LUNGS UNDER THE LENS: EPIDEMIOLOGICAL TRENDS, GENETICS AND INNOVATIONS IN RESPIRATORY CARE

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Respiratory diseases remain a leading global health burden, accounting for substantial morbidity and mortality across both communicable and non-communicable spectra. Recent epidemiological data indicate rising prevalence of asthma (~262 million cases), chronic obstructive pulmonary disease (COPD), lung cancer, and tuberculosis, with environmental determinants—particularly air pollution—emerging as critical drivers . In low- and middle-income countries such as Bangladesh, a dual burden exists: rural populations are disproportionately affected by biomass fuel exposure, while urban populations face escalating risks from industrial emissions and traffic-related pollution.

Advances in genomics have fundamentally transformed the understanding and management of respiratory diseases by revealing complex genetic architectures and susceptibility patterns across populations. Rather than single-gene disorders alone, many conditions are now recognized as polygenic, involving gene–environment interactions that influence disease onset, severity, and treatment response. This has enabled precision medicine approaches, including individualized risk stratification and the development of targeted therapies, aligning clinical care with a patient's unique molecular profile. These genomic insights complement established public health measures such as tobacco control, air quality regulation, vaccination, and early screening.

Concurrently, integration of artificial intelligence is redefining respiratory diagnostics. AI-enabled imaging systems can detect subtle abnormalities—including small pulmonary nodules, early interstitial changes, and tuberculosis-related lesions—with high sensitivity, often at stages difficult for human interpretation. Strengthening surveillance systems, fostering multi-sectoral collaboration, and scaling digital health solutions along with rehabilitation enforcement, are imperative for mitigating disease burden. These findings underscore the need for adaptive, equity-focused public health models to address evolving respiratory health challenges globally.

Keywords: Respiratory diseases, Genomics and precision medicine, Artificial intelligence in diagnostics

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