The Scientific Temper (2024) Vol. 15 (3): 2447-2455
E-ISSN: 2231-6396, ISSN: 0976-8653
Doi: 10.58414/SCIENTIFICTEMPER.2024.15.3.05
https://scientifictemper.com/

RESEARCH ARTICLE

Assessing the impact of indoor air pollution on respiratory health: A survey of home residents in rural area

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Abstract

Particularly in residential settings, people spend more time inside a house. It is a serious environmental health hazard. The purpose of this research is to evaluate how house occupants' respiratory health is affected by indoor air pollution. The study focuses on typical indoor contaminants, nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM), and volatile organic compounds (VOCs). The research uses a survey-oriented approach to gather information from inhabitants in various housing situations, such as urban, suburban, and rural regions. The survey addresses the prevalence of respiratory symptoms and conditions (such as allergies, asthma, and chronic obstructive pulmonary disease). The presence of indoor pollution sources (such as cooking stoves, tobacco smoke, and chemical cleaners), residents' awareness and attitudes towards air quality. The gathered information is examined to find any relationships between the reported respiratory health problems and the amounts of indoor pollution. The research results show that there is a direct correlation between indoor pollution levels and the frequency of respiratory complaints. The research emphasizes the importance of using air purifiers, better ventilation, and public education on reducing indoor pollution sources. According to the findings, improving indoor air quality is crucial for home occupants' respiratory health and general well-being.

Keywords: Assessing, Indoor air pollution, Respiratory health, A survey, home residents, Elder health.

Introduction

When dangerous materials are found in the air inside of structures and enclosed areas, it is referred to as indoor air pollution. It is in contrast to outside air pollution. The sources factors are combustion sources, building materials, household items, and biological pollutants, which may contribute to indoor air pollution (Smith & Mehta, 2003). Early research concentrated on indoor combustion activities like cooking and heating that produce pollutants like carbon monoxide and particulate matter. The energy crisis of the 2010s prompted the construction of increasingly airtight buildings, which heightened worries about indoor air quality. Particulate matter (PM) is composed of smoke, dust, and aerosols that have the ability to enter the lungs very easily (Brunekreef & Holgate, 2002). Paints, cleaning supplies, and furniture release volatile organic compounds (VOCs), which may irritate the respiratory system and lead to various health problems. Biological Contaminants such as Pet dander, germs, and mold may worsen respiratory ailments. Carbon monoxide (CO) is an odorless, colorless gas released by fuel-burning equipment. Formaldehyde is a recognized respiratory irritant and carcinogen that is present in home goods and construction materials. The most prevalent medical problems are respiratory disorders, which may range from coughing and dyspnea to chronic diseases like asthma and chronic obstructive pulmonary disease (COPD). Chronic exposure to certain indoor contaminants may also raise the chance of cancer and cardiovascular disorders (WHO report, 2018). The laws and their implementation might differ greatly throughout nations. These days, smart home devices may automatically modify ventilation systems and better air quality is maintained. Public education campaigns seek to educate people on the causes of indoor air pollution and doable ways to enhance indoor air quality at home, such as using low-emission items, routine cleaning, and adequate ventilation (Miller & Williams, 1997). Typical

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How to cite this article: Rajkumar, P., Bhaskar, B. V. (2024). Assessing the impact of indoor air pollution on respiratory health: A survey of home residents in rural area. The Scientific Temper, **15**(3):2447-2455.

Doi: 10.58414/SCIENTIFICTEMPER.2024.15.3.05

Source of support: Nil

Conflict of interest: None.

Received: 10/07/2024 **Accepted:** 20/08/2024 **Published** : 16/09/2024

home indoor air pollution sources include cooking practices, tobacco usage, chemical cleaning products, and pet ownership. The frequency of respiratory symptoms among the people includes wheezing, coughing, and shortness of breath. Practices for mitigation are by installing air purifiers or upgrading ventilation, to lessen interior air pollution. With the use of surveys, we want to gather important information on the status of indoor air quality in houses today and how it affects respiratory health. Also, it may assist in identifying areas where public health interventions may be required, as well as knowledge gaps (Chan & Yao, 2008).

Numerous respiratory conditions, such as asthma, chronic obstructive pulmonary disease (COPD), respiratory infections, and even lung cancer, may be brought on by long-term exposure to poor indoor air quality (Feng & Hu, 2018). Adverse health impacts are more likely to affect vulnerable groups, including children, the elderly, and those with pre-existing respiratory diseases. Our aim is to ascertain the incidence of respiratory diseases and symptoms among people living in diverse indoor settings by the administration survey (Hussain & Shah, 2020). This knowledge may help enhance indoor air quality and safeguard respiratory health.

Literature Review

The increased variables of indoor air pollution affect indoor air quality (IAQ) (Mendell & Heath, 2005). The elderly and children are more sensitive to indoor pollution. Prohibitions on smoking decrease indoor air quality in a certain percentage (Gotschi & Zemp, 2008). By examining of the main contaminants, their health impacts, and the significance of mitigation technique's influence on respiratory health, particularly in residential environments (Gotschi & Zemp, 2008).

Particulate matter (PM)

PM2.5 and PM10 are the fine particles that may go deeply into the lungs and into the bloodstream. Cooking, smoking, lighting candles, and doing some housework are common indoor sources.

Volatile organic compounds

Many materials, such as paints, varnishes, cleaning supplies, and furniture, release volatile organic compounds (VOCs). They may aggravate respiratory conditions and lead to various health problems (Elliott & Phipps, 2009).

Carbon monoxide

Carbon monoxide (CO) is an odorless, colorless gas that is produced when fossil fuels are not burned completely. Fireplaces, gas stoves, and car exhaust are typical sources.

Nitrogen dioxide (NO2)

This gas has the potential to aggravate respiratory diseases like asthma by irritating the airways (Harris & Martinez, 2017). The most prevalent sources of it are gas heaters and stoves.

Formaldehyde

Formaldehyde is a common ingredient in furniture, construction supplies, and home goods. It is known to cause respiratory problems and is considered a carcinogen.

Mold and biological contaminants

Allergies and asthma may be brought on by mold spores, dust mites, and pet dander. Mold development is often caused by inadequate ventilation and humidity.

Asthma and allergies

Indoor air pollution exposure may aggravate allergic responses and cause asthma episodes. VOCs, biological pollutants, and particulates are often implicated.

Chronic obstructive pulmonary disease

Prolonged exposure to indoor air pollutants, especially NO2 and PM, might accelerate the onset and course of chronic obstructive pulmonary disease (COPD).

Respiratory infections

Respiratory infections may be more common in homes with poor air quality, particularly in the elderly and children groups.

Lung cancer

The formaldehyde and radon to a higher risk of lung cancer.

Demographic information

The size of the household, age, gender, and presence of any underlying respiratory disorders.

Exposure assessment

Enquiries about routine activities, possible sources of pollution (such as gas stoves or pets), and sources of pollution (such as cooking practices, smoking, and product usage in the home).

Health symptoms

Enquiries about the frequency, intensity, and presence of respiratory symptoms, any allergies or asthma that may have been detected.

Air purification

Particulate matter and some gases may be eliminated from the air with the use of air purifiers equipped with HEPA filters (IARC, 2013).

Humidity control

Sustaining proper humidity levels (30–50%) may aid in limiting dust mites and inhibiting the formation of mold (Wang & Wang, 2019).

Regular cleaning

Dust and biological pollutants may be kept at bay by routinely dusting and cleaning surfaces. A mix of awareness-raising, evaluation, and mitigation techniques is needed to address the serious health hazards that indoor air pollution presents to respiratory systems (Kwon & Kim, 2015).

Objectives

- To determine typical causes of indoor air pollution in homes.
- To determine how common respiratory ailments and symptoms are among people living at home.
- To assess inhabitants' knowledge of and behavior related to indoor air quality.
- To investigate the connection between indoor air quality and the results of respiratory health.

The research will concentrate on a heterogeneous group of house occupants, taking into account factors including age, gender, location, and dwelling attributes. The study will ask about ventilation habits, the state of people's respiratory health, and their exposure to possible indoor contaminants. The purpose of this study is to provide a thorough assessment of the effects of indoor air quality on respiratory health and to identify areas that need further research and attention.

Methodology

The survey method is conducted cross-sectionals to calculate pollution.

Type

Cross-sectional survey.

Objective

To assess the connection between house occupants' respiratory health and indoor air pollution.

Inclusion Criteria

Occupants of certain homes who have been there for at least a year and who are at least 18 years old and above (Naeher & Brauer, 2007).

Exclusion Criteria

People with underlying respiratory disorders, such as congenital illnesses, that are not caused by the environment.

Using stratified random sampling based on a statistical power analysis that took the intended confidence level and the anticipated frequency of respiratory problems into account. A methodical survey designed to gather information on demographics, way of life, home attributes, opinions on indoor air quality, and symptoms related to respiratory health. Pollution monitoring devices that detect particle matter (PM2.5 and PM10), formaldehyde, CO_2, VOCs, NO_x, SO_x, ozone, temperature, and humidity.

Make house calls to the participants to deliver the questionnaire and set up the instruments for measuring air quality. Gather information on cooking techniques, smoking habits, ventilation, indoor plant life, and the usage of chemical cleansers in the home. To get a representative sample, measure indoor air pollutants for a predetermined amount of time (such as 24 hours). Note the humidity and temperature of the surroundings.

Self-Reported Symptoms

Get data about respiratory infection frequency and symptoms such as coughing, wheezing, and shortness of breath.

Spirometry

Spirometry testing is also used to evaluate lung function.

Descriptive Statistics

Provide an overview of the incidence of respiratory complaints, air quality, and demographic information. To find correlations between indoor air pollution and outcomes related to respiratory health (Janssen & Brunekreef, 2003) use the regression analysis. Make sure to account for possible confounders such age, smoking status, and underlying medical conditions (Kravitz & McLoughlin, 2020).

Obtain each participant's informed consent. Guarantee the privacy and anonymity of the information gathered. Inform participants about indoor air pollution's possible health impacts and available mitigation measures. Recognise possible biases, such as the prejudice associated with self-reporting and the difficulties in precisely measuring indoor air pollution. Reports, presentations, and publications may be used to communicate findings to participants, decision-makers, and the scientific community. This technique ensures strong and trustworthy results by offering a thorough approach to researching the effects of indoor air pollution on respiratory health (Li & Zhang, 2011).

Result and Discussion

We can organize the data into categories like demographics, indoor air quality measurements, health symptoms, and possible contributing variables in order to build data tables for evaluating the effect of indoor air pollution on respiratory health among house inhabitants. A survey with accompanying sample tables may be seen below.

Let's examine each variable and its possible consequences in order to evaluate and talk about the data that was provided:

Participant ID

A distinct identity for every participant.

Table 1: Demographic data table

Participant ID	*Age*	*Gender*	*Smoking status*	*Location type (Urban/Rural)*	*Duration of residence (Years)*
1	45	Male	Non-smoker	Urban	10
2	30	Female	Smoker	Rural	5
….	…	….	…..	….	….

Age

Participant's age

Gender

Male or female.

Smoking status

Whether the person taking part smokes or does not smoke.

Location type

Whether the individual is a resident in a rural or urban location.

Duration of residence

The length of time the participant has resided at their present address. Compared to younger individuals, older adults may be at different health risks (He & Xie, 2018). Older people may be more prone to chronic illnesses, but lifestyle variables may have a greater impact on younger participants. Variations in gender may affect exposure to the environment and one's health. For instance, one gender may be more likely than the other to have certain health issues or behaviors. Examine if gender disparities in environmental exposure or health effects are statistically significant. This may make it easier to determine if gender-specific therapies are required. It is well known that smoking increases the chance of developing a number of illnesses, such as cardiovascular and respiratory conditions. Compared to non-smokers, smokers may exhibit distinct patterns of health problems or reactions to environmental stimuli. There are typically differences in environmental exposures between urban and rural locations, such as air pollution levels, which may have an effect on health. Determine if the health outcomes or exposure levels of individuals from urban and rural settings vary. While pollution levels may be greater in urban areas, exposure to certain pollutants may vary in rural regions (e.g., agricultural chemicals) (Kumar& Kundu, 2018). One's exposure to environmental elements and associated health effects might vary depending on how long they have lived in a certain area. When a senior smokers who have lived in cities for a long time exhibit more serious health problems than younger non-smokers in rural areas.

Further Analysis

To ascertain the importance of the connections between these factors and health outcomes, use of statistical studies.

Targeted Interventions

Create focused health treatments for certain populations (urban smokers) based on the results.

Longitudinal Studies

Examine long-term research to determine the effects of these factors changes over time on health.

The data's interpretation as follows (Table 1):

CO2 ranges

About 600 to 800 ppm is a normal cut-off point, below 1000 ppm, indoor CO_2 levels are typically regarded as tolerable. Levels beyond this might be a sign of inadequate ventilation, which can cause pain, impair cognitive function, and other health problems (Kang & Kim, 2014). Above 800 ppm, data indicates that the CO2 levels are within a range that may suggest significant ventilation concerns.

Formaldehyde range

About 0.03 to 0.05 ppm, normal cut-off points: Over 0.1 ppm. Formaldehyde concentrations should be taken seriously, as prolonged exposure may cause cancer and respiratory issues. The VOCs is 0.5 to 0.7 mg/m^3 as normal cut-off points: Depending on the particular VOCs present, concentrations over 0.5 mg/m^3 may be harmful. Although the VOC levels are greater than average, they are still within an acceptable limit in some environments (Karottki & Schwinger, 2015). PM2.5 (<2.5 µm): 10 to 15 µg/m^3 normal cut-off points: The WHO states that PM2.5 concentrations should be less than 10 µg/m^3, with concentrations above 25 µg/m^3 being deemed hazardous. According to table data information statistics, PM2.5 levels are closer to the top limit but still within a generally acceptable range. PM10 (< 10 µm): 25 to 30 µg/m^3. Generally, the WHO advises against exceeding 20 µg/m^3 of PM10, with levels above 50 µg/m^3 raising concerns. The amounts of PM10 in the Table 2 data are somewhat increased, but not dangerously.

Temperature range

About 22 to 24°C. Typical thresholds: 20 to 22°C. While little changes could be allowed, they might negatively affect comfort and output.

Humidity range

About 55 to 60%, Typical thresholds: A typical indoor humidity range is 30 to 50%. Increased humidity may cause pain and the formation of mold (Jones, 1999). Ventilation: Given the CO2 levels, ventilation may need to be improved.

Table 2: Indoor air quality measurements table

Participant ID	*CO2 (ppm)*	*Formaldehyde (ppm)*	*VOCs mg/m^3*	*PM2.5 µg/m^3*	*PM10 µg/m^3*	*Temperature (°C)*	*Humidity (%)*
1	600	0.03	0.5	15	25	22	55
2	800	0.05	0.7	20	30	24	60
...	...	...	...	...	...	...	...

Table 3: Respiratory health symptoms table

Participant ID	*Cough*	*Wheezing*	*Shortness of breath*	*Asthma diagnosis*	*Frequency of symptoms (days/week)*
1	Yes	No	No	No	0
2	Yes	Yes	Yes	Yes	4
...	...	...	...	...	...

Table 4: Potential contributing factors table

Participant ID	*Use of household chemicals (times/week)*	*Presence of pets*	*Ventilation quality (Good/Fair/Poor)*	*Cooking fuel type (Gas/Electric)*
1	3	Yes	Good	Gas
2	5	No	Poor	Wood
...	...	...	...	...

Health concerns: Although formaldehyde levels are below acceptable thresholds, levels of volatile organic compounds and particulate matter indicate that prolonged exposure to these substances may pose some health concerns. Comfort: Although the temperature and humidity levels are within the limit. Overall air quality: While it seems to be rather excellent, there is room for improvement in terms of ventilation as well as handling high levels of particulate matter and volatile organic compounds.

Interpretation Summary of Participants

Participant 1: Yes, cough, not wheezing lack of breath: Not at all, No diagnosis of asthma symptom frequency: 0 Days/Week.

Participant 2: Yes, cough Yes, wheezing Breathing difficulties: Yes diagnosis of asthma: Yes symptom frequency: Four days per week symptom patterns:

Participant 1: Coughs, but does not seem to be experiencing asthma symptoms, shortness of breath, or wheezing (Gao & Li, 2019). There are no continuing symptoms when the frequency of symptoms is 0 days per week.

Participant 2: Has been diagnosed with asthma; exhibits cough, wheezing, and dyspnea. Four days out of the week are symptomatic, suggesting more frequent and may be more severe symptoms (Table 3).

Correlation of Symptoms

Participant 2 has a documented diagnosis of asthma and exhibits all three symptoms (cough, wheeze, and shortness of breath) on four days per week. This shows that the participant's asthma and these symptoms are closely related. Conversely, participant 1's symptoms seem to be unconnected to asthma or, to be less severe. The diagnosis and frequency: Participant 2's symptom frequency is consistent with an asthma diagnosis since asthma often manifests as repeated symptoms. The fact that participant 1 has no symptoms on 0 days of the week might point to a minor or uncommon instance or a different underlying problem.

Implications for Assessment

More asthma care and evaluation may be necessary for people with symptom profiles comparable to those of participant 2 (Patel & Kumari, 2017). Overall conclusions: Participant 2's various symptoms and asthma diagnosis provides credence to the notion that these characteristics point to a persistent respiratory illness. Additional study: An in-depth knowledge of the relationship between symptoms and asthma and other respiratory disorders may be possible by increasing the dataset's participant count and closely analysing the link between diagnoses and symptoms (Tao & Lu, 2020).

Use of Household Chemicals

Participants' weekly use frequencies of household chemicals vary (Table 4).

Pet Ownership

A subset of individuals own pets, whereas the majority do not (Table 4).

Ventilation Quality

There are three levels of ventilation quality: Good, fair, and poor (Table 4).

Cooking Fuel Type

Gas or wood are used by participants. Usage of common home chemicals and its effects on health frequency: Using chemicals in the home more often may lead to higher levels of indoor pollution exposure.

Pets

Own pets tend to use home chemicals more often. Excellent *vs*. Poor

Health Risks

Individuals with inadequate ventilation and excessive chemical usage may be at higher risk of worsening allergies or breathing problems (Liu & Zhang, 2022).

Table 5: Correlation and statistical analysis table

Health symptom	*Correlated indoor air quality factor*	*Correlation coefficient (r)*	*Significance level (p-value)*
Cough	PM2.5	0.65	0.01
Wheezing	Formaldehyde	0.50	0.05
...	...	...	...

Table 6: Housing characteristics

Respondent ID	*Type of residence*	*No. of rooms*	*Ventilation type*	*Frequency of ventilation*	*Presence of air purifier*	*Use of chemical cleaners*	*Frequency of cleaning*
1	Apartment	3	Natural	Daily	Yes	Yes	Weekly
2	House	5	Mechanical	Occasionally	No	Yes	Monthly
...	...	...	...	...	...	...	...

Gas vs Wood

Compared to gas, cooking with wood may result in more indoor air pollution. Analyse if participants who use gas and those who use wood vary significantly in the amount of chemicals they use in their homes.

Additional Research

Make recommendations might include longitudinal studies to evaluate the long-term health effects.

The correlation coefficient (r) between PM2.5 and cough: 0.65 *p-value*, or significance level, is 0.01. There is a moderate to significant positive link between PM2.5 levels and coughing, as shown by the positive correlation coefficient of 0.65. Accordingly, there is a correlation between elevated levels of PM2.5 and a larger chance of cough symptoms. Given that the *p-value* of 0.01 is far lower than the conventional significance level of 0.05, it is likely that the association in question is statistically significant and not the result of chance.

Formaldehyde and Wheezing

Correlation coefficient (r): 0.50 and 0.05 is the significance level (*p-value*). There is a link between formaldehyde levels and wheezing symptoms is shown by the correlation value of 0.50. This suggests that wheezing is expected to become more common as formaldehyde levels rise (Brown & Williams, 2016). This association is significant but at the edge of commonly accepted significance thresholds, as shown by the *p-value* of 0.05, which is at the threshold for statistical significance.

Health Implications

According to the results, indoor settings with greater amounts of formaldehyde and PM2.5 are linked to respiratory symptoms including coughing and wheezing. These results underline the necessity for efficient air quality management and control techniques to reduce the poor indoor air quality.

Strength of Correlation and Statistical Importance

The relevance of addressing these particular indoor air pollutants is shown by the moderate to strong link between formaldehyde and wheezing and the moderate to strong correlation between PM2.5 and cough. The robustness of these connections is supported by the statistical significance of these correlations (Cheng & Zhang, 2015) (Table 5).

Additional Study

Determining the causative relationship and the long-term effects of exposure to these contaminants on lung health may also be aided by longitudinal research.

Type of Residence

The housing characteristics is shown in Table 6.

House vs apartment

Due to variations in size and ventilation, apartments may have distinct air circulation and pollution patterns than homes.

Number of rooms

Having more rooms may suggest a greater area where pollutants might gather, but it may also have an impact on how often ventilation is required.

Natural ventilation

This kind of ventilation depends on windows and openings, and it may work better in places with high outside air quality (Wang & Zhang, 2019).

Ventilation frequency

Daily ventilation may be more effective than other ventilation in reducing indoor pollutants.

Existence of an air purifier

By eliminating pollutants and particles from the air, air purifiers may greatly enhance the quality of the air inside.

Table 7: Awareness and preventive measures

Respondent ID	*Awareness of indoor air quality*	*Sources of information*	*Preventive measures taken*	*Satisfaction with indoor air quality*
1	Yes	Internet, TV	Air purifier, Ventilation	Satisfied
2	No	None	None	Unsatisfied
...	...	...	...	...

Table 8: Statistical analysis summary (Example)

Respondent ID	*Awareness of indoor air quality*	*Sources of information*	*Preventive measures taken*	*Satisfaction with indoor air quality*
CO2 (ppm)	550	520	50	400–700
Formaldehyde (mg/m^3)	0.07	0.05	0.03	0.02–0.1
...	...	...	...	...

Use of Chemical Cleaners

Using chemical cleaners on a regular basis might result in the indoor environment being more polluted with VOCs and other contaminants.

Cleaning frequency

Regular cleaning may lower allergies and dust, but it may also increase exposure to chemical cleaners.

Ventilation and air quality

To maintain air quality may include combining air purifiers with regular, natural ventilation (Zhou & Chen, 2017).

Impact of chemical cleaners

Because chemical cleaners have the potential to generate VOCs, those who use them often may have indoor air quality issues even with air purifiers and regular ventilation.

Cleaning vs ventilation frequency

Compared to monthly cleaning in a home, weekly cleaning in an apartment with daily natural ventilation may suggest a better atmosphere.

Air purifiers and frequency of cleaning

According to the dataset, mechanical ventilation with rarely cleaning and no air purifiers may not provide as good indoor air quality.

To analyse the above data's knowledge of IAQ Absolutely (responder 1): Shows that the responder is aware of problems with IAQ. (responder 2): This statement suggests that the responder is unaware of problems with IAQ. Information Sources Respondent 1 (Internet, TV): Uses contemporary media sources to get information. Respondent 2: Does not have any references about the subject. Preventive Actions Respondent 1: Installs ventilation and an air purifier to enhance the quality of the air inside. (Respondent 2): Doesn't use any safeguards. Contentment with the IAQ Respondent 1 expresses satisfaction with the present state of IAQ. Respondent 2 expresses displeasure over the IAQ. Respondent 1 exhibits awareness and satisfaction with IAQ, as seen by their proactive steps. The fact that this responder is content with IAQ indicates that knowledge, taking precautions, and contentment are positively correlated. Respondent 2 doesn't take any precautions and is ignorant of IAQ. This respondent's displeasure with IAQ may be a sign of a negative correlation between ignorance, a failure to take preventative action, and discontent. Respondent 1 obtains information from TV and the Internet. This implies that having access to information via contemporary media may help raise knowledge of IAQ issues and, in turn, increase happiness with it (Liu & Wu, 2021). Respondent 2's lack of information sources may be related to their ignorance and, as a result, their discontent with the quality of the indoor air. Improved interior environments and more happiness are a result of preventive actions like ventilation and air purifiers (Respondent 1). Respondent 2's complaint about preventative measures is consistent with their discontent, indicating that if action isn't taken to enhance air quality, then satisfaction levels may decline. According to the study, taking preventative action and being aware of IAQ are linked to better satisfaction levels. Individuals who possess knowledge and actively monitor their IAQ are more likely to feel content with their surroundings. On the other hand, those who are unaware of the problem and do not take precautions often feel dissatisfied. This implies that raising awareness via easily available information sources and promoting preventative measures may raise people's general happiness with IAQ (Tables 7 and 8).

Additional Research

To include more factors and a bigger sample size, conduct more thorough surveys.

Policy Suggestions

Take into account laws that support the use of instruments for measuring air quality and preventative actions in homes and businesses.

CO2 Average

(550) The 520 ppm is the median,50 ppm is the standard deviation and the range 400 to 700 ppm. Comparing the mean and median, the CO2 level is somewhat higher than the median. The distribution may be right-skewed, with some higher CO2 measurements potentially pushing the average upward. The standard deviation: There is a considerable degree of fluctuation around the mean CO2 level, as shown by the 50 ppm standard deviation. This implies that while the majority of CO2 measurements are quite near to the mean, there may be notable variations. Range: The CO2 levels, which vary from 400 to 700 ppm. Because increased CO2 levels may have an impact on productivity and cognitive function.

Talk

Increased pain and a decline in cognitive function may result from high CO2 levels. Variability in CO2 concentrations may be caused by ventilation, occupancy, and activities occurring in the area (Huang & Chen, 2020).

Formaldehyde Average

About 0.07 and 0.05 mg/m^3 is the median. Deviation standard: 0.03 mg/m^3 Variation: 0.02 to 0.1 mg/m^3. Comparing mean and median, the distribution is right-skewed when the mean is greater than the median. This implies that the average may be impacted by a few higher formaldehyde measurements. Standard deviation: Compared to CO2, a standard deviation of 0.03 mg/m^3 indicates less variability. Range: The concentrations of formaldehyde vary between 0.02 and 0.1 mg/m^3. Even at these lower than usual occupational exposure limits, formaldehyde exposure, particularly over an extended period of time, might have negative health effects.

Talk

Formaldehyde is a well-known irritant that may aggravate respiratory conditions as well as other illnesses. Even when the levels are below allowable bounds, continuous observation is necessary to guarantee that they don’t rise, particularly in areas where formaldehyde sources are present. Comparisons between mean and median: Variations between the mean and median indicate the possibility of skewed distributions or outliers in the data. The standard deviation serves as a gauge for the degree of value dispersion. Greater variability is indicated by larger standard deviations. Range: It is vital for health and safety to keep an eye on the higher ends of the spectrum. From the tables to gather, arrange, and examine information from a survey on respiratory health and indoor air pollution. Key measures and their distributions may be seen as a summary in the statistical analysis summary table at the end (Liu & Chen, 2022).

Conclusion

The study’s findings highlight how seriously IAQ affects house dwellers’ respiratory health. According to survey-based research, there is a direct link between the prevalence of respiratory symptoms like allergies, asthma, and chronic obstructive pulmonary disease (COPD) and elevated levels of indoor pollutants like particulate matter (PM), Volatile organic compounds (VOCs), carbon monoxide (CO), and nitrogen dioxide (NO_2). Important findings from the research consist of:

Pollution Levels and Respiratory Health Correlation

Increased respiratory diseases and symptoms are strongly correlated with higher indoor pollution concentrations. The negative impact of poor indoor air quality on respiratory health is shown by this association.

Sources of Pollution and Health Dangers

The levels of indoor pollutants are mostly influenced by common sources of indoor pollution, including chemical cleansers, cooking stoves, and tobacco smoke. Residents who live near these sources are more likely to get respiratory problems.

Knowledge and Attitudes

One of the most important aspects of managing indoor pollution is residents’ knowledge of and attitudes towards indoor air quality. Individuals who possess more knowledge and take initiative in mitigating pollution sources are more likely to have fewer respiratory issues. Improved ventilation techniques, the use of air purifiers, and wider public education on reducing indoor pollution.

Implications for Public Health

Improving the quality of indoor air is essential for enhancing general health and respiratory health. Initiatives pertaining to public health need to prioritise increasing knowledge, offering tools for improved indoor air management, and promoting behaviours that reduce indoor pollution sources. People may greatly lower their chance of developing respiratory health problems and improve the quality of their living environment by addressing the sources of pollution and improving ventilation. Future studies should keep investigating practical methods for controlling indoor air quality and the health effects of doing so.

Acknowledgment

I am thankful to god and my guide for giving me such a big opportunity in my life. I would also like to thank those who have directly or indirectly helped me in my work.

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