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Review on Indoor Air Quality and Health

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ABSTRACT
The quality of air inside spaces determines how comfortable and healthy building inhabitants remain in residential, commercial and institutional areas. Cooking areas together with basements and large-scale car parking spaces along with living rooms and kitchens and garages remain exposed to inadequate air quality because people use these spaces for smoking and cooking and cleaning and mosquito repellent use. The combined actions produce dangerous contaminants such as volatile organic compounds (VOCs) together with particulate matter (PM) and carbon monoxide (CO) and nitrogen oxides (NOx). The undetectable airborne pollutants give rise to respiratory difficulties and cardiovascular diseases along with worsening asthma symptoms that result in permanent health complications. The combination of wood-burning stoves with heating methods that use solid fuels and mosquito repellents which are typical in colder and tropical climates drives the production of benzene, toluene, and pyrethroids that create major health hazards. Chemicals including formaldehyde, isopropanol and cleaning agents found in healthcare facilities, offices and banks damage indoor air quality because they trigger respiratory symptoms and depression of the central nervous system as well as various health problems. Indoor air quality concerns grow worse because of substandard ventilation systems together with building material off-gas emissions and poor thermal conditions affecting temperature levels and humidity control and air velocity standards. The U.S. Environmental Protection Agency (USEPA) along with other regulatory authorities defined guidelines to resolve these issues which emphasize proper ventilation and safe substance utilization and scheduled maintenance of systems which minimize pollutant contamination.

A strategic approach to IAQ controls represents a vital necessity that lowers health-related risks as well as boosts comfort and work productivity and classroom performance. Healthy inside environments with reduced health risks will emerge when people pursue pollutant source elimination alongside ventilation system efficiency enhancements and standard compliance.

Keywords: - indoor pollutants, respiratory diseases, thermal conditions, dust and molds, ventilation, productivity, health safety, indoor environment.

INTRODUCTION

All living being depends on the Earth's atmosphere to breathe since air consists of gases and tiny dust particles. The atmosphere contains 78 percent nitrogen followed by 21 percent oxygen then 0.9 percent argon with minor compositions of 0.1 percent additional gases but space lacks air completely. The lifecycle between plants and animals depends on oxygen as animals use it for inhalation yet release carbon dioxide while plants transform carbon dioxide to create oxygen needed for animal and plant survival. Air possesses mass and weight thus creates atmospheric pressure. Air pollution occurs from harmful emissions such as carbon monoxide and hydrocarbons alongside nitrogen oxides together with smoke and ash. The pollution results in smog formation and acid rain and global warming. The rising temperature of

Earth poses a major threat because scientists predict Earth will become uninhabitable and deaths from heat exposure will increase beyond the potential benefits of reduced cold-related fatalities.

Literature shows that indoor air quality (IAQ) in residential areas is greatly influenced by various important factors during times of peak human activity in kitchens, living rooms, and home gyms. Various pollutants stemming from activities such as cooking, smoking and cleaning and indoor exercising have multiple impacts on indoor air quality. The document examines residential indoor air quality by providing details about kitchen pollution and comparing it to basement and garage pollution profiles. A review of air quality exists for enormous car parking areas which serve as one classification of indoor environment. Xenobiotic chemicals particularly volatile organic compounds (VOCs) along with particulate matter and carbon monoxide accumulate in these spaces which people usually occupy temporarily although this leads to elevated health perils for continuous exposure. This section examines primary space pollutants in these environments which include carbon dioxide and nitrogen oxides and particulate matter together with an analysis of pollutant levels based on ventilation conditions and usage patterns and materials used (Śmiełowska et al., 2018).

Long-duration exposure to inferior indoor air quality leads to respiratory medical problems as well as cardiovascular diseases which aggravate existing asthma conditions. Indoor air pollution exists as a hidden dangerous force because it is both undetectable and highly damaging to health. People need to understand the importance of pollution awareness combined with inside air quality mitigation techniques like better ventilation and cleaning and lower substance use to maintain healthy living environments. The protection of residents' health dependent strongly on effective indoor air quality management in places with elevated pollutant concentrations. (McCormack, et al., 2020). India ranked 5th most polluted in 2024 Air pollution and other four countries are Chad, Bangladesh, Pakistan, and the Democratic Republic of Congo (Current news by worldwide).

INTERNATIONAL REVIEW

The set of standards and procedures controlling indoor air quality varies extensively between different regions across the globe. The World Health Organization (WHO) has established guidelines for three main indoor air pollutants including particulate matter PM2.5, PM10 and volatile organic compounds (VOCs) yet additional guidelines come from both the European Union (EU) and the United States Environmental Protection Agency (EPA). Developed economies like Sweden and Japan use advanced IAQ management systems whereas India and China encountering major issues because of their rapid development and deficient infrastructure and rapid removal of number of trees. The Swedish population experiences quality indoor air because of their strict building regulations and public environmental initiatives while Indian people face airborne pollution issues because of traditional cooking practices using solid fuels and insufficient indoor ventilation methods. The study described by Marć*et al*., 2018, reveals the importance of chemical compound identification in indoor environments since these compounds are driving factors for air quality and human health effects. The discovery of polycyclic aromatic hydrocarbons (PAHs) stands as fundamental pollutants which lead to negative health impacts (Suryawanshi*et al*., 2016). The research by Chen *et al*., 2017, studied Particulate matter PM2.5-bound polycyclic aromatic hydrocarbons between indoor and outdoor environments in Beijing to understand their origins and health effects.The World Health Organization (WHO) reports that indoor air pollution is responsible for approximately 3.2 million deaths each year, especially in low- and middle-income countries where people mainly rely on biomass fuels for cooking and heating (Singha, *et al*.,2024).

The combination of indoor air pollution from industrial zones and urban areas increases due to particulate matter and VOCs and nanomaterial's while inadequate ventilation worse exposure risks in

home and office environments. Scientific studies by Kumar *et al*., 2015, demonstrate that indoor air quality exists due to a combination of particulate matter and inorganic compounds and biological contaminants which negatively affect human health. The evaluation of IAQ consists of three main aspects: pollutant levels together with thermal variables such as temperature airflow and humidity and additional aspects of light and noise management. IAQ heavily depends on temperature levels and moisture content because elevated heat and humidity cause building materials to release pollutants.

The EPA's 2020 fundamental IAQ guidelines were designed to establish a clear and practical standard for assessing and improving indoor air quality within residential buildings.The healthcare workplace exposes its workers to numerous chemicals which arise from laboratory work and pharmaceutical operations. Histopathology laboratories contain four VOC chemicals which include formaldehyde, isopropanol and ethanol and xylene but these compounds lead to multiple health concerns that span from central nervous system depression to respiratory issues and permanent organ damage.

Standards of heating and cooking within households generate significant indoor air pollution most noticeably in rural settings. The combustion of wood through stoves and boilers generates benzene and toluene and xylene together with particulate matter leading to health complications in addition to respiratory problems for human beings. The research conducted by Piccardo*et al*., 2014, demonstrates that adequate management strategies for wood-burning stoves such as correct installation practices with proper usage methods reduce their harmful effects on indoor air quality. Wood heating patterns are increasing in European regions with cold climates which demands improved knowledge of its effects on indoor air quality. The global disease burden significantly increases because of household air pollution while respiratory along with non-respiratory symptoms develop as a result of polluting exposure. Respiratory disease can be triggered by heating and cooking particles that result in coughing and wheezing symptoms together with breathing problems. The inhalation of carbon monoxide (CO) during wood smoke exposure causes headaches together with eye irritation and disease progression.

Some geographical areas experience particular health threats from domestic fuel usage. Over two million Chinese individuals suffer from skeletal fluorosis because they consume fluoride-rich coal while arsenic in coal has demonstrated its link to lung cancer advancement. The reduction of smoke exposure creates new worries among experts who warn about potential unfavorable effects on vector-borne health hazards such as malaria. Limited research exists regarding the minimal impact of biomass smoke on mosquito repellence as it might lower their biting frequency.

The research conducted at southern Mexico showed smoke exposure did not provide protective effects according to Bruce *et al*., 2006, yet The Gambia study revealed wood smoke failed to protect children against malaria in moderate transmission areas. The air pollution from outdoor sources which includes traffic alongside industrial emissions and central heating systems will extensively affect indoor pollution levels. According to Assimakopoulos*et al*., 2008, research shows that elevated SO_2, NO and NO_2, O_3 concentrations in outdoor air enhance indoor pollution rates particularly in dense urban zones. The continued evolution of IAQ research requires better methods to track and manage pollution for safeguarding worldwide public health. Science shows bank office carbon dioxide concentrations break recommended thresholds because of poor air ventilation which produces staff discomfort together with adverse cognitive effects (Saidin*et al*., 2023).

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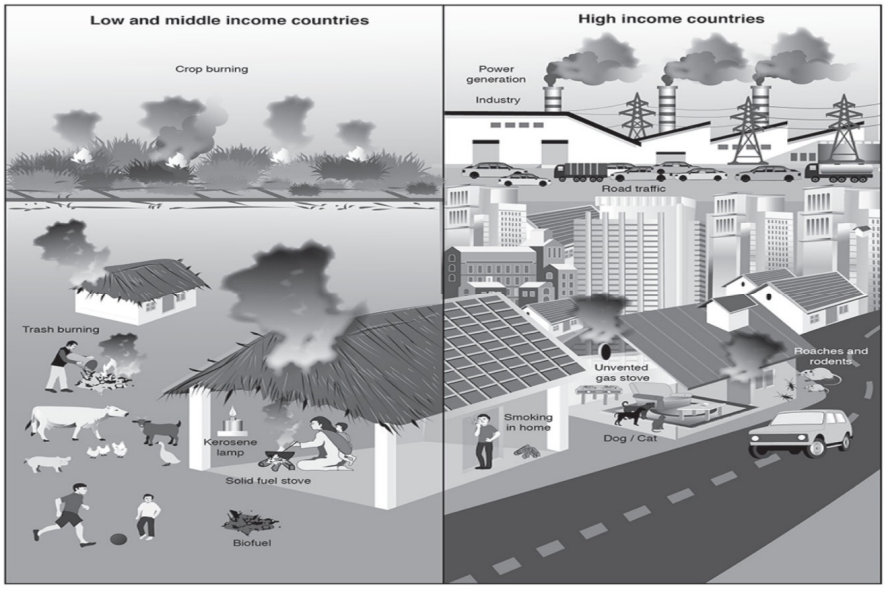

Fig. 1 Indoor air pollution causes respiratory effects in rural and high-tech cities and countries

NATIONAL REVIEW

Indian studies have demonstrates that indoor air pollution (IAP) from biomass fuel use creates dangerous outcomes due to improper combustion followed by toxic emissions (Sehgal *etal*., 2014). The generation of high PAH levels from wood burning produces blood pressure reductions by 3.7 mm Hg for systolic pressure and 3 mm Hg for diastolic pressure (McCracken *et al*., 2007). Mishra*et al*., 2003 discovered that elderly people older than 60 years who resided in homes using biomass fuel faced higher asthma incidence rates compared to those using cleaner fuel alternatives. The research conducted by Bhat *et al*., 2012, revealed that unclean fuel use increases the development of respiratory tract infections. Female victims show higher sensitivity toward polluted air from fuel combustion sources through dissolved fine particulate matter since these exposures enhance their risk for children's and aged peoples mostly (Rechkemmer*et al*., 2005; Pokhrel*et al*., 2005).

The pollution levels inside homes become worse due to the release of pollutants including aldehydes and volatile as well as semivolatile organic compounds through household products such as resins, waxes, polishing materials, cosmetics, and binders (Kankaria*et al*., 2014). Bad IAQ occurs because of biological pollutants such as dust mites along with mold spores and pollen and infectious agents that develop from continuous water sources and mattress materials and carpeting and humidifiers. The houses where ventilation systems are not developed which permits harmful chemicals to enter blood circulation which results in harm to lung tissue along with heart and brain damage as well as increased inflammation and impaired neuronal function also damage the respiratory system (Peters *et al*., 2006). Airborne particulate matter which penetrates the brain through the olfactory bulb leads to central nervous system inflammation and neurochemical stress according to Genc and colleagues 2012.Scientists have discovered that long-term indoor air pollution exposure leads to serious damage in cognitive brain functions. Research shows that brain deposits of particulate matter together with olfactory dysfunction serve as precursor signs for both dementia and Alzheimer's disease (Fagundes*et al*., 2015). Science experiments performed in China discovered indoor air contaminants cause detrimental brain effects among senior adults which negatively affect their short-term memory and their ability to perform mathematics. Adults

aged 50 and above in Mexico present diminished cognitive performance when regularly exposed to indoor air pollution as per Saenz *et al*., 2021 study. Research must be conducted to understand solid fuel pollution's effect on cognitive decline because existing evidence shows this link affects Indian elderly mental health (Chattopadhyay*et al*., 2021).Indoor air pollution suffers from significant additional harm because of the widespread use of mosquito repellents. Each of the three devices for pest control including mats, liquid vaporizers, perfumes, room fresheners and coils emits particulate matter (PM) and volatile organic compounds (VOCs) that includes nanoparticles along with carbonyl compounds which may cause health hazards and some perfumes causes skin cancer like diseases. The present scientific body of work about repellent emissions exists but research on comparing diverse repellents against each other has gaps that need additional investigation about their impact on indoor air quality and human health (Lee *et al*., 2024). Society needs better ventilation together with alternative fuel systems or cooking system and uses of chimney along with raised awareness about indoor pollutants to successfully reduce adverse health outcomes from indoor air pollution.

➢ **MainPollutant Sources**

There are many sources of indoor air pollution. These can include:

- ✓ Fuel-burning combustion appliances
- ✓ Tobacco products
- ✓ Building materials and furnishings as diverse as:
  - Deteriorated asbestos-containing insulation
  - Newly installed flooring, upholstery or carpet
  - Cabinetry or furniture made of certain pressed wood products
- ✓ Products for household cleaning and maintenance, personal care, or hobbies
- ✓ Central heating and cooling systems and humidification devices
- ✓ Excess moisture, paints, paint strippers and other solvents
- ✓ Wood preservatives, aerosol sprays, cleansers and disinfectants
- ✓ Moth repellents and air fresheners, stored fuels and automotive products

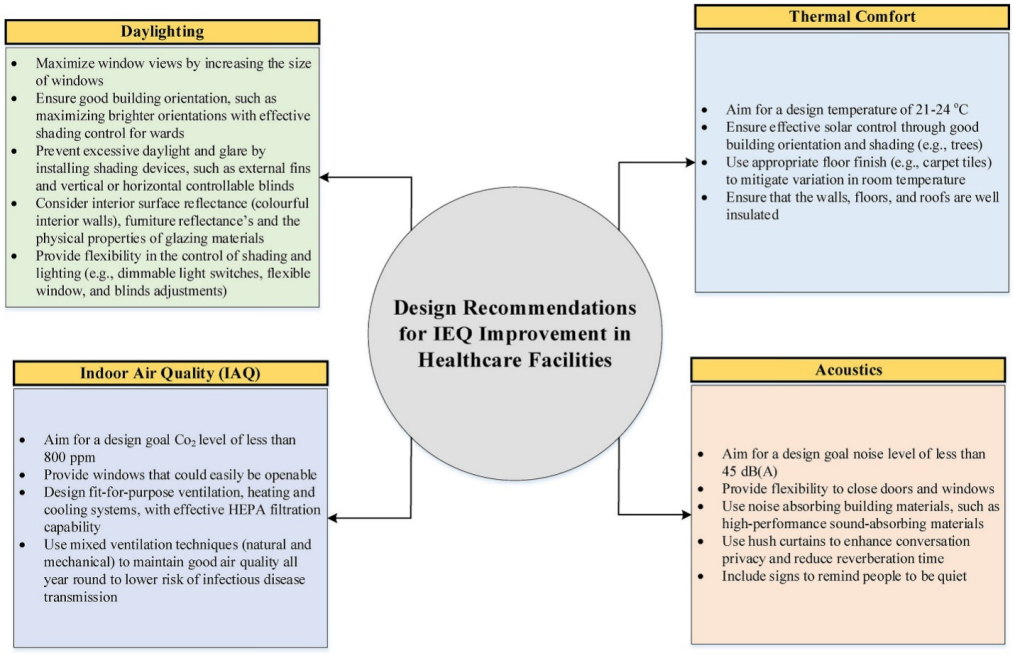

Fig. 2 Improvements of Healthcare facilities Ackley,*et al*., (2024).

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OBSERVATION

Fine particulate particles, carbon monoxide (CO), volatile organic compounds (VOCs), and other hazardous substances are released when *agarbatti* is burned at home or in places of worship. Prolonged exposure to these pollutants may exacerbate disorders like asthma or contribute to chronic respiratory ailments. They can also irritate the respiratory system, eyes, and throat. While concealing scents, air fresheners emit toxic volatile organic compounds (VOCs) such phthalates, benzene, and toluene, which can lead to allergic responses, respiratory problems, and secondary pollutants that worsen indoor air pollution. Similarly, harmful substances like pyrethroids and organophosphates found in pesticides can cause nausea, vertigo, and respiratory irritation when breathed, endangering human health (Singha *et al.,* 2024).

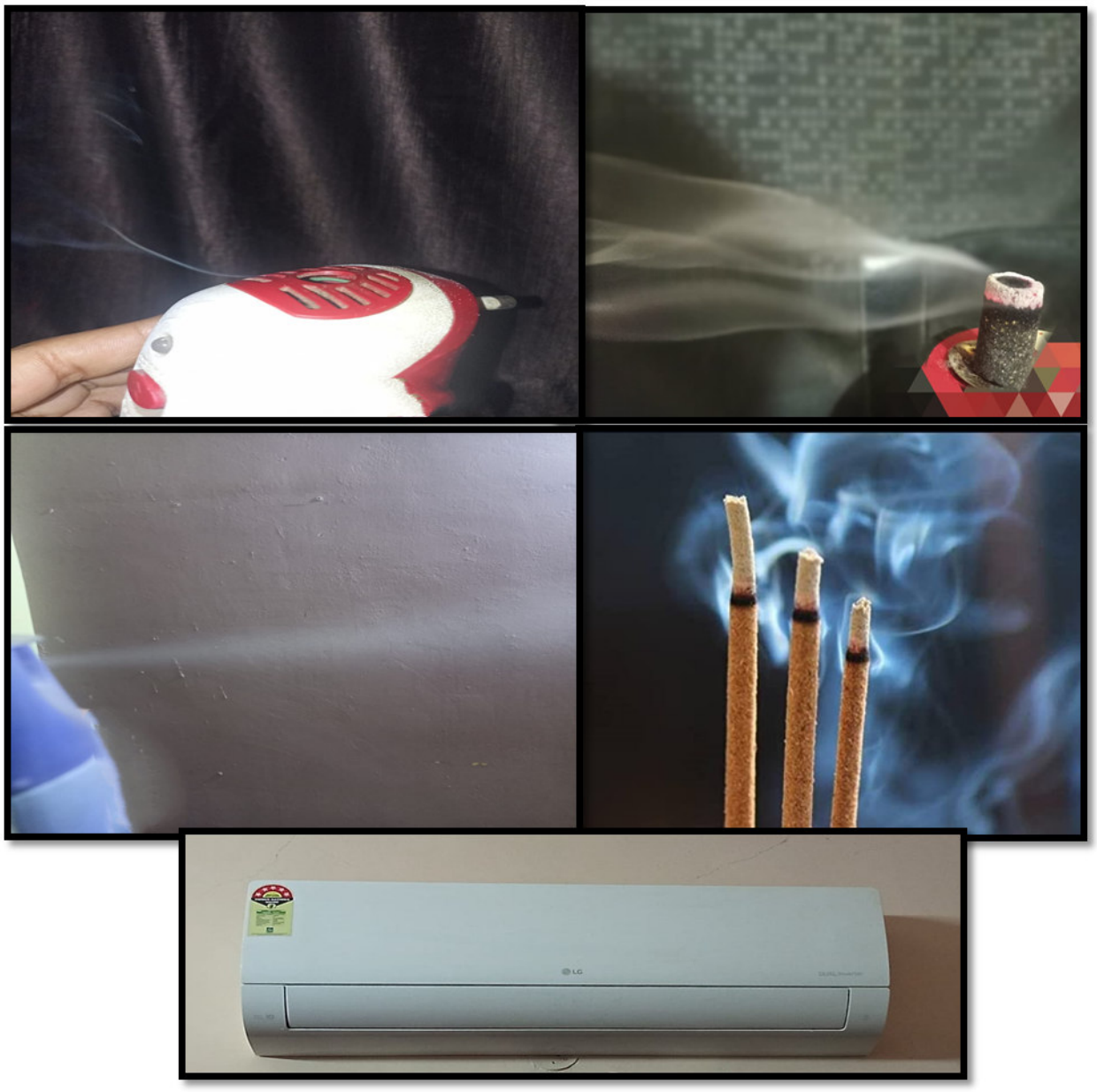

Fig. 3 Mosquito repellant, agarbattiesroom freshenerand air conditioner are the daily indoor air pollutants use in all houses and residences.

1. To determine the causes of indoor air pollution in both urban and rural locations, including busy workplaceslike banks.
2. To monitor and quantify the effects of indoor air pollution on susceptible groups' health.
3. To investigate practical methods for enhancing indoor air quality and establishing its inherent healthfulness.
4. To make policy suggestions to combat indoor air pollution.

➢ **POSSIBLE SOLUTIONS TO IMPROVE INDOOR AIR QUALITY**

Fig.8 Indoor plants grow in artificial lights

The water plant based aquarium and indoor plants like *Livistonachinesis, Syngoniumangustatum, Chlorophytum comosum,* peace lily, pothas or money plant,and other plants have ability to absorb indoor molds and pollutants.Plants can do photosynthesis if the right spectrum of artificial light is provided, such as for indoor plants. This method is used to boost production and growth performance of plants.According to researcher Pegas based on the successful results on air purification in plant experiments, scientists made the step to air purification in living rooms, class rooms and offices.Solid research was done in Portuguese

class rooms which showed that the presence of plants decreased the concentration of CO2 as well as contaminants like PM10 and VOCs (Pegas*et al.*, 2012).In addition to increasing energy efficiency, LEDs promote plant development in a variety of environmental settings. Research has indicated that LED lighting can increase output (Chi *et al*., 2015).Improve air quality and reduce the CO_2 in air which can cause headache and fatigue.Also remove dust particles dirt and mold. Increase oxygen level plant as natural Air purifier significantly improves oxygen concentration in the air, creating a healthier environment for our home.Rich oxygen will help us feel more energized and focus.Plants at indoor increase positive feeling reduce anxiety and stress level, also control humidity to and make cooling effect. Aesthetic design and décor for future the water plants as air purifier is look like as fish pot and designed to be a stylish addition to our home and office décor. Also advance ventilation system in packed and building systems so it will help to pass fresh and pure air.

AWARENESS AND RECOMMENDATIONTO PREVENT THE INDOOR AIR POLLUTION

Preventing indoor air pollution requires residents to understand fully the health risks associated with the contamination because it poses severe threats to personal wellness. Education programs need to teach population members methods to minimize their exposure to pollutants by improving kitchen management while safeguarding environment in homes. People should receive instruction on cleaner energy alternatives which can replace traditional biomass fuel usage. The awareness campaign to address indoor air pollution must incorporate both public members and government administrators and politicians to obtain maximum commitment toward education on health impacts from contaminated air. Three major factors namely habits and availability and affordability determine fuel consumption rates. Biomass fuel direct combustion stands as the most affordable cooking method for low-income families who use it because it is the most accessible solution. The promotion of gobar gas production from cow dung represents a sustainable alternative to clean up cooking gas resources (Ankita*et al*., 2014).

Stove producers should redesign their cooking products. Stoves with double functions as fuel-efficient smokeless units should replace the old traditional stoves yet should integrate a ventilation system through chimneys to allow safe pollutant removal. The National Biomass Cook stoves Initiative from the Ministry of New and Renewable Energy introduced in 2009-2010 works to deliver superior and sustainable energy systems to households without essential energy supplies and people experiencing limited financial resources. Appropriate ventilation should be made a priority element of house construction. Installing a window above cooking stoves together with proper door ventilation can make a substantial impact on reducing residential indoor air pollution in homes with bad ventilation. The control of indoor air pollution demands organizations from health to environment departments to work together with those from energy and housing and rural development fields. The solution to this multifaceted issue demands total global commitment together with cross-sectorial cooperation (Kankaria*et al*., 2014).

The development of healthy cities needs IAQ improvement to create a better urban environment. Since humanswell within indoor spaces for most of their time it becomes vital to decrease VOCs and allergens exposure. Strategic implementation of efficient ventilation with green spaces along with public awareness practices will strengthen overall well-being (Saini *et al*., 2022).

CONCLUSION

The public health problem of indoor air pollution affects millions around the world because developing nations continue to use traditional biomass fuels primarily as their primary energy source. The presence of PM with VOCs alongside CO and PAHs in indoor air causes severe respiratory diseases and leads to cardiovascular problems and neurological dysfunction(Kurti et al., 2016). Scientists now establish

a connection between sustained exposure to indoor air contaminantsand neuroinflammatory reactions and accelerated mental deterioration and disease development leading to dementia and Alzheimer's disease.

The solution to indoor air pollution demands solutions from multiple sectors which unite environmental policies with technology advancement and social modifications. Governments must establish indoor air quality as their priority by maintaining strict building approval requirements while spreading knowledge about renewable solutions to the public. Homeowners can make major improvements to indoor air quality through regular house ventilating efforts alongside air purifier utilization alongside synthetic chemical reduction and a change to clean cooking methodology. Preventing IAP requires more than eliminating pollutants because it ensures both long-term health protection and enhances both mental cognition and lifestyle quality. Researchers and communities will create a necessary environment of clean air and improved health conditions.

REFERENCES

1. Ackley, A., Olanrewaju, O. I., Oyefusi, O. N., Enegbuma, W. I., Olaoye, T. S., Ehimatie, A. E., ... & Akpan-Idiok, P. (2024). Indoor environmental quality (IEQ) in healthcare facilities: A systematic literature review and gap analysis. *Journal of Building Engineering*, *86*, 108787.
2. Agency, E. E. (2015). Air quality in Europe-2015 report.
3. Argunhan, Z., &Avci, A. S. (2018). Statistical evaluation of indoor air quality parameters in classrooms of a university. *Advances in Meteorology*, 2018, 4391579. https://doi.org/10.1155/2018/4391579
4. Assimakopoulos, V. D., Saraga, D. E., Helmis, C. G., Halios, C. H., & others. (2008). An experimental study of the indoor air quality in areas of different use. *Global Nest Journal, 10*(2), 140-146.
5. Bruce, N., Rehfuess, E., Mehta, S., et al. (2006). Indoor air pollution. In D. T. Jamison, J. G. Breman, A. R. Measham, et al. (Eds.), *Disease control priorities in developing countries* (2nd ed., p. 42). The International Bank for Reconstruction and Development.
6. Chen, Y., Li, X., Zhu, T., Han, Y., &Lv, D. (2017). PM2.5-bound PAHs in three indoor and one outdoor air in Beijing: Concentration, source, and health risk assessment. *Science of The Total Environment, 586*, 255–264.
7. Chi, N., Haas, H., Kavehrad, M., Little, T. D., & Huang, X. L. (2015). Visible light communications: demand factors, benefits and opportunities [Guest Editorial]. IEEE Wireless Communications, 22(2), 5-7.
8. Pokhrel, A. K., Smith, K. R., Khalakdina, A., Deuja, A., & Bates, M. N. (2005). Case–control study of indoor cooking smoke exposure and cataract in Nepal and India. *International journal of epidemiology*, *34*(3), 702-708.
9. Fagundes, L. S., Fleck, A. da S., Zanchi, A. C., Saldiva, P. H. N., & Rhoden, C. R. (2015). Direct contact with particulate matter increases oxidative stress in different brain structures. *Inhalation Toxicology, 27*(8), 462–467.
10. Genc, S., Zadeoglulari, Z., Fuss, S. H., &Genc, K. (2012). The adverse effects of air pollution on the nervous system. *Journal of toxicology*, *2012*(1), 782462.
11. Kankaria, A., Nongkynrih, B., & Gupta, S. K. (2014). Indoor air pollution in India: Implications on health and its control. *Indian Journal of Community Medicine, 39*(4), 203-207.

12. Kumar, P., Morawska, L., Martani, C., Biskos, G., Neophytou, M., Di Sabatino, S., ... &Britter, R. (2015). The rise of low-cost sensing for managing air pollution in cities. *Environment international*, *75*, 199-205.
13. Kurti, S. P., Kurti, A. N., Emerson, S. R., Rosenkranz, R. R., Smith, J. R., Harms, C. A., & Rosenkranz, S. K. (2016). Household Air Pollution Exposure and Influence of Lifestyle on Respiratory Health and Lung Function in Belizean Adults and Children: A Field Study. *International Journal of Environmental Research and Public Health*, *13*(7), 643.
14. Lee, S., Park, J., Lee, M., Kim, M., Kim, B., Lee, K., Zoh, K., Yoon, C. (2024). Evaluation of Airborne Particulate Matter and Volatile Organic Compounds Released by Three Types of Mosquito Repellents. Aerosol Air Qual. Res. 24, 230250.
15. Marć, M., Śmiełowska, M., Namieśnik, J., & et al. (2018). Indoor air quality of everyday use spaces dedicated to specific purposes—a review. *Environmental Science and Pollution Research, 25*(3), 2065–2082.
16. McCracken, J. P., Wellenius, G. A., Bloomfield, G. S., Brook, R. D., Tolunay, H. E., Dockery, D. W., ... & Rajagopalan, S. (2012). Household air pollution from solid fuel use: evidence for links to CVD. *Global heart*, *7*(3).
17. Mishra, V. (2003). Effect of indoor air pollution from biomass combustion on prevalence of asthma in the elderly. *Environmental health perspectives*, *111*(1), 71-78.
18. National Biomass Cookstoves Programme (NBCP) Ministry of New and Renewable Energy.Last accessed on 2013.
19. Park, J., Ham, S., Kim, S., Jang, M., Lee, J., Kim, S., Park, D., Lee, K., Kim, H., Kim, P., & Yoon, C. (2020). Physicochemical characteristics of colloidal nanomaterial suspensions and aerosolized particulates from nano-enabled consumer spray products. *Indoor Air, 30*(5), 925–941.
20. Pegas, P. N., Nunes, T., Alves, C. A., Silva, J. R., Vieira, S. L. A., Caseiro, A., & Pio, C. A. (2012). Indoor and outdoor characterisation of organic and inorganic compounds in city centre and suburban elementary schools of Aveiro, Portugal. Atmospheric Environment, 55, 80-89.
21. Peters, A., Veronesi, B., Calderón-Garcidueñas, L., Gehr, P., Chen, L. C., Geiser, M., ... & Schulz, H. (2006). Translocation and potential neurological effects of fine and ultrafine particles a critical update. *Particle and fibre toxicology*, *3*, 1-13.
22. **Piccardo, M. T., Cipolla, M., Stella, A., Ceppi, M., Bruzzone, M., Izzotti, A., & Valerio, F. (2014).** Indoor pollution and burning practices in wood stove management. *Journal of the Air & Waste Management Association, 64*(11)Saenz, J. L., Adar, S. D., Zhang, Y. S., Wilkens, J.,
23. Chattopadhyay, A., Lee, J., & Wong, R. (2021). Household use of polluting cooking fuels and late-life cognitive function: a harmonized analysis of India, Mexico, and China. *Environment international*, *156*, 106722.
24. Raju, S., Siddharthan, T., & McCormack, M. C. (2020). Indoor air pollution and respiratory health. *Clinics in Chest Medicine, 41*(4), 825-843.
25. Ramesh Bhat, Y., Manjunath, N., Sanjay, D., &Dhanya, Y. (2012). Association of indoor air pollution with acute lower respiratory tract infections in children under 5 years of age. *Paediatrics and international child health*, *32*(3), 132-135.
26. Saidin, H., Razak, A. A., Mohamad, M. F., Ul-Saufie, A. Z., Zaki, S. A., & Othman, N. (2023). Hazard Evaluation of Indoor Air Quality in Bank Offices. *Buildings*, *13*(3), 798.

27. Saini, J., Dutta, M., & Marques, G. (2022). **Indoor air pollution: A comprehensive review of public health challenges and prevention policies**. In *Chapter 6*. National Institute of Technical Teacher's Training & Research, Chandigarh, India; Polytechnic of Coimbra, ESTGOH, Portugal. *ScienceDirect*
28. Shaw, S., Kundu, S., Chattopadhyay, A., & Rao, S. (2024). Indoor air pollution and cognitive function among older adults in India: A multiple mediation approach through depression and sleep disorders. *BMC Geriatrics, 24*, Article 81.
29. Sehgal, M., Rizwan, S. A., & Krishnan, A. (2014). Disease burden due to biomass cooking-fuel-related household air pollution among women in India. *Global health action*, *7*(1), 25326.
30. Singha, R., & Singha, S. (2024). Indoor Air Pollution: Causes, Effects, And Solutions. *Effects, And Solutions (November 25, 2024)*.
31. Saenz, J. L. (2021). Solid cooking fuel use and cognitive decline among older Mexican adults. *Indoor air*, *31*(5), 1522-1532.
32. Suryawanshi S, Chauhan AS, Verma R, Gupta T (2016) Identification and quantification of indoor air pollutant sources within a residential academic campus. Sci Total Environ 569-570:46–52.
33. U.S. Environmental Protection Agency. (2014). (accessed September 19, 2014).
34. USEPA. (2020, January 28). *Fundamentals of indoor air quality in buildings*. U.S. Environmental Protection Agency.
35. USEPA. (2020, January 28). *Introduction to indoor air quality*. U.S. Environmental Protection Agency.