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**INDOOR AIR POLLUTION IN RURAL AREA IN INDIA: CONSEQUENCES ON HEALTH AND ITS CONTROL**

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Several studies have shown that indoor pollution will trigger asthma attack attacks and may be damaging to metastasis health standing. Conjointly indoor pollution contains a spread of health damaging air pollutants. Preparation fuels are the main sources of indoor pollution. This study aims to match material (PM<sub>2.5</sub> and PM<sub>10</sub>) levels from rural kitchens mistreatment various preparation fuels. Material levels were measured in thirty three rural representative homes. Amongst that thirteen use chullah, ten homes use lamp oil stove, five homes use LPG stove and five homes use combination of preparation media. Indoor air was undergone 47mm quartz paper mistreatment MiniVol (Airmetrics) sampler at steady rate of five l/min for twenty-four hours. The mass of the PM<sub>2.5</sub> associated PM<sub>10</sub> particles were analyzed gravimetrically mistreatment an ultra-sensitive weighing machine with least count 1µg. Higher particulate concentrations were determined in homes mistreatment chullah (PM<sub>2.5</sub> 1218 g/m<sup>3</sup> and PM<sub>10</sub> 2993 g/m<sup>3</sup>), compared to lamp oil stove (PM<sub>2.5</sub> - 416 g/m<sup>3</sup> and PM<sub>10</sub> - 491 g/m<sup>3</sup>) and LPG stoves (PM<sub>2.5</sub> 122 g/m<sup>3</sup> and PM<sub>10</sub> 341 g/m<sup>3</sup>) severally. Comparison with National close Air Quality Standards, determined levels found to be eighty one.8% and ninety seven of times higher than for PM<sub>2.5</sub> and PM<sub>10</sub> severally. Individuals living in homes mistreatment chullah and lamp oil stoves ar subjected to considerably redoubled risk of adverse metastasis health effects.

**KEYWORDS-** Indoor Air Quality, MiniVol (Airmetrics) sampler, Rural, Residential area**INTRODUCTION**

Indoor pollution is that the degradation of indoor air quality by harmful chemicals and alternative materials; it is up to ten times worse than out of doors pollution. this is often as a result of contained areas alter potential pollutants to make up quite open areas. Statistics recommend that in developing countries, health impacts of indoor pollution way outweigh those of out of doors pollution. Indoor pollution from solid fuels accounted for three.5 million deaths and four.5% international daily-adjusted life year (DALY) in 2010; it additionally accounted for 16 PF material pollution. although there's a decrease in unit pollution from solid fuels in geographic region, still it hierarchical third among risk factors within the report of the world Burden of illness.(1) This paper provides AN evidence-based insight into indoor pollution, its impact on health, and steered management measures. Standing of Indoor pollution in Asian nation

Status of Indoor pollution in Asian nation The principal sources of indoor pollution are: Combustion, artifact, and bioaerosols.(2) whereas atomic number 86, asbestos, pesticides, significant metals, volatile organic matter, and environmental tobacco smoke square measure thought-about major indoor pollutants in developed countries, the combustion merchandise of biomass fuels contribute most to indoor pollution in developing nations. In India, out of 0.2 billion individuals victimization fuel for cooking; forty ninth use fi rewood; eight.9% scrap cake; one.5% coal, lignite, or charcoal; a pair of.9% kerosene; twenty eight.6% liquefi ED rock oil gas (LPG); zero.1% electricity; zero.4% biogas; and zero.5% the other suggests that.(3) the unfinished combustion merchandise of biomass fuels embody suspended material, CO, polyaromatic hydrocarbons, polyorganic matter, methanol, etc., that have adverse effects on health. The combustion of coal ends up in production of oxides of sulfur, arsenic, and Sunshine State urine. Pollutants like aldehydes, volatile, and semi volatile organic compounds square measure created from resins, waxes, sharpening

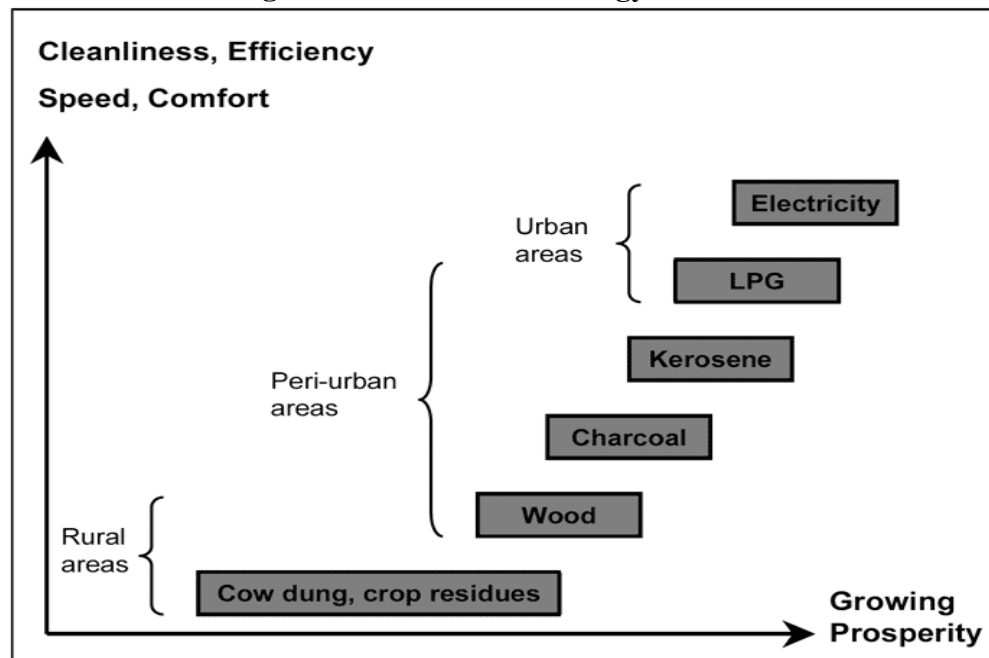
materials, cosmetics, and binders. Lastly; biological pollutants like mud mites, molds, pollen, and infectious agents created in stagnant water, mattresses, carpets, and humidifiers too grime indoor air.(4) A study on quantifying exposures to metabolic process material found concentrations of material starting from five hundred to a pair of,000 mg/m<sup>3</sup> throughout change of state in biomass-using households. Average 24-h exposures ranged from eighty two  $\pm$  thirty-nine mg/m<sup>3</sup> for those victimization clean fuels, to 231  $\pm$  109 mg/m<sup>3</sup> for people who used biomass fuel for change of state.(5) In indoor air, CO levels throughout change of state by dung, wood, coal, kerosene, and LPG were found to be one hundred forty four, 156, 94, 108, and fourteen mg/m<sup>3</sup> , severally. The indoor levels of total polyaromatic hydrocarbons throughout use of dung, wood, coal, kerosene, and LPG were three.56, 2.01, 0.55, 0.23, and 0.13 mg/m<sup>3</sup> of air, severally.(6) The methanol mean levels were 670, 652, 109, 112, and sixty eight mg/m<sup>3</sup> , severally, for dung, wood, coal, kerosene, and LPG.(7)

## FUEL TYPES, TRADITIONAL COOKING STOVES AND AIR POLLUTION LEVELS

Households at lower levels of financial gain and development tend to be at rock bottom of the energy ladder, mistreatment fuel that's low-cost and domestically out there however not terribly clean nor economical.

According to the planet Health Organization, over 3 billion folks worldwide are at these lower rungs, looking on biomass fuels—crop waste, dung, wood, leaves, etc.—and coal to satisfy their energy wants. A disproportionate range of those people reside in Asia and Africa: ninety fifth of the population in Asian country uses these fuels, ninety fifth in Chad, eighty seven in Gold Coast, eighty two in Asian country, eightieth in China, then forth. Coal is seen as a better quality fuel because of its potency and storage, and therefore is higher on the energy ladder, however as Holden and Smith (2000) describe, coal will in truth be dirtier than wood. As incomes rise, we'd expect that households would substitute to higher quality fuel selections. However, this method has been quite slow. In fact, the planet Bank reports that the utilization of biomass for all energy sources had remained constant at regarding twenty fifth since 1975. For empirical tests of the energy ladder, see, as an example, tradesman and Dowd (1987) and Chaudhuri and Pfaff (2003).

**Figure 1: The Classic “Energy Ladder”**



This ladder describes transitions in fuel use at completely different levels of economic development (adapted from Holdren and Smith, 2000).

For those on the lower rungs, change of state with ancient solid fuels on open flames or ancient change of state stoves (see Figure 2a) might end in exposure to very damaging hepatotoxic pollutants, resulting, in some contexts, in close concentrations of quite ten times the allowable Environmental Protection Agency level over a twenty four hour amount. as an example, PM10 refers to particulate with a diameter of but or adequate to 10 $\mu$ m; these particles square measure wide believed to cause the best health issues. The u. s. Environmental Protection Agency (EPA) commonplace for a suitable annual 24-hour average of PM10 is 150 $\mu$ g/m<sup>3</sup>, and that they state that this level mustn't be exceeded quite once annually. In fact, 50 $\mu$ g/m<sup>3</sup> is that the accepted norm for PM10 (EPA, 2006). In distinction, Smith (2000) reports that mean 24-hour PM10 concentration in solid-fuel-using households in India typically exceed 2000 $\mu$ g/m<sup>3</sup>. Dasgupta et al. (2004) realize a mean of 600 $\mu$ g/m<sup>3</sup> in People's Republic of Bangladesh, so much outside the Environmental Protection Agency pointers. Similarly, a study of concerning four hundred households within the provinces of Shaanxi, Hubei, and Zhejiang, China, were monitored for PM4, and it had been found that almost all households exceed China's Indoor Air Quality Standards (Zhang and Smith, 2007).

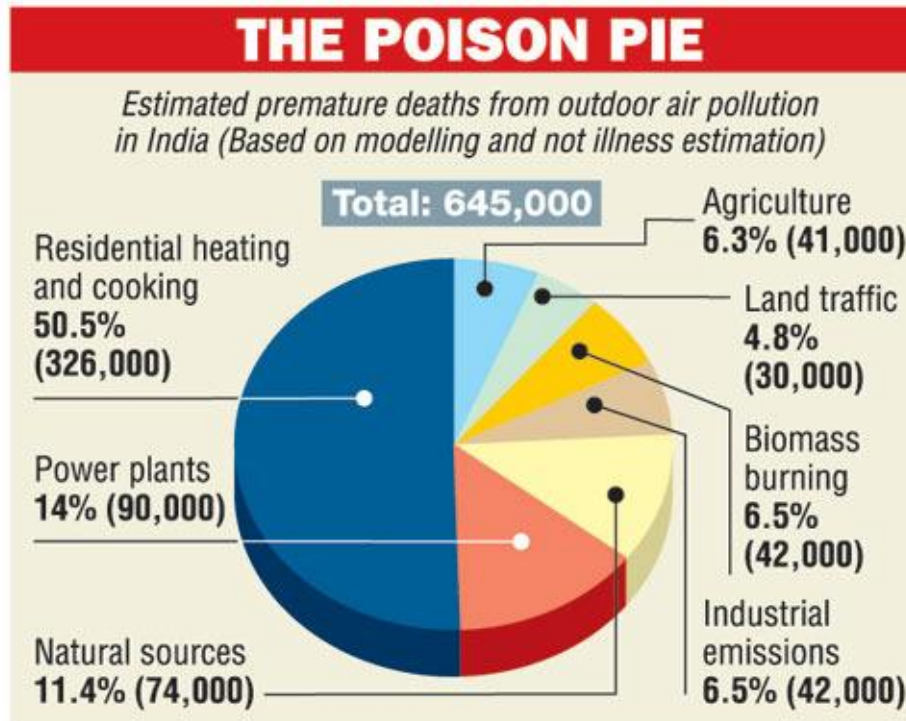
These close concentration readings alone might mask individuals' true exposure, as exposure might also vary with Associate in Nursing individual's proximity to the stove during times once the stove is in use. Ezzati, Saleh, and Kammen (2000) and Ezzati and Kammen (2001b) used personal monitors with {real-time|time amount|period of time|period} observation in rural Kenya over a biennial period. These studies recorded peak concentrations larger than fifty,000  $\mu$ g/m<sup>3</sup> within the immediate locality of the change of state fireplace, suggesting that ladies and kids UN agency congregate close to change of state stoves square measure exposed to pollution levels exceptional within the developed world. Menon (1988) and Saksena, Prasad, Pal, Joshi (1992) have found similar leads to India, with reportable levels of twenty, 000  $\mu$ g/m<sup>3</sup> or a lot of close to the change of state location and with abundant lower concentrations of those toxins within the remainder of the kitchen/other rooms within the family. the worldwide health community has recognized the deficit of knowledge on exposure levels: as an example, the 1999 Air Quality pointers of the planet Health Organization states that "although work on easy exposure indicators desperately must be inspired, realistically it's seemingly to be some years before ample environmental observation may be undertaken in most developing countries." However, continued innovations within the field square measure allowing a lot of correct and reliable knowledge that may yield a lot of conversant policy choices concerning IAP.

Overall, whereas there's general agreement that ancient fuels unleash a high level of poison pollutants, the recent literature has been centered on making an attempt to grasp the magnitude of the exposure levels. succeeding main challenge, then, is to translate these exposure levels to health impacts. Therefore, we tend to currently address a discussion of this state of the literature concerning the results of pollution on health.

#### Effects of Indoor pollution on Health

The ill-effects of indoor pollution end in concerning a pair of million premature deaths annually, whereby four hundred and forty yards square measure thanks to respiratory disease, fifty four from chronic preventative pulmonic illness (COPD), and a pair of from carcinoma.(8) the foremost affected teams square measure ladies and younger kids, as they pay most time reception.(8) The morbidities related to indoor pollution square measure metabolism sicknesses, viz., acute tract infection(9) and COPD,(10) poor perinatal outcomes like low birth weight(11) and still birth, cancer of cavum, larynx, lung,(12) and leucaemia. The harmful health effects of methanol vary from being Associate in Nursing acute pain, reducing capacity, inflicting respiratory disorder, to being a matter inflicting leucaemia and carcinoma.(13,14) There square measure few studies done thus far to point out the result of wood smoke on vas health. A study from Guatemala reportable that reduction in wood smoke exposure by use of improved chimney stove resulted in lowering of pulse pressure level by three.7 mmHg (95% confidence interval (CI): -8.1, 0.6) and heartbeat pressure level by three.0 mmHg (95% CI: -5.7, -0.4).(15) Another study reportable reduction in ST-segment depression (odds magnitude relation (OR) zero.26, 95% CI: 0.08, 0.90) on ECG when stove intervention.(16) The indoor air pollutants have potential health effects.(17) The particulates cause metabolism infections,

bronchitis, COPD, and conjointly cause exacerbation of COPD. sulphur dioxide and dioxide cause unhealthy and exacerbation of respiratory disease. Additionally to the present, dioxide causes metabolism infections and deteriorates respiratory organ functions. sulphur dioxide has an extra etiological role in exacerbation of COPD and upset. the chance of poor perinatal outcomes, viz., low birth weight and perinatal death will increase from exposure to CO. Biomass smoke, particularly metal ions and polycyclic aromatics, results in development of cataract. Polycyclic aromatic hydrocarbons cause development of cancers of lungs, mouth, cavum, and larynx. As a consequence of economic condition, factors like living conditions, sanitation, and access to water square measure related to solid fuel use, and may be thought-about whereas measurement impact of solid fuel on kid survival.(17) varied studies in India have reportable harmful effects of indoor pollution. in an exceedingly giant case-control study, when adjustment for demographic factors and living conditions, solid-fuel use significantly accrued kid deaths at ages one-4 years (prevalence magnitude relation boys: 1.30, 95% CI: 1.08-1.56; girls: one.33, 95% CI: 1.12-1.58). a lot of women than boys died from exposure to solid fuels. Solid fuel use was conjointly related to nonlethal respiratory disease (boys: Prevalence magnitude relation one.54; ninety fifth CI: one.01-2.35; girls: Prevalence magnitude relation one.94; ninety fifth CI: one.13-3.33).(18) the utilization of fuel apart from LPG was considerably related to acute lower tract infection even when adjusting for different risk factors (adjusted OR = 4.73, 95% CI: 1.67–13.45). In kids with acute lower infection, 24.8% had respiratory disease, 45.5% had severe respiratory disease, and 29.7% had terribly severe illness.(19) In Ladakh, thanks to severe cold, and ventilation unbroken to a minimum, the inmates square measure exposed to high concentration of soot, leading to morbidities that tally respiratory illness.(20,21) the utilization of biomass fuel was related to considerably prolonged nasal mucociliary clearance time ( $765.8 \pm 378.16$  s) as compared to scrub fuel users ( $545.4 \pm 215.55$  s), and reduced peak breath rate of flow (319.3 l/min) as compared to scrub fuel users (371.7 l/min).(22) the utilization of biomass as a change of state fuel was found to be significantly related to a high prevalence of active infectious disease (OR = three.56, 95% CI: 2.82-4.50). The prevalence remained giant and significant even when analyzing on an individual basis for men (OR = a pair of.46) and girls (OR = a pair of.74) and for urban (OR = a pair of.29) and rural areas (OR = a pair of.65). li % of prevalence of active infectious disease is as a result of change of state smoke within the cohort twenty years and higher than.(23) Results from a study among aged men and girls (age = sixty years) showed higher prevalence of respiratory disease in households mistreatment biomass fuels than those mistreatment cleaner fuels (OR = one.59; ninety fifth CI: one.30-1.94). As compared to men (OR = one.83; ninety fifth CI: one.32-2.53), the result of change of state smoke on respiratory disease was larger among ladies when adjustment.(24) The results from a study conducted in southern India reportable the next prevalence of COPD among biomass fuel user than clean fuel users (OR: one.24; ninety fifth CI: zero.36–6.64). It conjointly found that the prevalence was double higher in ladies disbursement quite a pair of h every day in change of state.(25) Biomass fuels contain carcinogens like polyaromatic hydrocarbons, methanal, etc. A case-control study among ladies diagnosed with carcinoma reportable that additionally to tobacco, exposure to biomass fuels conjointly results in development of carcinoma. In nonsmoker ladies, exposure to biomass fuel was related to higher risk of developing carcinoma (OR three.04, 95% CI: 1.1-8.38). The exposure to biomass fuel remained significantly related to carcinoma despite adjusting for different factors like smoking and passive smoking.(26) As compared to the utilization of trash and wood smoke, LPG use was found to be related to animal tissue, nuclear, Associate in Nursing mixed cataract with an odds magnitude relation of zero.69 (95% CI: zero.4-0.9),(27) whereas biomass fuel use resulted in partial or complete visual disorder with odds of one.32 (95% CI: one.2-1.5), as compared to different fuels.(28) Similar studies in western India reportable use of wood to be a crucial explanation for age-dependent cataract (OR = a pair of.12, 95% CI: 1.03-4.34). Coal and oxendung use resulted in eye irritation (OR = a pair of.04, 95% CI: 1.13–3.68) and (OR = one.83, 95% CI: 1.35–2.47), severally.(29)



Source: [https://www.google.com/search?biw=1242&bih=557&tbm=isch&sa=1&ei=m9agW4T\\_K8rzvgTg6JuQBA&q=death+by+indoor+air+pollution+in+India&oq=death+by+indoor+air+pollution+in+India&gs\\_l=img..3...21365.23270.0.23664.7.7.0.0.0.289.1120.2-4.4.0....0...1c.1.64.img..3.0.0....0.KVQEY856AaY#imgrc=JIUXazO4SnFJ9M](https://www.google.com/search?biw=1242&bih=557&tbm=isch&sa=1&ei=m9agW4T_K8rzvgTg6JuQBA&q=death+by+indoor+air+pollution+in+India&oq=death+by+indoor+air+pollution+in+India&gs_l=img..3...21365.23270.0.23664.7.7.0.0.0.289.1120.2-4.4.0....0...1c.1.64.img..3.0.0....0.KVQEY856AaY#imgrc=JIUXazO4SnFJ9M)

## Key Health Outcomes

### • Childhood Acute Lower Respiratory Infections (ALRI)

Childhood Acute Lower Respiratory Infections (ALRI) stay the one most vital reason for death globally in youngsters beneath five years, and account for a minimum of two million deaths annually during this cohort. There are currently sixteen revealed studies from developing countries that have according on the association between indoor pollution exposure and ALRI, and 2 more studies among Navajo Indians within the North American country. Discussion is restricted here to studies that have used definitions of ALRI that adapt fairly closely to current UN agency criteria (or different definitions that were accepted at the time the study was carried out) and/or embrace picture taking proof. These ALRI studies embrace ten case-control styles (two mortality studies), five cohort studies (all morbidity), and one case-fatality study. In distinction to the comparatively strong definitions of ALRI, the measuring of exposure within the majority of those studies has relied on proxies, as well as the sort of fuel used, stove type, exposure of the kid to smoke throughout peak cookery times, according hours spent close to the stove, and whether or not the kid is carried on the mother's back throughout cookery. One study created direct measurements of pollution (particulates) and exposure (COHb) in an exceedingly subsample (20). in this study, respirable particulates within the kitchens of cases were considerably beyond for controls (1998 mg/m<sup>3</sup> vs. 546 mg/m<sup>3</sup>; p sixty five mg/m<sup>3</sup> had Associate in Nursing OR of seven.0 (95% CI: zero.9-56.9) times that for youngsters with levels < sixty five mg/m<sup>3</sup>. The recent study in Central African nation, that controlled for variety of contradictory covariates, obtained Associate in Nursing exposure-response relationship for PM<sub>10</sub> exposure and childhood ALRI, with those in higher exposure classes being 2-3 times as probably because the baseline cluster classified as having ALRI (15, 16).

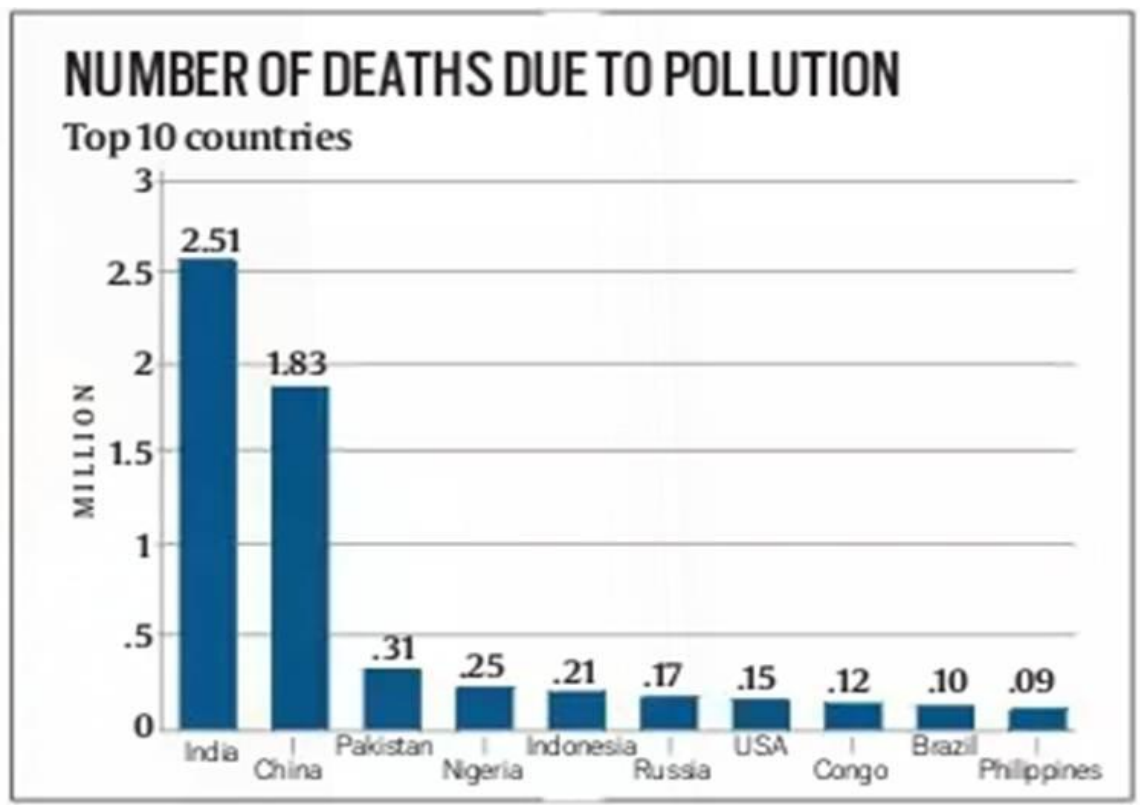
### • Chronic Obstructive Pulmonary Disease (COPD)

There are regarding twenty community – and hospital – based mostly studies with numerous outcomes that embrace bronchitis (by assessment of symptoms) and chronic preventive pulmonic illness (COPD – by

clinical examination and respiratory organ perform measurement) (7). Some patients conjointly proceed to develop pulmonary emphysema [over inflation of the air sacs within the lung] or hypertrophy [right heart failure]. the bulk of studies found associations between exposure and COPD, though these aren't according in an exceedingly consistent manner. Like studies of acute lower metabolism infections in youngsters, only a few distributed exposure assessments, and contradictory was inadequately treated in some. Overall, the studies indicate that exposure to indoor pollution will increase the chance of bronchitis, but, like ALRI, the relative risks in some instances could also be poorly calculable.

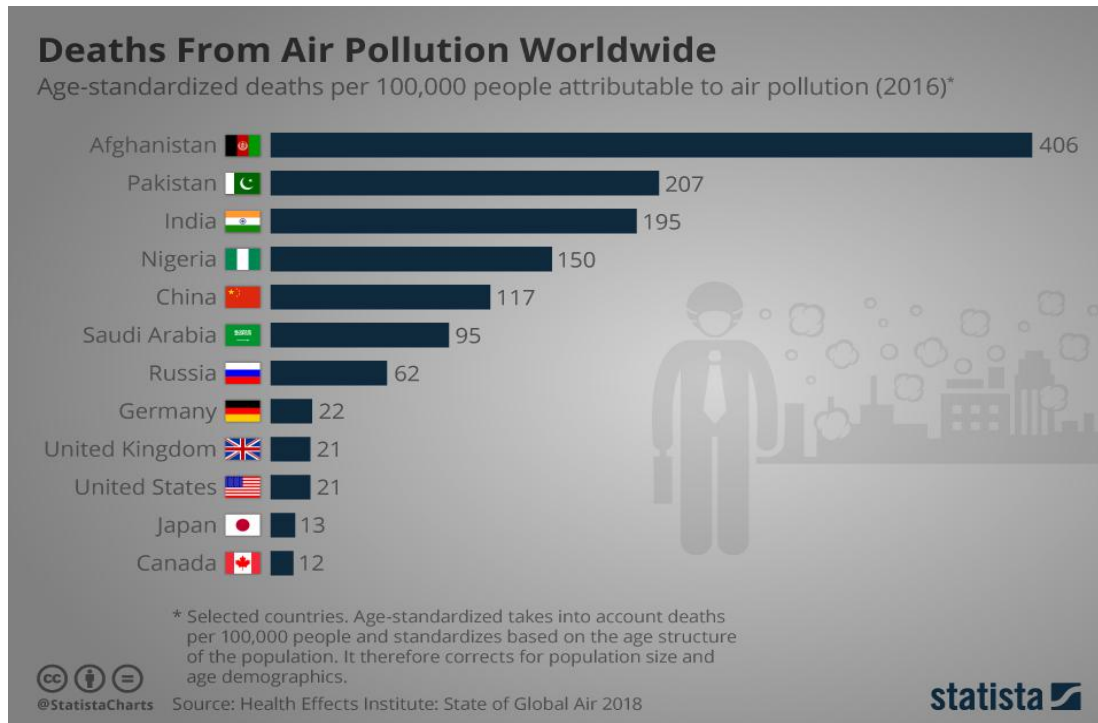
### • Lung Cancer

Smoke from each coal and biomass contains substantial amounts of carcinogens, as well as benzo[a]pyrene, 1,2 hydrocarbon and aromatic hydrocarbon. a standardized body of proof, notably from China, has shown that girls exposed to smoke from coal fires within the home have Associate in Nursing elevated risk of carcinoma (17, 19), within the vary 2-6. This impact has not been incontestable among populations mistreatment biomass, however the presence of carcinogens within the smoke suggests that the chance could also be gift. Synergistic health impact between use of coal for domestic heating and passive smoking from environmental tobacco smoke has conjointly been noted (30).



### Source:

[https://www.google.com/search?biw=1242&bih=557&tbm=isch&sa=1&ei=m9agW4T\\_K8rzvgTg6JuQBA&q=death+by+indoor+air+pollution+in+India&oq=death+by+indoor+air+pollution+in+India&gs\\_l=img.3...21365.23270.0.23664.7.7.0.0.0.0.289.1120.2-4.4.0....0...1c.1.64.img..3.0.0....0.KVQEY856AaY#imgrc=m1\\_\\_5DbxL7N8-M:](https://www.google.com/search?biw=1242&bih=557&tbm=isch&sa=1&ei=m9agW4T_K8rzvgTg6JuQBA&q=death+by+indoor+air+pollution+in+India&oq=death+by+indoor+air+pollution+in+India&gs_l=img.3...21365.23270.0.23664.7.7.0.0.0.0.289.1120.2-4.4.0....0...1c.1.64.img..3.0.0....0.KVQEY856AaY#imgrc=m1__5DbxL7N8-M:)



Source: <https://www.statista.com/chart/13575/deaths-from-air-pollution-worldwide/>

## OTHER HEALTH OUTCOMES

### • Upper Respiratory Infection, and Otitis Media

Several studies have reported AN association between biofuel smoke exposure and general acute respiratory disorder in kids, principally higher respiratory disorder (URI). The Kenyan cohort study enclosed total ARI also as ALRI as outcome measures, finding AN association for each (15, 16). proof from developing countries concerning tympanum infection (otitis media) - a condition that causes a substantial quantity of morbidity - is restricted as normally studies haven't differentiated otitis from all URI, however there's reason to expect AN association. There's currently sturdy proof that environmental tobacco smoke (ETS) exposure causes tympanum disease: a recent meta-analysis reported AN OR of one.48 (1.08-2.04) for perennial otitis if either parent smoke-cured and 1.38 (1.23-1.55) for middle-ear effusion (31). A clinicbased case-control study of youngsters in rural ny State, reported AN adjusted OR for otitis (two or additional separate episodes) of one.73 (1.03-2.89) for exposure to wood burning stoves (32). the particular exposure to smoke from wood stoves in industrialized country things is way below those found in developing country households burning solid fuels.

### • Asthma

Fewer than ten studies from developing countries examining the association between biomass fuel smoke and respiratory disorder (mainly in children) are revealed (7). Again, outcome definitions haven't been well standardised, exposure has not been measured and contradictory has not been controlled in some studies. Proof up to now is inconsistent in each industrialized and developing countries; but, taken along side studies of environmental tobacco smoke and close pollution, the proof is suggestive that wood smoke pollution could exacerbate and/or trigger respiratory disorder in susceptible folks.

### • Cancer of the Nasopharynx and Larynx

Several studies have found an increased risk of nasopharyngeal and laryngeal cancer, although this is not a consistent finding. The most recent study, from South America, reported an adjusted odds ratio of 2.7 (95% CI: 2.2-3.3), and estimated that exposure to wood smoke accounted for around one third of such cancers in the region (33).

### • Tuberculosis

There are 3 revealed studies so far examining the association with T.B. (two from Republic of India, one from Mexico) (7). AN analysis of information from two hundred,000 Indian adults as a part of the Indian National Family Health Survey (1992-93) found that persons living in households burning biomass rumored T.B. additional oftentimes compared to persons victimization cleaner fuels, with AN adjusted odds quantitative relation of two.58 (95% CI: one.98-3.37) (34). though massive, this study relied on self-reported T.B.. the opposite studies used clinically outlined T.B. and located consistent results. additional analysis is required to totally perceive the character of this relationship. Such AN association, if proven, could also be because of reduced resistance to infection as shown in laboratory experiments with animals exposed to wood smoke.

### • Perinatal Mortality

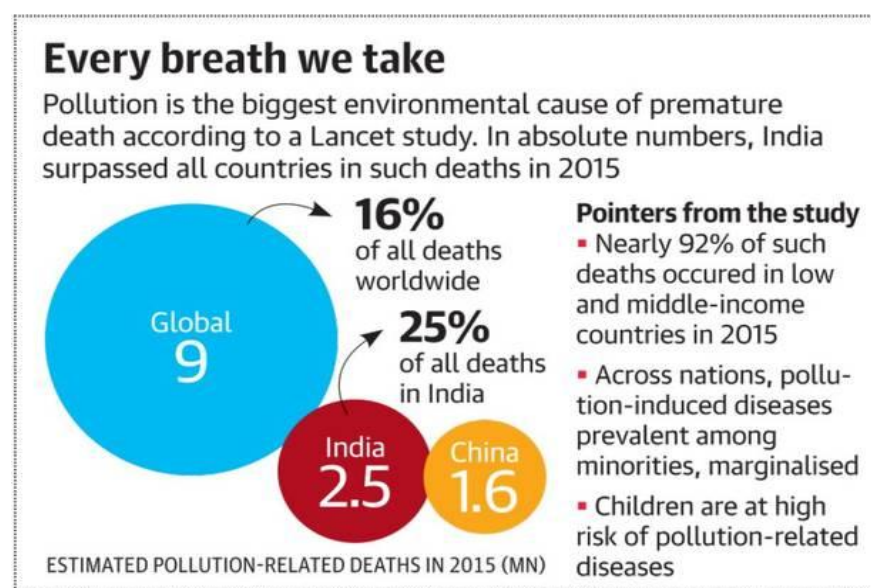
Only one study has been reported from a developing country (35). This found an association between perinatal mortality (still births and deaths in the first week of life) and exposure to indoor air pollution, with an odds ratio of 1.5 (95% CI: 1.0-2.1 p=0.05) adjusted for a wide range of factors, although exposure was not assessed directly. Although this finding is of marginal statistical significance, there is also some supportive evidence from outdoor air pollution studies.

### • Low Birth Weight

Currently only one study of the effects of fuel use on birth weight in a developing country has been published (36). This study, conducted in Guatemala, found that birth weight was 63 grams (95% CI: 0.4-127) lower for babies born in households using wood versus those using cleaner fuels. This estimate was adjusted for confounding but exposure was not assessed directly. This result is, however, consistent with a meta-analysis of the effects of environmental tobacco smoke (36) and several outdoor air pollution studies (7, 37).

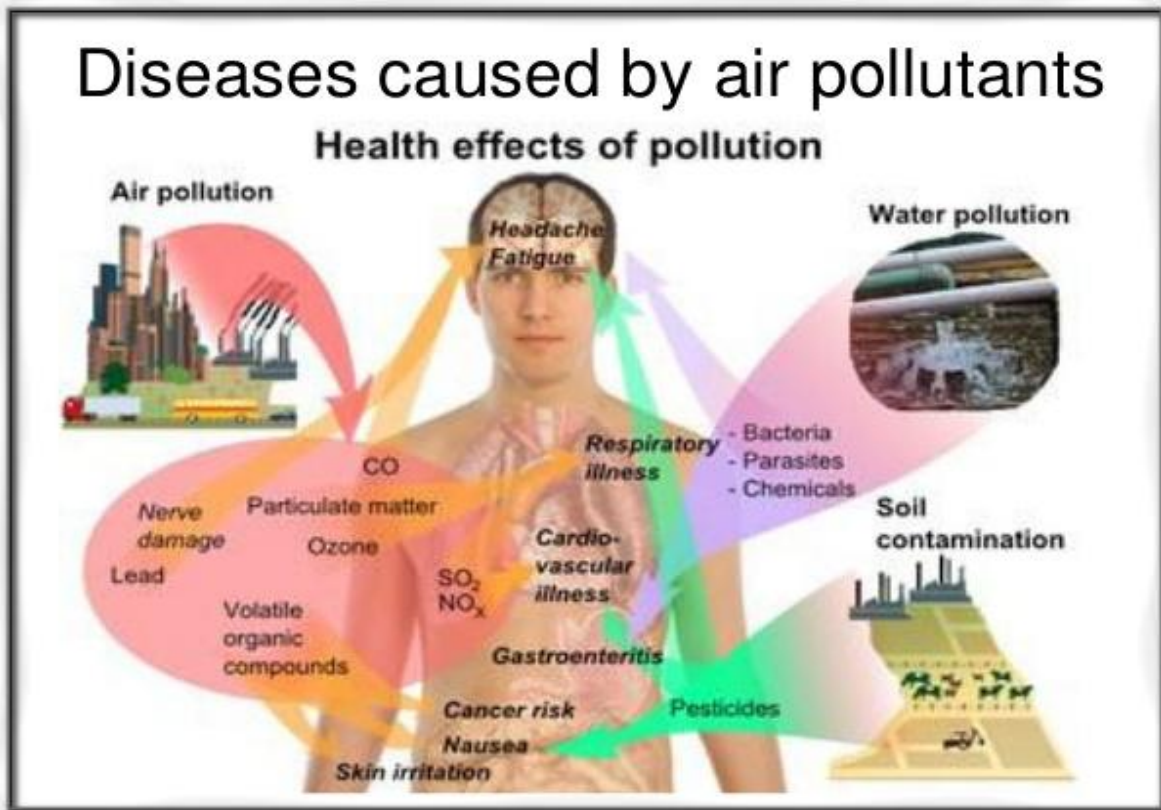
### • Eye Irritation and Cataract

Eye irritation (sore, red eyes and tears) from smoke is widely reported, but there is also preliminary evidence that it may be associated with blindness. A hospital-based case-control study in Delhi comparing liquid petroleum gas (LPG) with biomass fuel use found adjusted odds ratio of 0.62 (95% CI: 0.4-0.98) for cataracts (LPG use had lower risk) (38). Animal studies report that biomass smoke damages the lens and evidence from environmental tobacco smoke is also supportive (7).



SOURCE: THE LANCET COMMISSION ON POLLUTION AND HEALTH





**Source:** [https://www.google.com/search?biw=1242&bih=557&tbm=isch&sa=1&ei=ts-gW4TxFoTivASztbWgBQ&q=disease+caused+by+air+pollution&oq=disease+&gs\\_l=img.1.0.0i67k119j0.492235.505236.0.510235.24.19.2.0.0.0.564.2770.3-5j0j2.7.0....0...1c.1.64.img..15.9.2794.0..0i10k1.0.DPeodrJWGbE#imgrc=WO6FOUtOidoeQM:](https://www.google.com/search?biw=1242&bih=557&tbm=isch&sa=1&ei=ts-gW4TxFoTivASztbWgBQ&q=disease+caused+by+air+pollution&oq=disease+&gs_l=img.1.0.0i67k119j0.492235.505236.0.510235.24.19.2.0.0.0.564.2770.3-5j0j2.7.0....0...1c.1.64.img..15.9.2794.0..0i10k1.0.DPeodrJWGbE#imgrc=WO6FOUtOidoeQM:)

### Control Measures

Studies done so far in India provide us enough evidence that indoor air pollution is a cause of increasing morbidities and mortalities, and there is a need for an urgent intervention. There are social, cultural, and financial factors that influence the decision of people about energy and cooking. (34) Other factors include the availability and flexibility of traditional fuels, the type of dishes prepared, the taste of food, the problems with smoke, the aesthetic appeal of stoves, and users' perception about other alternatives. Following is a list of suggested measures which should be adopted to curb the menace of indoor air pollution:

- **Public awareness:** One of the most important steps in prevention of indoor air pollution is education, viz., spreading awareness among people about the issue and the serious threat it poses to their health and wellbeing. The education should help people in finding different ways of reducing exposures with better kitchen management and protection of children at home. People should also be educated about the use of alternative cleaner sources of energy to replace direct combustion of biomass fuel. The stakeholders must include not only public, but also politicians and administrators to ensure their commitment and increase their awareness about health effects of indoor air pollution.
- **Change in pattern of fuel use:** Fuel use depends on ones' habit, its availability, and most importantly, its affordability. At present, majority of low income families rely solely on direct combustion of biomass fuels for their cooking needs as this is the cheapest and easiest option available to them; however, this could be rectified by promoting the use of cleaner energy sources such as gohar gas which utilizes cow dung to produce gas for cooking.

- **Modification of design of cooking stove:** The stoves should be modified from traditional smoky and leaky cooking stoves to the ones which are fuel efficient, smokeless and have an exit (e.g., chimney) for indoor pollutants. A good example is the one designed by the National Biomass Cookstoves Initiative, of the Ministry of New and Renewable Energy under a Special Project on Cookstove during 2009-2010, with the primary aim of enhancing the availability of clean and efficient energy for the energy deficient and poorer sections of the country.(35)
- **Improvement in ventilation:** During construction of a house, importance should be given to adequate ventilation; for poorly ventilated houses, measures such as a window above the cooking stove and cross ventilation through doors should be instituted.
- **Intersectoral coordination and global initiative:** Indoor air pollution can only be controlled with coordinated and committed efforts between different sectors concerned with health, energy, environment, housing, and rural development. Tackling indoor air pollution and providing universal access to clean household energy is a great opportunity to improve health, reduce poverty, and protect our environment; thus, contributing significantly to achieving the Millennium Development Goals (MDGs) which are listed below:
  - Improved household energy practices will provide opportunities for income generation-MDG 1 (eradicate extreme poverty and hunger).
  - With less time spent on fuel collection and lost due to ill health, children will have more time for school attendance and homework-MDG 2 (achieve universal primary education).
  - Freeing women's time for income generation will help in eradicating poverty and hunger (MDG 1) and achieving gender equality (MDG 3).
  - **Better respiratory health:** MDG 4 (reduce child mortality), MDG 5 (improve maternal health), and MDG 6 (combat HIV/AIDS, malaria and other diseases like tuberculosis).
  - Use of clean household energy will ensure environmental sustainability; the World Health Organization is the agency responsible for reporting the "proportion of the population using solid fuels" as an indicator for reporting progress towards MDG 7 to ensure environmental sustainability (MDG 7).
  - An intersectoral approach for use of clean household energy practices will lead to economic and social development-MDG 8 (develop a global partnership for development). Conclusion Though evidence exists for increase in indoor air pollution in India, and its association with both increased morbidity and mortality, there is still a need of further studies to assess the exposure levels of indoor pollutants and to further strengthen the evidence for their association with outcomes like tuberculosis, cataract, asthma, cardiovascular health, and cancers. At the same time, effective interventions, starting from education, change in fuel patterns; proper designing of stoves and houses, to a committed and determined intersectoral coordination towards promotion of public health is the need of the hour.

## CONCLUSION

Indoor pollution (IAP) could have probably massive impacts on the health and well-being of poor families. The literature indicates close IAP levels and private exposure levels from cookery with ancient fuels square measure dramatically high. though the literature is growing, there's presently a deficit of knowledge on the impacts of IAP on health, and even less on the impacts on the economic well-being of the family, with abundant of the evidence—except from the RESPIRE study—resulting from data-based studies. within the data-based studies, we tend to cannot rule out the chance that discovered metabolism sicknesses don't seem to be thanks to alternative factors that conjointly contribute to a households' call to use a standard stove, as

well as economic condition and health preferences. Thus, our understanding of the causative impact of IAP is weak.

However, the proof from the RESPIRE study and randomised evaluations of iron supplements (that conjointly have an effect on metabolism health) suggests that the gains from reducing pollution among the home will, in fact, be quite massive. First, the reduction of pollution among the home has the potential to possess an on the spot impact on respiratory—and even general—health. Second, if home tend be in higher health thanks to the stoves, they will save abundant in medical expenditures that tends to be an oversized portion of expenditures among the terribly poor. Third, if home members square measure in higher health, there's a possible for the home to be additional productive, with home adults missing fewer days of labor and kids missing fewer days of college. Much work, therefore, is required to higher perceive the welfare effects of reducing IAP among households and to higher perceive the foremost price effective thanks to scale back it.

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