Exploring the impact of air pollution on chronic respiratory diseases using Global Burden of Disease data

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Contents

Abstract

Background: Air pollution is a leading environmental determinant of morbidity and mortality worldwide and remains a major risk factor in the causation of chronic respiratory diseases (CRDs), including chronic pulmonary obstructive disease (COPD) and asthma. While substantial evidence links air pollutants to impaired respiratory health, global disparities persist across regions, socioeconomic and health system settings, and population groups. Comprehensive assessments integrating long-term temporal and spatial patterns are essential to guide policy and interventions aimed at reducing exposure and improving respiratory health outcomes.

Objectives: To review and synthesize global evidence on the associations between air pollution and CRDs using data from the Global Burden of Disease (GBD) 1990–2021 dataset, examining differences across types of air pollution, Socio-Demographic Index (SDI) categories, health system typologies, world regions, sex, and age groups, and to evaluate temporal trends over the past three decades.

Methods: An exploratory data analysis (EDA) of GBD-derived estimates and supporting epidemiological literature was conducted. Disability-adjusted life years (DALYs), years lived with disability (YLDs), years of live lost (YLLs) and deaths of CRDs attributable to major air pollution exposures (particulate matter, nitrogen dioxide and ambient ozone pollution) were extracted and analyzed. Comparative analyses explored variations by disease, gender, age, countries, SDI, and health system characteristics. Temporal trends from 1990 to 2021 were evaluated to identify global progress and persistent inequalities.

Results: Globally, CRDs attributable to air pollution account for 22.1% of all deaths and 29.4% of YLDs linked to this risk factor, with COPD contributing the largest share of the burden. Particulate matter pollution represents the leading contributor to the burden of air pollution–related CRDs, with a marked increase in ambient particulate pollution and a decline in household air pollution since 1990. Countries with low- and middle-Sociodemographic Index (SDI) experience the highest impact in terms of deaths and disability-adjusted life years (DALYs), while low-SDI countries remain disproportionately affected by household air pollution and YLDs. Interestingly, nations with minimal health system development do not exhibit the worst reported outcomes for CRDs attributable to air pollution, which likely reflects underdiagnosis and underreporting rather than true lower disease burden. Sex- and age-specific analyses demonstrated higher vulnerability among males and older adults, consistent with biological susceptibility and exposure patterns.

Conclusions: Substantial global reductions in air pollution–related CRD burden have been achieved since 1990; however, these gains are unevenly distributed. Persistent disparities by region, sociodemographic status, and pollution type highlight the need for integrated interventions combining environmental regulation, public health policies, and health system strengthening. The GBD framework provides a valuable platform for monitoring and addressing inequities in respiratory health outcomes associated with air pollution.

Keywords: Air pollution; Chronic respiratory diseases; Global Burden of Disease; Environmental epidemiology; Health disparities; Temporal trends.

1 Introduction

Air pollution is one of the leading environmental risk factors for public health worldwide. It can be broadly categorized into ambient (outdoor) air pollution, which originates from sources such as traffic emissions, industrial activities, forest fires, and energy production, and household (indoor) air pollution, which is prevalent in rural areas of low-income countries due to the burning of solid fuels like wood, dung, and crop residues for cooking and heating (Dhimal et al., 2021). Both forms of air pollution are strongly associated with chronic respiratory diseases (CRDs), including chronic obstructive pulmonary disease (COPD) and asthma, as well as other serious health conditions such as lower respiratory infections, cardiovascular diseases, diabetes, and adverse birth outcomes. It is estimated that around 3.6 billion people are exposed to household air pollution, highlighting the global scale of the issue (Dhimal et al., 2021). This study aims to analyze the impact of air pollution on CRDs using data from the Global Burden of Disease (GBD) project. Through exploratory data analysis (EDA), we identify patterns, trends, and disparities across countries, age groups, and genders. The goal is to deepen our understanding of how air pollution affects respiratory health and to support the development of more effective public health interventions.

2 Methodology

This study employs an exploratory data analysis (EDA) approach to investigate the global burden of CRDs attributable to air pollution. Data were sourced from the GBD 2021 dataset, accessed via the GBD Results Tool. The dataset includes metrics such as deaths, DALYs (Disability-Adjusted Life Years), YLLs (Years of Life Lost), and YLDs (Years Lived with Disability), stratified by age, sex, location, health system type, and socio-demographic index (SDI). A comprehensive list of these variables is presented in *Table 1.* DALYs represent the total burden of disease and are calculated as the sum of YLLs and YLDs. YLLs quantify premature mortality by multiplying the number of deaths at each age by the standard life expectancy at that age. YLDs measure the non-fatal burden of disease and are derived by combining disease prevalence or incidence with disability weights, which reflect the severity of health loss and are estimated using population surveys and expert consensus. SDI is a composite indicator of development, constructed as the geometric mean of scaled values for income per capita, average educational attainment in the population aged 15 years and older, and total fertility rate under age 25. It ranges from 0 (least developed) to 1 (most developed), and is used to stratify countries into five development categories. The analysis focused on key risk factors including ambient particulate matter pollution, household air pollution from solid fuels, ambient ozone pollution, and nitrogen dioxide pollution. Data preparation involved selecting relevant variables and ensuring consistent formatting across datasets. All analyses were conducted using the R programming language, employing a suite of packages to support data manipulation, visualization, and geospatial mapping. Specifically, the tidyverse package was used for data wrangling and plotting; scales for formatting axis labels and percentages; rnaturalearth and rnaturalearthdata for retrieving country-level spatial data; sf for handling spatial features; countrycode for harmonizing country names to ISO3 codes; viridis for perceptually uniform color palettes; patchwork for combining multiple plots; and purrr for functional programming operations. Uncertainty intervals for GBD estimates are derived using a Bayesian statistical framework. For each metric, the GBD methodology generates 1,000 posterior draws based on input data and model assumptions. The 95% uncertainty interval is then defined by the 2.5th and 97.5th percentiles of the resulting distribution, capturing both sampling and model-based uncertainty. This analytical framework enabled the exploration of temporal trends, geographical distribution, and disparities across SDI classes, health system types, sex, and age groups, providing a comprehensive view of the impact of air pollution on CRDs.

3 Results

3.1 Impact of chronic respiratory diseases

From an estimated 8 million deaths globally attributable to air pollution, CRD accounted for 22.1% of all deaths, highlighting their substantial contribution to the global mortality burden. When examining morbidity (**Figure 1**), the YLDs from CRDs represent 29.4% of all air pollution–related YLDs, emphasizing that CRDs impose a disproportionately large burden on quality of life. Within CRDs, COPD accounts for 97% of YLDs, illustrating that COPD is the primary driver of chronic respiratory health losses attributable to air pollution.

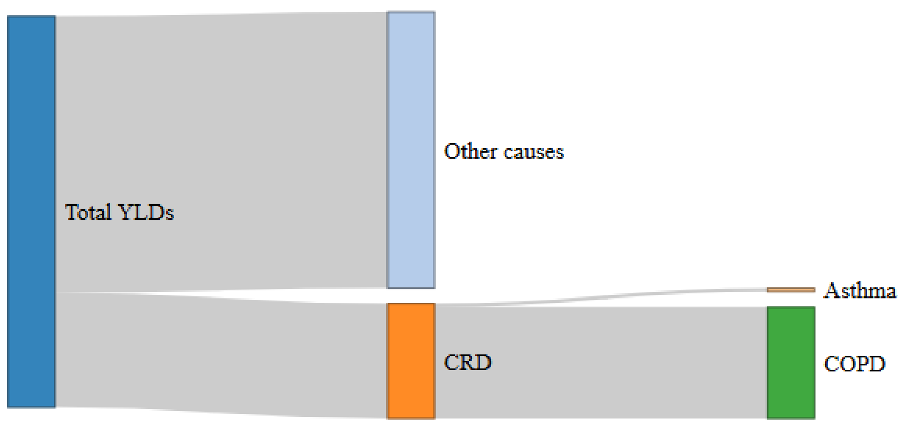

Figure 1: Burden of air pollution on chronic respiratory diseases in 2021. YLDs - years lived with disability, COPD - chronic pulmonary obstructive disease, CRD - chronic respiratory diseases.

3.2 Impact of different types of polluents

Air pollution–related CRD burden varies markedly by pollutant type. As shown in **figure 2** ambient particulate matter (224 DALYs per 100,000) and household air pollution (197 DALYs per 100,000) contribute the largest share of disease burden, whereas ozone (111 DALYs per 100,000) and nitrogen dioxide (2 DALYs per 100,000) contribute substantially less. The predominance of particulate matter aligns with its established pathogenic role in airway inflammation, impaired lung function, and exacerbation of chronic respiratory conditions. The substantial burden from household air pollution reflects ongoing exposure in low-income settings where solid fuels are widely used, emphasizing disparities in environmental health risks.

3.3 Impact on different socio-demographic index

3.3.1 Percentage of household air pollution contribution on particulate matter pollution

Figure 3 depicting deaths, DALYs, YLDs, and YLLs attributed to household air pollution as a proportion of all particulate matter–related outcomes reveal striking socioeconomic disparities. In low SDI countries, household air pollution accounts for approximately 80% of particulate matter–related CRD burden, whereas in high SDI countries, this proportion approaches zero. This gradient reflects differences in fuel use, housing conditions, and energy access, highlighting that interventions to reduce indoor air pollution remain critical in low- and low-middle SDI regions, whereas ambient sources dominate in more developed settings.

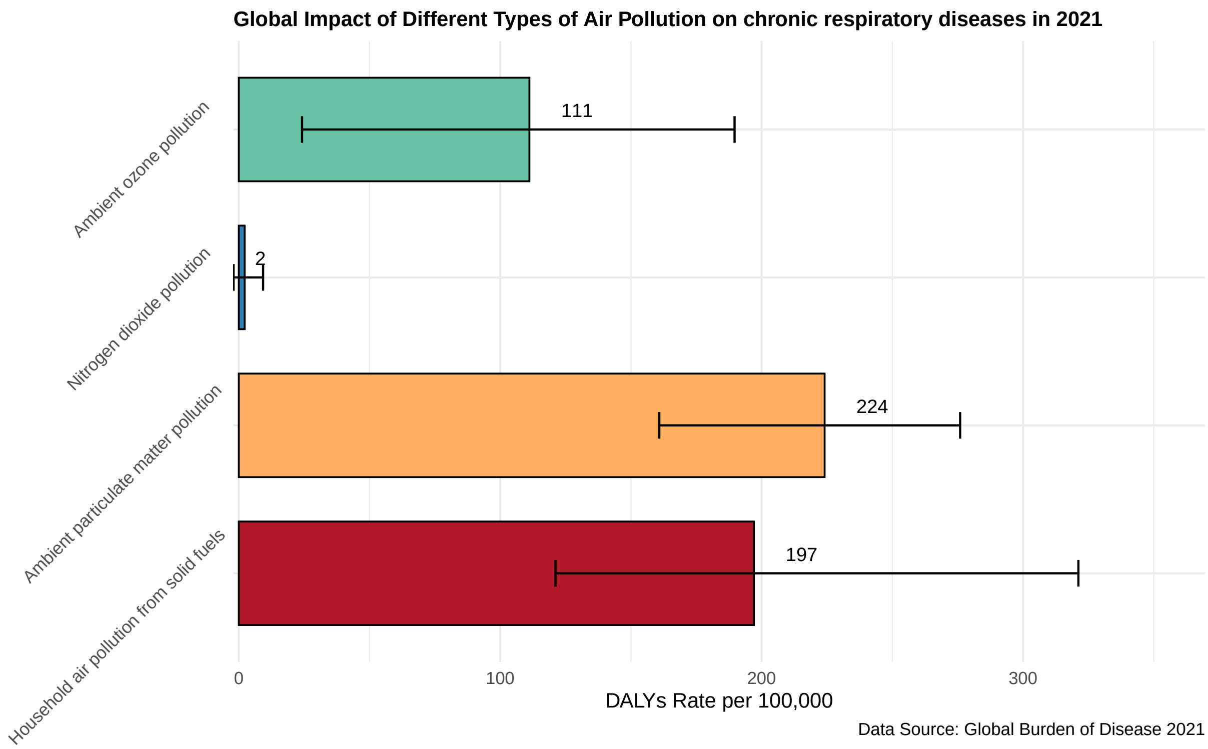

Figure 2: Global impact of different types of air pollution on chronic respiratory diseases in 2021. DALYs - Disability-adjusted life years.

3.3.2 Impact of particulate matter pollution by socio-demographic index classes in 2021

When considering the absolute burden of CRDs attributable to air pollution by SDI (**Figure 4**), a clear gradient emerges. For deaths, DALYs, and YLLs, the ranking from highest to lowest burden is low-middle SDI, low SDI, middle SDI, high-middle SDI, and high SDI, reflecting the combined effects of environmental exposures. In low-middle SDI countries, the burden may be amplified by a synergistic impact of persistently high household air pollution and rising ambient pollution from industrial and urban sources in contexts with relatively weak environmental regulation. Notably, for YLDs, there is a proportional increase with SDI, likely reflecting early-life exposure to household air pollution combined with longer life expectancy in low-SDI countries, which increases the duration of living with chronic respiratory disability.

3.4 Disability-adjusted life years attributable to household versus ambient particulate air pollution worldwide from 1990 to 2021

Analysis the rate of DALYs from household and ambient particulate pollution between 1990 and 2021 (**Figure 5**) reveals divergent temporal trends. DALYs attributable to household air pollution have steadily decreased, reflecting global transitions away from solid fuel use and improvements in household energy access. Conversely, DALYs attributable to ambient particulate matter have increased, driven by industrialization, urbanization, and traffic-related emissions in many regions. These opposing trends highlight the evolving nature of environmental risk and the need for policy interventions that target both indoor and outdoor air quality simultaneously.

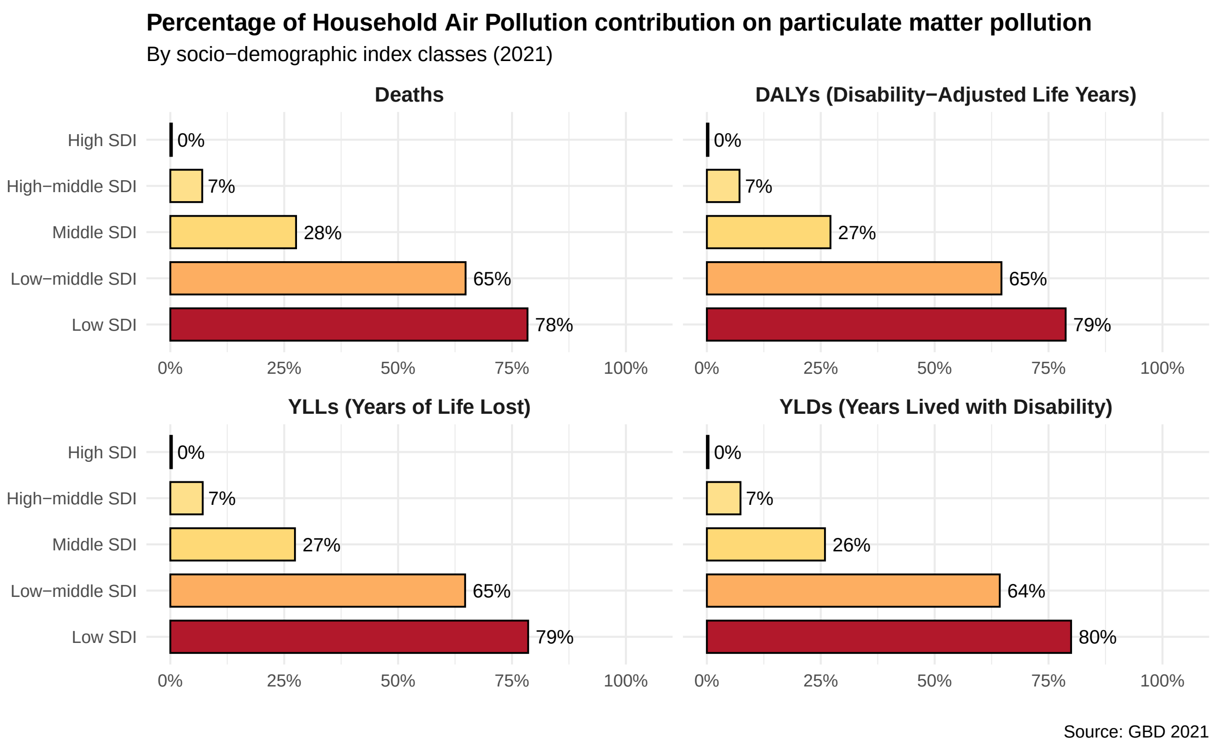

Figure 3: Health metrics showing the proportion of household air pollution relative to total particulate matter pollution attributable to chronic respiratory diseases, stratified by socio-demographic index (SDI) classes in 2021.

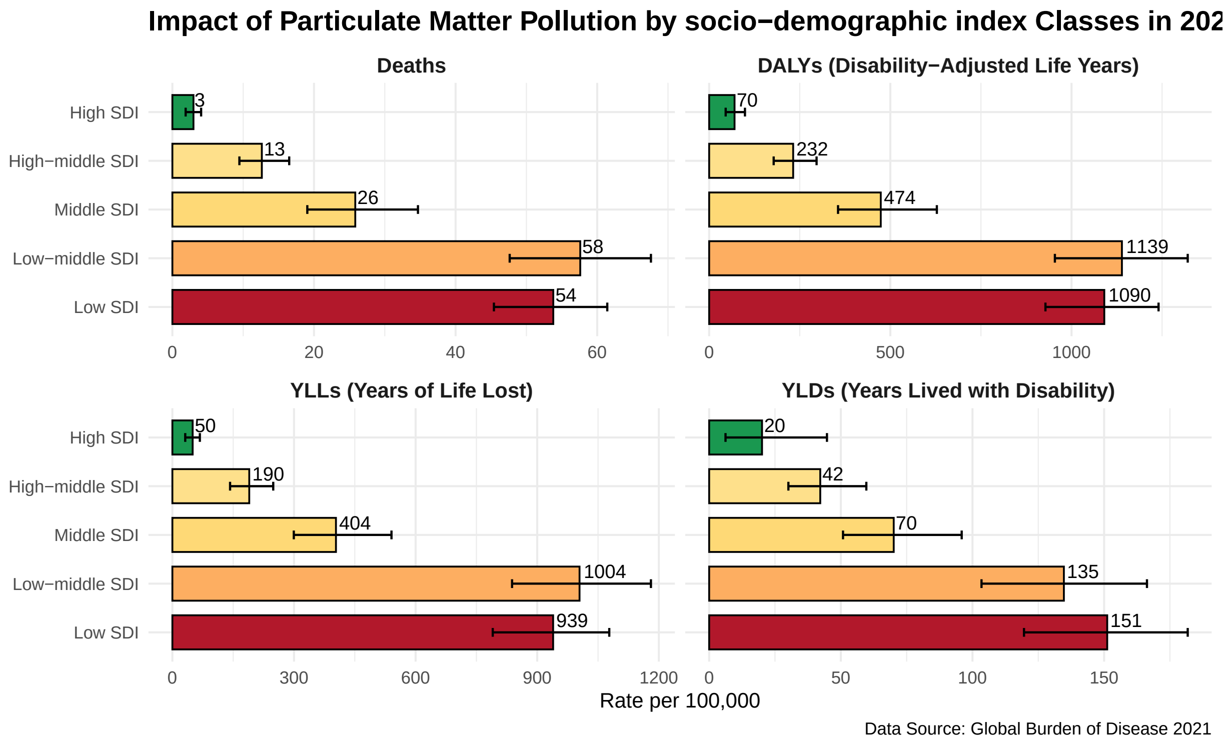

Figure 4: Health metrics showing the impact of particulate matter pollution attributable to chronic respiratory diseases, stratified by socio-demographic index classes in 2021.

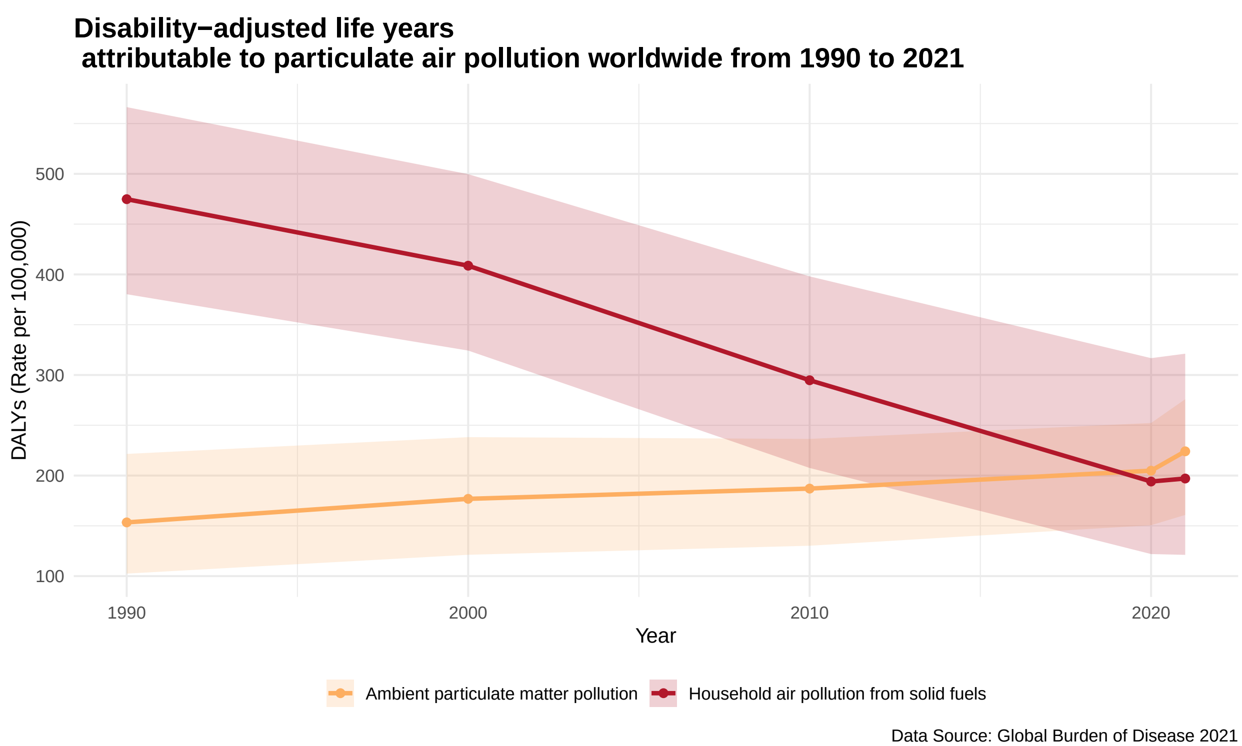

Figure 5: Temporal trend of disability-adjusted life years caused by chronic respiratory diseases attributable to household air pollution and ambient particulate matter pollution from 1990 to 2021.

3.5 Global health impact of air pollution on chronic respiratory diseases from 1990 to 2021

Between 1990 and 2021, global mortality rates from CRDs attributable to air pollution showed marked geographical variation and a overall decline over time (**Figure 6**). In 1990, the highest mortality rates were concentrated in East and South Asia, particularly in China and India, as well as parts of Sub-Saharan Africa and northern Oceania. By 2021, although these regions remained among the most affected, the intensity of mortality had visibly decreased, as shown by the lighter colour gradients on the map.

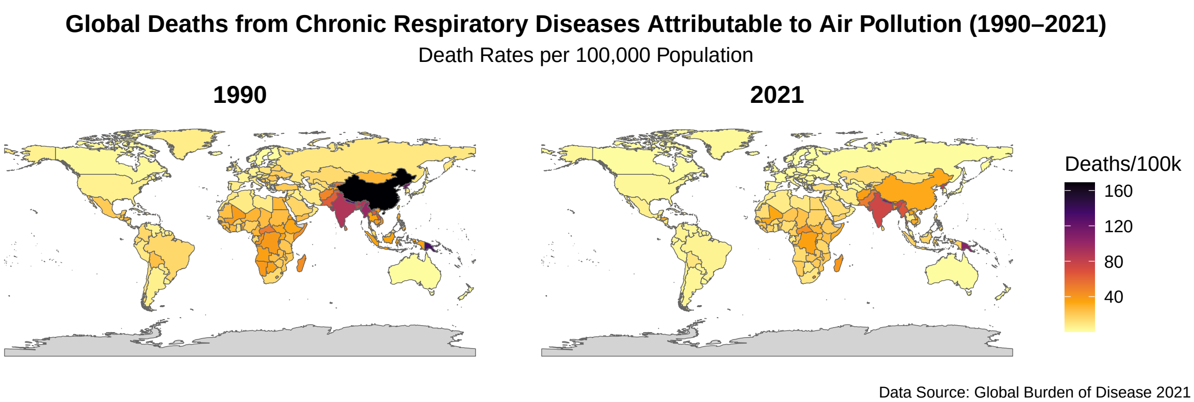

Figure 6: Global age-standardized death rates per 100,000 population from chronic respiratory diseases attributable to air pollution, 1990 versus 2021.

Figure 7 further highlights these temporal changes at the country level. In 1990, China recorded one of the world's highest mortality rate (over 160 deaths per 100,000 population), followed by several South Asian and Oceanian countries, including India, Papua New Guinea, and Nepal. By 2021, China had achieved a remarkable decline, dropping below 40 deaths per 100 000 and no longer appearing among the top 10 most affected nations. In contrast, Nepal emerged as the country with the highest mortality rate in 2021, followed by Papua New Guinea, India, Bangladesh, and Myanmar, confirming that South and East Asia remain the global hotspots for CRDs related to air pollution.

Countries with the lowest mortality rates (under 2 deaths per 100 000) in both years were predominantly high-income nations such as Finland, Sweden, New Zealand, and Australia, together with several Caribbean and Pacific island states.

At the regional level (**Figure 8**), Oceania, South Asia, and Sub-Saharan Africa show the highest burden across all measures (deaths, DALYs, YLLs, and YLDs), while North America, Western Europe, and Australasia consistently display the lowest rates.

Overall, the data indicate a global reduction in CRD mortality attributable to air pollution between 1990 and 2021, accompanied by persistent disparities across regions.

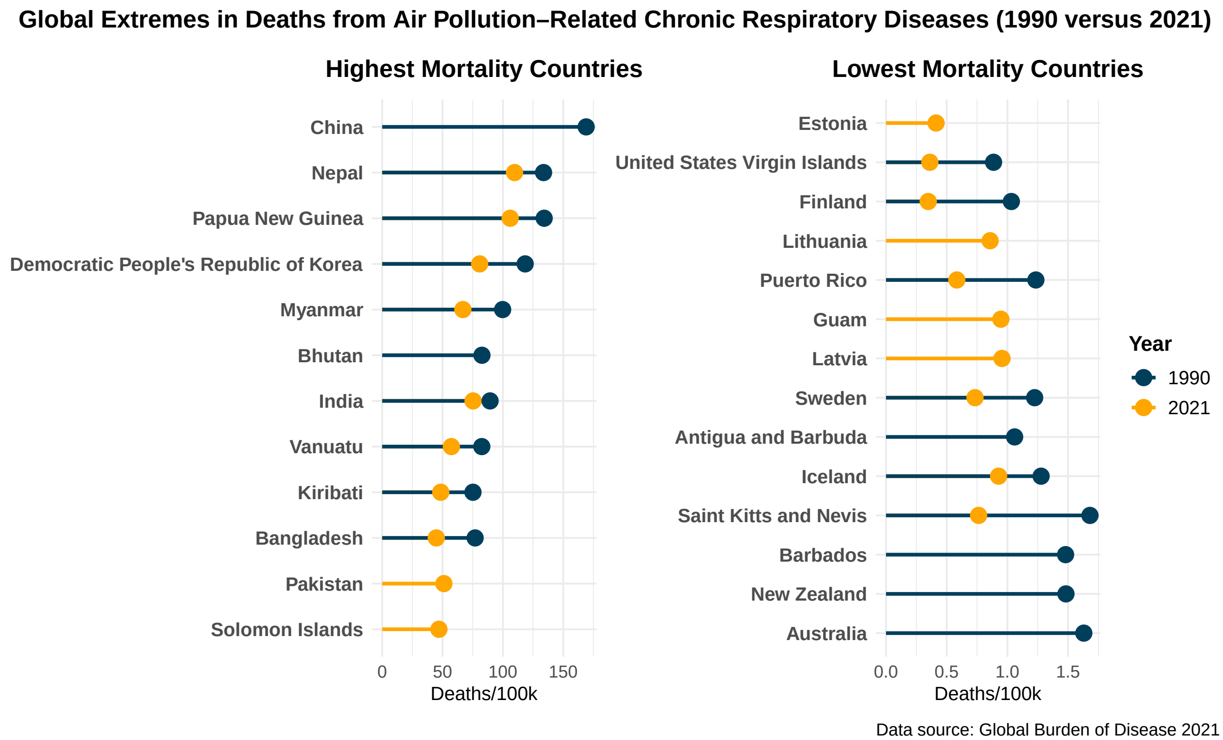

Figure 7: The top ten countries with the highest and lowest age-standardized death rates per 100,000 population from air pollution–related chronic respiratory diseases, 1990 versus 2021 .

3.6 Impact of air pollution on chronic respiratory disease by health system type in 2021

As shown in **figure 9**, the burden of CRDs caused by air pollution varies depending on the strength of a country's health system. As expected, countries with strong, advanced health systems (in green) show the lowest bruden rates. However, the pattern across weaker systems is not linear. Surprisingly, countries with basic health systems report higher rates than those with limited or even minimal systems.Additionally, most of the burden originated from premature deaths (YLLs) rather than long-term disability (YLDs), as it is perceptal trought the higher values in YLLs.

3.7 Temporal trends attributable to air pollution on chronical respiratory diseases between 1990 and 2021

Figure 10 presents the global evolution of deaths and disease burden from chronic respiratory diseases attributable to air pollution over the past three decades. Overall, the data shows a declining trend in both mortality and disability burden, although the reduction is not uniform across all measures.

The number of deaths per 100,000 population decreased from approximately 30 in 1990 to around 25 in recent years, with a slight increase observed toward the end of the period due to the atipic year of the covid pandemic. A more pronounced decline is seen in DALYs, which dropped from about 700 per 100,000 in 1990 to roughly 500 per 100,000 by 2021. The decrease is largely driven by a reduction in YLLs, which fell from around 700 to below 400 per 100,000, indicating fewer premature deaths over time. In contrast, YLDs remained relatively stable throughout the period, with minor fluctuations and a slight increase in recent years.

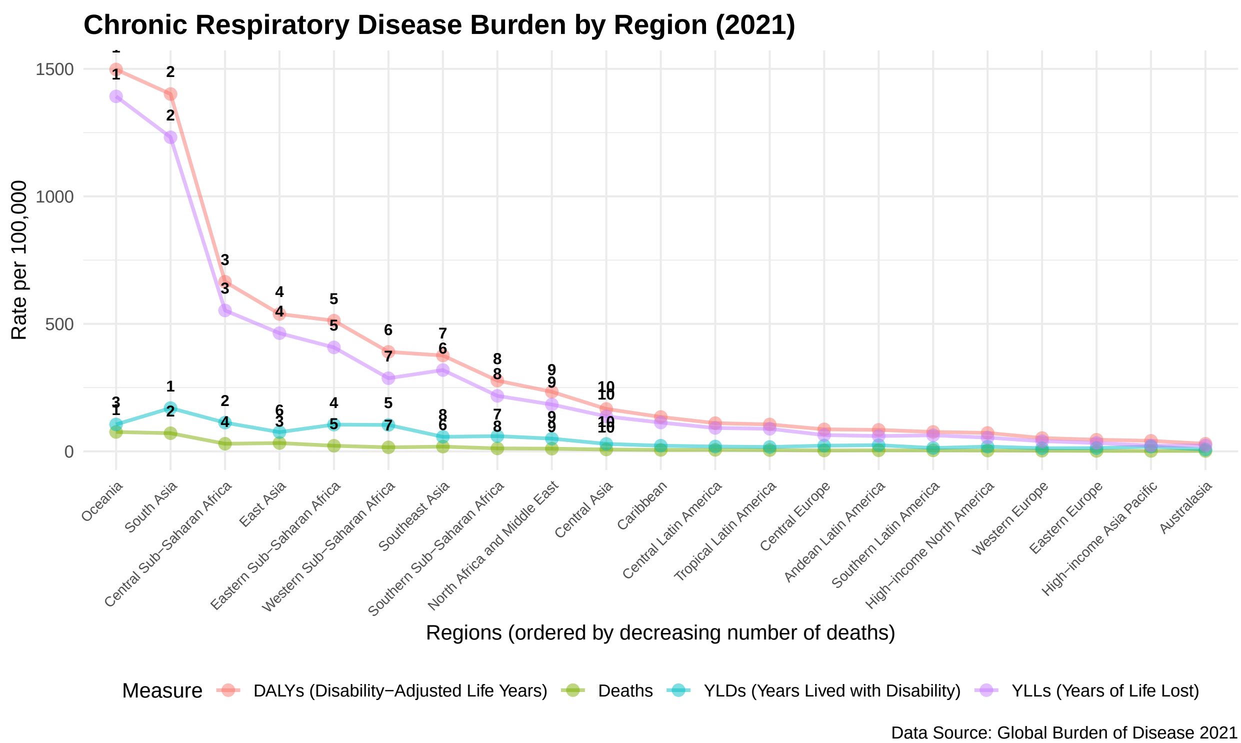

Figure 8: Regional variation in chronic respiratory disease burden attributable to air pollution in 2021. Measures are age-standardized rates per 100,000 population for deaths, disability-adjusted life years (DALYs), years of life lost (YLLs), and years lived with disability (YLDs)

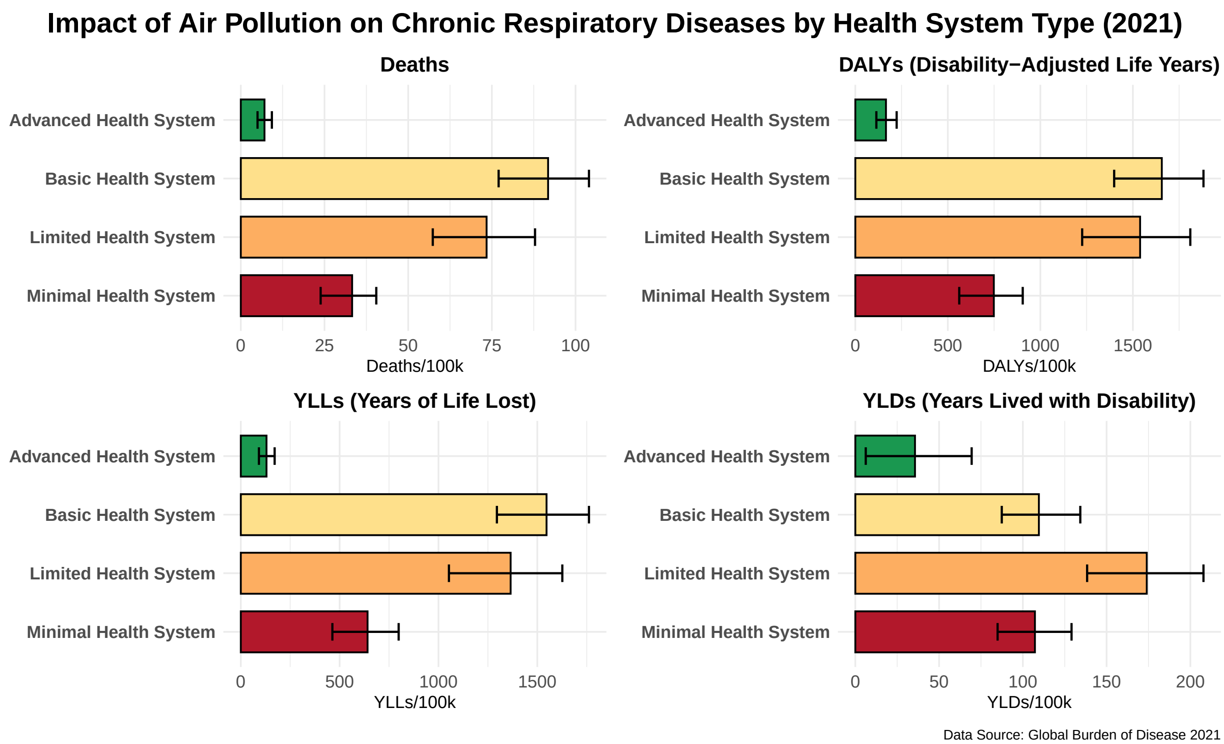

Figure 9: Impact of air pollution on chronic respiratory diseases by health system type in 2021. Each panel shows age-standardized rates per 100,000 population for deaths, disability-adjusted life years (DALYs), years of life lost (YLLs), and years lived with disability (YLDs), grouped by advanced, basic, limited, and minimal health system types

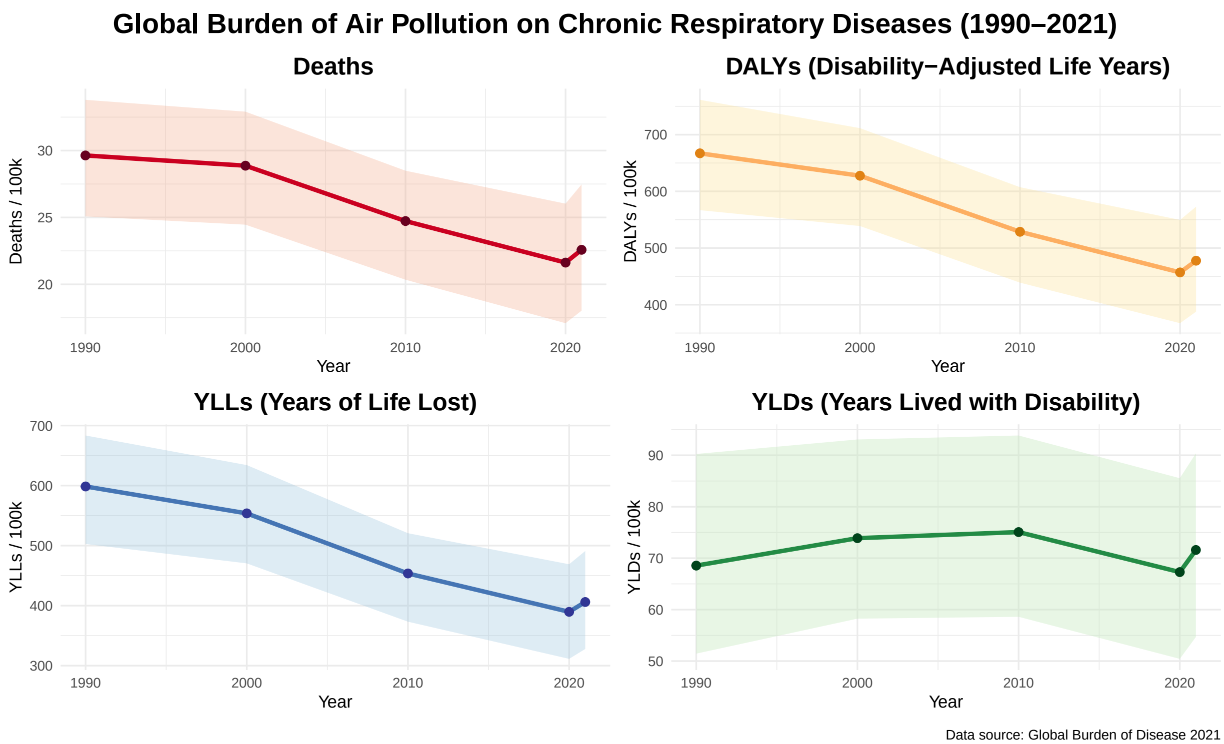

Figure 10: Global burden of air Pollution on chronic respiratory diseases over time. Each graph shows age-standardized rates per 100,000 population for deaths, disability-adjusted life years (DALYs), years of life lost (YLLs), and years lived with disability (YLDs) from 1990 to 2021.

3.8 Age- and sex-specific mortality associated with air pollution

Figure 11 illustrates the relationship between age, gender and mortality from CRDs attributable to air pollution. The data reveal a clear upward trend, with the number of deaths increasing progressively across older age groups. This pattern highlights the cumulative vulnerability of the respiratory system over time, particularly under prolonged exposure to polluted air. When stratified by gender, the plot shows that men consistently exhibit higher mortality rates than women in all age groups, except among individuals aged 95 years and older, where the difference slightly reverses.

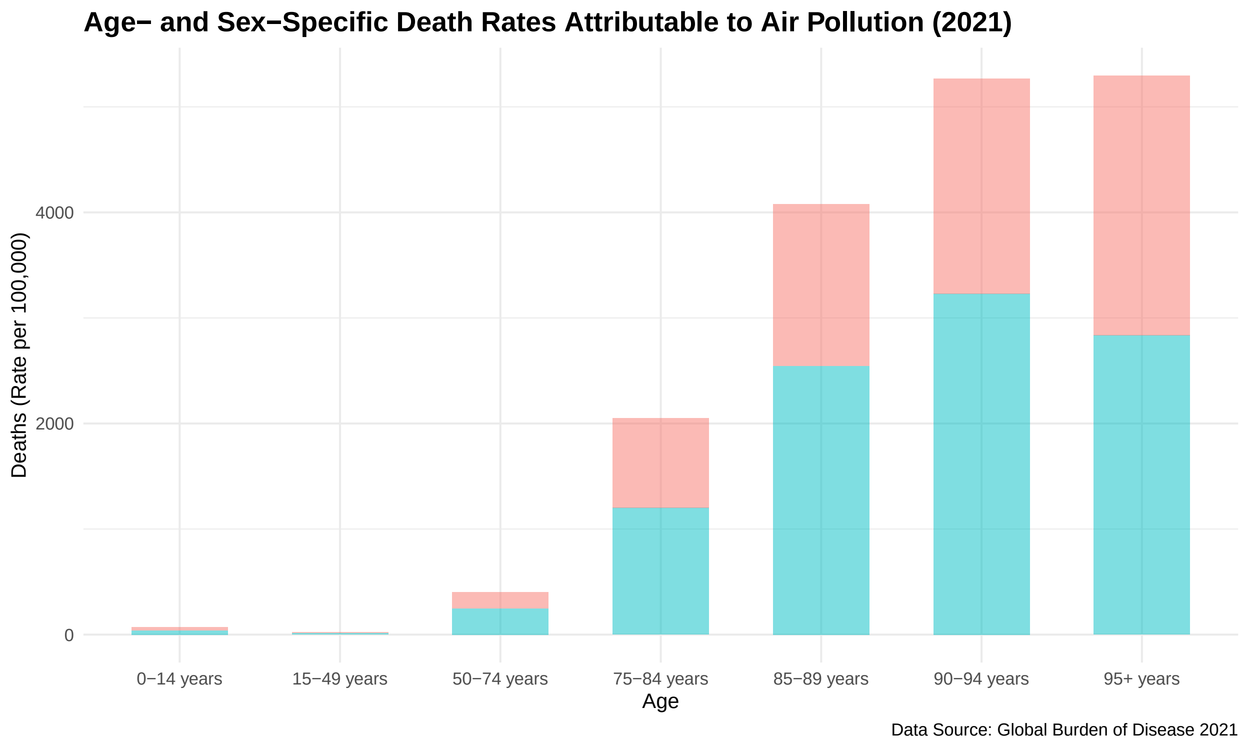

Figure 11: Age- and sex-specific death rates from chronic respiratory diseases attributable to air pollution. The graph shows age-standardized rates per 100,000 population for deaths in 2021.

4 Discussion

Our findings align closely with the study by Dhimal et al. (2021), which emphasized the extensive impact of both ambient and household air pollution on global health metrics, particularly mortality and DALYs from 1990 to 2019. Similar to our analysis, Dhimal et al. (2021) reported how ambient and household pollution disproportionately affect vulnerable groups, such as infants, the elderly, women, and those with pre-existing cardiorespiratory conditions—while also highlighting regional disparities by SDI levels (Dhimal et al., 2021). Our study corroborates these findings, revealing comparable geographical and demographic patterns, and reinforcing the need for targeted environmental health strategies in low-SDI regions.

Ostro et al.'s (2018) assessment of the GBD methodology for estimating the burden of ambient air pollution in low- and middle-income countries brings out critical methodological complexities (Ostro et al., 2018). They argue that changes in exposure modelling, such as refining $PM_{2.5}$ concentration estimates and adjusting exposure–response curves, significantly alter burden estimates across different geographical contexts. Our research employs analogous methodological enhancements, using updated exposure-response functions and stratifying by pollutant type, and yields remarkably consistent estimates of CRD burden, particularly in nations with inadequate monitoring infrastructure. This parallel strengthens confidence in our approach and supports the WHO's revised burden metrics. Finally, the recent Lancet study by Bennitt et al. (2025) provides a comprehensive evaluation of household air pollution (HAP) trends and burdens from 1990 to 2021, reporting that in 2021 approximately 2.67 billion people (33.8% of the global population) were exposed to HAP at mean $PM_{2.5}$ concentrations of 84.2 µg/m³. They also estimate 111 million attributable DALYs, constituting 3.9% of the global DALY total (Bennitt et al., 2025).

Beyond confirming these global patterns, our results reveal persistent geographical inequalities in the burden of air pollution-related CRDs. Regions such as South Asia, Oceania, and Sub-Saharan Africa continue to exhibit disproportionately high rates of deaths and DALYs, whereas North America, Western Europe, and Australasia display much lower rates. These differences are strongly influenced by economic development, health-system capacity, and the degree of environmental regulation. Countries with advanced health systems show the lowest mortality rates, reflecting better healthcare access and pollution control. In contrast, in low-income countries, weak infrastructure and limited monitoring contribute to both higher actual burdens and underreported disease rates.

Interestingly, nations with basic health systems reported higher rates than those with limited or minimal systems. This apparent anomaly likely reflects better diagnostic capacity and disease reporting rather than a true increase in disease burden. It illustrates that improved surveillance may temporarily inflate recorded rates while actually signalling advances in health-system performance.

The temporal analysis indicates a global improvement in air-pollution-related CRD mortality since 1990, driven largely by a decline in premature deaths (YLLs). However, YLDs have remained relatively stable, suggesting that while fewer people are dying prematurely, the chronic health consequences of air pollution persist. The striking progress observed in countries like China, where mortality rates fell from more than 160 to under 40 deaths per 100 000, demonstrates the effectiveness of large-scale pollution-control measures. Yet, slower progress in South Asia and parts of Africa underscores widening disparities between regions.

Our analysis also highlights important age- and gender-specific patterns in CRD mortality attributable to air pollution. There is a clear age gradient, with mortality rates increasing substantially among older age groups. This trend underscores the cumulative impact of long-term exposure to air pollutants on respiratory health, particularly in aging populations. Furthermore, the data reveal consistent sex-based disparities: males exhibit higher mortality rates than females across all age groups, except among individuals aged 95 years and older, where the trend slightly reverses. These findings suggest that biological susceptibility, occupational exposures, and behavioral factors may contribute to the observed differences, emphasizing the need for gender-sensitive public health strategies and targeted interventions for older adults.

Overall, our findings demonstrate that despite notable progress in reducing mortality, air pollution remains a major global health challenge. Sustained reductions in exposure require multi-sectoral interventions combining clean energy transitions, improved urban air quality management, and strengthened healthcare systems. Priority should be given to vulnerable populations in low- and middle-income countries, where the dual burden of pollution and limited healthcare capacity continues to drive inequality in respiratory health outcomes.

5 Limitations

While this study provides valuable insights into the global impact of air pollution on chronic respiratory diseases, several limitations must be acknowledged. First, the GBD dataset relies on modeled estimates, which may be affected by data availability and quality across countries, particularly in low-income regions. Second, the attribution of disease burden to specific pollutants is complex and may involve overlapping exposures, making it difficult to isolate the effects of individual pollutants. Additionally, the analysis does not account for potential confounding factors such as smoking, occupational exposures, or socioeconomic determinants that may influence respiratory health. The use of aggregated data also limits the ability to explore individual-level risk factors or causal relationships. Finally, while the study spans multiple years, changes in data collection methods or definitions over time may affect comparability. Future research should aim to integrate more granular data and consider longitudinal designs to better understand the dynamics of air pollution and respiratory disease burden.

6 Conclusions

In 2021, CRDs accounted for approximately 22.1% of all deaths and 29.4% of all YLDs attributable to air pollution. Ambient particulate matter emerged as the leading contributor to the global CRD burden, followed by household air pollution, whose impact is inversely related to the SDI level. The burden of air pollution on CRDs is most pronounced in low-middle SDI countries, with the exception of YLDs, followed by low SDI regions. While the impact of ambient pollution is increasing over time, the influence of household air pollution is gradually declining. Geographically, the highest death rates due to air pollution were observed in Oceania, South Asia, and Sub-Saharan Africa, whereas the lowest rates occurred in North America, Europe, and Australasia. Health system capacity also plays a critical role: countries with limited or minimal health systems experience a significantly higher burden of CRD due to air pollution. Although progress has been made in reducing mortality, the chronic health impact remains substantial, with a noticeable shift from mortality to long-term disability and illness. Finally, the mortality rate from air pollution-related CRDs is directly proportional to age and consistently higher in men than in women, underscoring the need for targeted interventions and gender-sensitive public health strategies

7 References

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Ostro, B., Spadaro, J. V., Gumy, S., Mudu, P., Awe, Y., Forastiere, F., & Peters, A. (2018). Assessing the recent estimates of the global burden of disease for ambient air pollution: Methodological changes and implications for low- and middle-income countries. *Environmental Research*, *166*, 713–725. https://doi.org/10.1016/j.envres.2018.03.001

8 Annexes

8.1 Search link and generated file

1990 + Global + SDI + Health System
https://vizhub.healthdata.org/gbd-results?params=gbd-api-2021-permalink/4ea5715918446e5a6d9b154d62e0cc4a
IHME-GBD_2021_DATA-4835a3dc-1.csv
2000 + Global + SDI + Health System
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2010 + Global + SDI + Health System
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2020 + Global + SDI + Health System
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2021 + Global + SDI + Health System
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1990 + All countries + Age (all + standardized) + Sex (Both)
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2000 + All countries + Age (all + standardized) + Sex (Both)
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2010 + All countries + Age (all + standardized) + Sex (Both)
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2020 + All countries + Age (all + standardized) + Sex (Both)
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(1990,2000,2010,2020,2021) + GBD countries except costume + Age standardized + Sex (Both)
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Table 1: List of variables

Variable	Values
measure	Deaths, DALYs (Disability-Adjusted Life Years), YLDs (Years Lived with Disability), YLLs (Years of Life Lost)
location	Global, High SDI, High-middle SDI, Middle SDI, Low-middle SDI, Low SDI, Advanced Health System, Basic Health System, Limited Health System, Minimal Health System, China, Democratic People's Republic of Korea, Taiwan, Cambodia, Indonesia, Malaysia, Lao People's Democratic Republic, Maldives, Myanmar, Philippines, Sri Lanka, Thailand, Timor-Leste, Viet Nam, Kiribati, Fiji, Micronesia (Federated States of), Marshall Islands, Papua New Guinea, Solomon Islands, Samoa, Tonga, Armenia, Vanuatu, Georgia, Azerbaijan, Kazakhstan, Tajikistan, Mongolia, Kyrgyzstan, Albania, Turkmenistan, Uzbekistan, Czechia, Bosnia and Herzegovina, Hungary, Bulgaria, Croatia, Poland, Romania, Montenegro, North Macedonia, Serbia, Slovakia, Belarus, Slovenia, Estonia, Russian Federation, Latvia, Ukraine, Republic of Moldova, Lithuania, Brunei Darussalam, Singapore, Andorra, Australia, New Zealand, Japan, Republic of Korea, Austria, Belgium, Cyprus, France, Germany, Iceland, Finland, Greece, Ireland, Denmark, Italy, Luxembourg, Malta, Norway, Netherlands, Israel, Spain, Portugal, United Kingdom, Argentina, Switzerland, Uruguay, Canada, Sweden, Chile, United States of America, Bahamas, Barbados, Antigua and Barbuda, Cuba, Belize, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Saint Vincent and the Grenadines, Saint Lucia, Trinidad and Tobago, Suriname, Bolivia (Plurinational State of), Ecuador, Peru, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Venezuela (Bolivarian Republic of), Brazil, Paraguay, Algeria, Bahrain, Egypt, Iran (Islamic Republic of), Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Palestine, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, Türkiye, United Arab Emirates, Yemen, Afghanistan, Bangladesh, India, Bhutan, Nepal, Pakistan, Angola, Central African Republic, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Somalia, United Republic of Tanzania, Uganda, Zambia, Botswana, Lesotho, Namibia, South Africa, Eswatini, Zimbabwe, Benin, Burkina Faso, Cabo Verde, Cameroon, Chad, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone, Togo, American Samoa, Bermuda, Cook Islands, Greenland, Guam, Monaco, Nauru, Niue, Northern Mariana Islands, Palau, Saint Kitts and Nevis, Puerto Rico, Tokelau, San Marino, United States Virgin Islands, Tuvalu, South Sudan, Sudan, Taiwan (Province of China), Turkey, East Asia, Southeast Asia, Oceania, Central Asia, Central Europe, Eastern Europe, High-income Asia Pacific, Australasia, Western Europe, Southern Latin America, High-income North America, Caribbean, Andean Latin America, Central Latin America, Tropical Latin America, North Africa and Middle East, South Asia, Central Sub-Saharan Africa, Eastern Sub-Saharan Africa, Southern Sub-Saharan Africa, Western Sub-Saharan Africa
sex	Male, Female, Both
age	All ages, 15-49 years, Age-standardized, 85-89 years, 90-94 years, 0-14 years, 50-74 years, 95+ years, 75-84 years
cause	All causes, Chronic respiratory diseases, Chronic obstructive pulmonary disease, Asthma
rei	Air pollution, Household air pollution from solid fuels, Ambient ozone pollution, Ambient particulate matter pollution, Particulate matter pollution, All risk factors, Nitrogen dioxide pollution
metric	Number, Rate
year	1990, 2000, 2010, 2020, 2021