollution related health hazards while less than 10% believed that regular health checkups could help in avoiding major issues related to health hazards whatever may be the cause. Hence this highlights the crucial role of Government as well as local bodies in emphasizing on regular health checkups by way of free camps or organizing specialty clinics in nearby primary health centers.

As per the study 52.6% of residents showed positive

attitude towards their responsibility in curbing air pollution causing activities as well as usage of PPEs (73%). While 79% of them felt that stricter legislations on motor vehicles as well as factories could help in reducing air pollution. 69% (n=65) of the residents felt that legislations needed to be tightened related to operation of a landfill, with 72% of them feeling that landfills are a major source of air pollution in their area.

In the present study regarding practices to prevent air pollution related health hazards our residents showed that 62.3% had good practices on the whole. 99% of the residents used masks while 97% used helmets with visors in our study. Above 90% of residents proved their better sense of personal hygiene regarding taking baths almost always after returning home. While the concept of regular health check-ups was downplayed with less than 50% undergoing regular health check-ups to avoid missing any diseases in their early stages. In addition, we were able to gauge their practice of self-medication that almost all had the idea that self-medication (41.4%- always) is justified in case they develop symptoms related to respiratory complaints. But on an alarming note it was observed that 47.8% of the residents also reported that a check-up is felt warranted by them only if they develop any symptoms rather than regularly.

To ensure the better health of such vulnerable at-risk population living in such polluted areas it is better if they are targeted for IEC activities more intensely as well as involving them in legislation purposes regarding operation of a solid waste management facility in residential areas, especially in rural areas.

There was no significant association between knowledge and either attitude or practice related to air pollution prevention practices or solid waste disposal related practices. But there was a very significant association between attitude of residents and their practices on solid waste segregation at the source(homes).

## LIMITATIONS

As the study was done in a single landfill related setting it cannot be extrapolated to similar residencies near landfills elsewhere. Due to the current Pandemic we were unable to obtain clinical measurements as well as laboratory evaluation in terms of any (minimally invasive or otherwise) investigations to further broaden the assessment of status of the residents' respiratory system physiology or deviations therein.

In view of the ongoing Pandemic, we were unable to include a more extensive sample population. So further studies can be undertaken with a larger sample under the same topic in the future.

## CONCLUSION

The attitude as well as practice among residents near a landfill of Vaniyambadi rural town is positive in spite of their formal educational deficiency, they also displayed better practices towards prevention against air pollution as well as regarding solid waste segregation at source and reduction of solid waste generation.

Although there was no significant association between education and knowledge, attitude or practice it is to be noted that the various sources of information (70% -TV, newspapers and friends) regarding air pollution among the residents had played a major role in affecting their practices towards it. This also proves that the lacuna in the knowledge can be bridged using the most common tools such as television as well as newspapers while interpersonal communication as always also remains the cornerstone in information dissemination in rural areas.

## RECOMMENDATIONS

- Health education to all residents living near such highly polluted areas need to be advised on adopting better preventive practices to safeguard themselves from air pollution as well as from other ill-effects of landfill vicinity.
- Administrative measures could be in place to check and prohibit establishment of water and related products manufacturing companies within the radius of 2 kilometers of an open landfill.
- Government as well as local bodies in collaboration with the factories can ensure the proper supply as well as usage of Personal Protective Equipment to at risk residents as well as those employed under risk prone areas.
- Regular health checkups to especially these at-risk populations can be made a compulsory function of local primary health centers in addition to their routine activities with help from the local governing bodies.
- The concept of Bio parks could be emphasized which might greatly help in reducing the air pollutants being generated from such densely polluted geographical sites.
- Regular annual master health checkups for such residents at nearby Medical colleges.
- Combined efforts of local public as well as local governing bodies towards amicably feasible closure of the continuous open landfills being operated and to promote environmentally positive waste management processes as

well as try to adopt other methods including waste reduction at source in addition to solid waste generation among all residents of that nearby residential locality.

## CONFLICT OF INTERESTS : Nil

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