

Global Burden of Lung Cancer in Women Attributable to Environmental Particulate Matter Pollution: Analysis of Status and Trends from 1990 to 2021

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Abstract

Background: Lung cancer poses a significant threat to human health, and environmental fine particulate matter (PM_{2.5}) pollution has become the second most important risk factor for lung cancer, following smoking. **Objective** To analyze the status and trends of the global burden of lung cancer in women attributable to particulate matter (PM_{2.5}) pollution from 1990 to 2021. **Methods:** Using the Global Burden of Disease Study 2021 (GBD 2021) database, indicators such as the number of deaths, Disability-Adjusted Life Years (DALYs), and Expected Annual Percentage Change (EAPC) were employed to assess the burden and trends of PM_{2.5}-attributable lung cancer in women globally and across different Socio-Demographic Index (SDI) regions from 1990 to 2021. An Age-period-cohort (APC) model was also constructed to analyze the risks of death and DALYs. The trends in lung cancer were predicted using an auto regressive integrated moving average (ARIMA) model. **Results:** In 2021, PM_{2.5} contributed to approximately 120,000 global female lung cancer deaths and 2.84 million DALYs. The ASMR and ASDR were 2.63 and 62.00 per 100,000 respectively. Compared with 1990, the ASMR and ASDR of female lung cancer attributable to PM_{2.5} decreased globally in 2021, with the EAPCs being -0.67% [95% CI (-0.75%, -0.65%)] and -0.97% [95% CI (-1.03%, -0.95%)], respectively. The middle SDI region accounted for the highest number of deaths and DALYs, representing about 40% of the global burden, while the middle-high SDI region had the highest ASMR 3.68% [95% CI (2.28%, 5.27%)] and ASDR 86.58% [95% CI (53.25%, 124.31%)]. Between 1990 and 2021, ASMR and ASDR increased in low SDI regions but decreased in middle, middle-high, and high SDI regions, with the most pronounced declines observed in high SDI regions. At the national level, the burden of lung cancer among Chinese women attributable to PM_{2.5} pollution is substantial. APC analysis revealed that the impact of PM_{2.5} on the ASMR and ASDR of female lung cancer increased with age globally, peaking at 80–84 years for ASMR and 70–74 years for ASDR. Projections to 2040 indicate the burden attributable to ambient particulate exposure (APE) is expected to continue rising globally, while household particulate exposure (HPE)-related burden shows a consistent declining trend across all SDI regions. **Conclusion:** From 1990 to 2021, the global burden of PM_{2.5}-attributable female lung cancer showed a downward trend, with differences across SDI regions, and elderly women are the key population for disease prevention and control.

Keywords

Lung Cancer, GBD, Mortality Rate, Disability-adjusted Life Year, Disease Burden