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THE IMPACT OF SOCIAL DETERMINANTS ON LUNG DISEASE IN EUROPEAN UNION MEMBER STATES. A NARRATIVE REVIEW[1]

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Abstract: Lung diseases represent a major global health challenge, currently affecting over 545 million individuals and causing nearly 4 million premature deaths every year. Social determinants of health, including where people are born, live, and work, significantly impact respiratory outcomes. While many pulmonary conditions are preventable, they remain disproportionately concentrated among vulnerable groups, thereby reinforcing health inequalities. This narrative review investigated the role of social factors in communicable and non-communicable respiratory illnesses, emphasizing tobacco use as a mediating risk factor and functional ability as an outcome. Data were analysed from the Eurostat Health Statistics Database and the Global Burden of Disease Study (2017–2021) for adults in EU-27 countries. Findings revealed marked social gradients, with pneumonia mortality almost twice as high in countries reporting lower education and higher overcrowding. Tobacco consumption was the leading modifiable risk factor, with Population Attributable Fractions exceeding 30% in high-burden countries. Smoking prevalence was highest in Eastern Europe, particularly among men and those with less education. Functional decline mediated the link between tobacco exposure and worse respiratory outcomes. Addressing these inequities requires comprehensive, equity-focused strategies, including tobacco control, improved access to healthcare, housing policy reform, and the integration of health across all public policies.

Keywords: Social determinants of health; respiratory diseases; tobacco control; health inequalities; functional decline; sustainable development goals; EU Member states.

Résumé : Les maladies pulmonaires constituent un problème de santé publique mondial majeur, touchant plus de 545 millions de personnes et causant près de 4 millions de décès prématurés chaque année. Les déterminants sociaux de la santé, tels que le lieu de naissance, de vie et de travail, influencent fortement la santé respiratoire. Bien que de nombreuses affections pulmonaires soient évitables, elles touchent de manière disproportionnée les groupes vulnérables et accentuent les inégalités en santé. Cette revue narrative a examiné l'impact des facteurs sociaux sur les maladies pulmonaires transmissibles et non transmissibles, en mettant l'accent sur le rôle médiateur du tabagisme

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et sur la capacité fonctionnelle comme critère de résultat. Les données d'Eurostat et du Global Burden of Disease Study (2017–2021) pour les adultes des pays de l'UE-27 ont été analysées. Les résultats révèlent de fortes disparités sociales, avec des taux de mortalité par pneumonie presque deux fois plus élevés dans les pays présentant une éducation plus faible et une surpopulation plus élevée. Le tabac est apparu comme le principal facteur de risque modifiable, représentant plus de 30% de l'attribution populationnelle dans les pays à forte charge. Le tabagisme reste particulièrement fréquent en Europe de l'Est, notamment chez les hommes et les personnes moins instruites. La détérioration fonctionnelle médie l'association entre l'exposition au tabac et les mauvais résultats respiratoires. Réduire ces inégalités exige des politiques axées sur l'équité, incluant la lutte antitabac, l'amélioration de l'accès aux soins, la réforme du logement et l'intégration de la santé dans toutes les politiques.

Mots-clés : Déterminants sociaux de la santé; maladies respiratoires; lutte antitabac; inégalités de santé; déclin fonctionnel; objectifs de développement durable; États membres de l'UE.

Rezumat: Bolile pulmonare rămân o problemă majoră de sănătate publică la nivel global, afectând peste 545 de milioane de persoane și provocând aproape 4 milioane de decese premature anual. Determinanții sociali ai sănătății, precum mediul în care oamenii se nasc, trăiesc și muncesc, influențează puternic starea respiratorie. Deși numeroase afecțiuni pulmonare sunt prevenibile, acestea afectează disproporționat grupurile vulnerabile, amplificând inegalitățile în sănătate. Această revizuire narativă a analizat rolul factorilor sociali asupra bolilor respiratorii transmisibile și netransmisibile, subliniind fumatul ca factor de mediere și capacitatea funcțională ca rezultat principal. Datele Eurostat și Global Burden of Disease Study (2017–2021) pentru adulții din țările UE-27 au fost analizate. Rezultatele au arătat existența unor granițe sociale clare, cu rate de mortalitate prin pneumonie aproape duble în statele cu educație scăzută și supraaglomerare locativă ridicată. Consumul de tutun a apărut ca cel mai important factor de risc modificabil, contribuind cu peste 30% la mortalitatea prin pneumonie în țările cu povară ridicată. Fumatul este mai frecvent în Europa de Est, în special la bărbați și persoane cu nivel educațional redus. Scăderea funcțională a mediat asocierea dintre expunerea la tutun și agravarea rezultatelor respiratorii. Reducerea acestor inegalități impune politici centrate pe echitate: controlul fumatului, acces îmbunătățit la servicii medicale, reforme privind locuințele și integrarea sănătății în toate politicile publice.

Cuvinte-cheie: Determinanți sociali ai sănătății; boli respiratorii; controlul tutunului; inegalități de sănătate; declin funcțional; obiective de dezvoltare durabilă; state membre UE.

1. Introduction and Problem Statement

Health extends beyond the traditional biomedical model, which focuses solely on the absence of disease. The World Health Organization (WHO) defines health as „a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (contained in the Preamble to its Constitution, 1948). This holistic view recognizes that optimal health arises from the complex interplay of individual characteristics and the social, economic, and environmental contexts in which individuals live. Well-being encompasses a broader spectrum of health, including emotional, social, and psychological

dimensions. Both health and well-being are essential for achieving a high quality of life, enabling individuals to function optimally despite challenges such as illness or socio-environmental constraints. While health and well-being are distinct concepts, they are closely interconnected; individuals in better health often report higher levels of overall well-being.

Social determinants of health (SDOH) are defined as the conditions in which individuals are born, grow, live, work, and age, as well as their access to power, money, and resources, that significantly influence health inequities (Centers for Disease Control and Prevention, 2025). These determinants create unfair and avoidable disparities in health status observed both within and between countries, with health and illness following a social gradient: individuals in lower socioeconomic positions tend to experience poorer health outcomes (Centers for Disease Control and Prevention, 2025; World Health Organization, 2019).

The relationship between social determinants and health outcomes is particularly evident in the global burden of lung diseases. These conditions arise from the intersection of biological vulnerability, environmental exposures, and social disadvantage (Momtazmanesh *et al.*, 2023; Zhang *et al.*, 2024). Approximately 545 million individuals are affected by chronic respiratory conditions, accounting for 7,4% of the global population. Additionally, chronic respiratory diseases cause 4 million premature deaths annually worldwide (Momtazmanesh *et al.*, 2023). The economic burden is substantial, with approximately €380 billion allocated to the care of chronic respiratory disease patients in European Union member states in 2019 (Soriano *et al.*, 2020).

2. Scope and Significance

In our paper, we use a narrative review to examine lung diseases through the lens of social determinants of health, focusing on both communicable diseases (tuberculosis, pneumonia, influenza) and non-communicable diseases (chronic obstructive pulmonary disease, asthma, and lung cancer). The analysis incorporates functional capacity as a critical outcome measure, recognizing that lung diseases impact not only mortality but also individuals' ability to perform daily activities and participate fully in society (da Silveira *et al.*, 2023). This review aims to inform evidence-based interventions that address both proximate and structural causes of lung disease burden. Understanding the influence of social determinants on respiratory health outcomes enables policymakers and health practitioners to design more effective and equitable interventions, supporting the World Health Organization's Sustainable Development Goal 3, which seeks to ensure healthy lives and promote well-being for all at all ages.

2. Theoretical Framework

2.1. The Evolving Landscape of Lung Disease Research

The understanding of lung illnesses has transitioned from a biological focus on pathophysiology and therapy to recognizing social, environmental, and

behavioural variables (Agustí & Hogg, 2019). This alteration illustrates the evolution of public health perspectives towards emphasizing the fundamental factors that render certain populations more vulnerable while others exhibit greater resilience (Commission on Social Determinants of Health, 2008). Contemporary studies on pulmonary ailments recognize that respiratory health outcomes cannot be sufficiently addressed without accounting for the social conditions in which they arise (Abdelaal *et al.*, 2024). The elevated mortality and disability-adjusted life years (DALYs) in poor and low-middle SDI nations underscore the urgent necessity to enhance preventative, diagnostic, and therapeutic interventions immediately. To reduce the prevalence of chronic respiratory diseases, it is essential to implement global strategies for tobacco control, enhance air quality, mitigate workplace hazards, and promote the adoption of clean cooking fuels (Soriano *et al.*, 2020).

2.2. Lung Diseases: A Global Health Challenge. Epidemiological Burden

Lung diseases are among the leading causes of global morbidity and mortality, affecting all demographic and geographic categories. Globally, 4 million people die prematurely from chronic respiratory disease, with the burden disproportionately impacting low- and middle-income countries and socially disadvantaged populations within high-income countries (Forum of International Respiratory Societies, 2017).

Recent Global Burden of Disease analyses reveal concerning trends. Chronic Obstructive Pulmonary Disease (COPD), with 212.3 million prevalent cases, is the primary cause of deaths from chronic respiratory diseases, accounting for 3.3 million deaths (GBD 2019 Chronic Respiratory Disease Collaborators, 2020). Asthma, with 262.4 million prevalent cases, has the highest prevalence among chronic respiratory diseases (Soriano *et al.*, 2020). In the EU, respiratory diseases are a significant public health issue, accounting for 6.1% of all deaths in 2021 and representing the third most common cause of death overall. In 2019, asthma affected almost 6% of the EU population, with Finland having the highest prevalence. However, chronic respiratory diseases (CRDs), such as COPD, are often underdiagnosed, underestimated, and pose a growing global health challenge, with increased prevalence projected by 2050 (World Health Organization. Regional Office for Europe, 2025). These statistics underscore the scale of respiratory disease burden and its impact on global health systems. The same specialist states that „This report shows that chronic respiratory diseases, which affect 81.7 million people in the WHO European Region, have long been overlooked due to insufficient policy focus and underfunding. This neglect has led to underdiagnosis, misdiagnosis and incomplete data, costing the Region an estimated $21 billion annually" declared Dr. Hans Henri P. Kluge, WHO Regional Director for Europe, in a press release to the WHO. The same specialist states that „to change this, we must strengthen health systems by making care for chronic respiratory diseases a core part of broader strategies for addressing noncommunicable diseases.

Prevention is key – this means tackling risks such as smoking, air pollution and unsafe working conditions. We also need to boost research and innovation, set measurable targets, and invest in data and science."

2.3. Disease Categories and Characteristics

Communicable Lung Diseases include infectious conditions spread through airborne transmission, direct contact, or environmental contamination. Major communicable lung diseases include:

– **Tuberculosis:** In the EU/EEA, there was a significant increase in tuberculosis (TB) cases from 35,000 in 2022 to nearly 37,000 in 2023, though incidence remains much lower than the global and WHO European Region averages. A leading infectious disease killer, with approximately 10 million new cases and 1.6 million deaths annually (WHO, 2021).

– **Pneumonia:** The leading infectious cause of death, particularly affecting children under 5 and adults over 65 (WHO, 2020). In the EU, a 2016 report showed that 131,450 people died from pneumonia, accounting for nearly 3% of all deaths, with a standardized death rate of 26 per 100,000 people.

– **Influenza:** While overall mortality from influenza has fluctuated, the 2022-2023 season saw 3,857 deaths from Severe Acute Respiratory Infections (SARIs) among 41,097 hospitalized patients in nine reporting countries, with 4% testing positive for influenza. It causes annual epidemics resulting in 290,000-to 650,000 deaths globally (WHO, 2021).

– **COVID-19:** As of 20 May 2022, Europe was the most affected continent in the world. Has altered the respiratory disease landscape since 2020 (Zhou *et al.*, 2020).

Non-Communicable Lung Diseases include chronic conditions developing over time due to genetic factors, environmental exposures, and lifestyle behaviours (Global Initiative for Chronic Obstructive Lung Disease, 2024). Key non-communicable lung diseases include:

– **COPD:** A progressive condition characterized by persistent airflow limitation (Rabe *et al.*, 2007). In 2025, the WHO reported that the global burden of COPD, a leading cause of chronic illness, is expected to rise, driven by factors like an aging population. Recent analyses indicate significant regional disparities, with high COPD prevalence in Western Europe but higher hospitalization and mortality rates in Eastern European countries. The number of COPD cases is projected to increase by 23% globally by 2050, a trend expected to impact the EU as well.

– **Asthma:** A chronic inflammatory airways disease causing episodic breathing difficulties (Global Initiative for Asthma, 2023). In 2019, asthma affected almost 6% of the EU population, a small increase compared with 2014 (+0.3 percentage points). Among EU countries, Finland stood at the top of the list, with 9% of the people reporting having asthma, followed by Germany and France (both 8%). In contrast, only 2% of people in both Romania and Bulgaria reported having this disease.

– **Lung Cancer:** The leading cause of cancer-related mortality worldwide (Jemal *et al.*, 2011), **Pulmonary Fibrosis:** Progressive scarring of lung tissue leading to respiratory failure and **Occupational Lung Diseases:** Including pneumoconiosis, asbestosis, and silicosis (Perez-Padilla *et al.*, 2010).

2.4. The Social Gradient in Lung Diseases

Lung diseases show a social gradient, with higher incidence, severity, and mortality rates among socially disadvantaged populations (Eisner *et al.*, 2011). This gradient reflects the unequal distribution of risk and protective factors across social groups.

Risk Factor Distribution: Social disadvantage increases exposure to risk factors for lung disease, including tobacco use, air pollution, occupational hazards, poor housing, and limited healthcare access (Gershon *et al.*, 2012). Lower socioeconomic groups experience higher smoking rates, live in polluted areas, work in hazardous occupations, and reside in substandard housing.

Protective Factor Distribution: Conversely, social advantage provides access to protective factors such as quality healthcare, health education, safe living environments, and resources for health-promoting behaviours (Braveman & Gottlieb, 2014). Higher socioeconomic groups have better access to smoking cessation programs, air filtration systems, occupational safety measures, and early disease detection services.

Cumulative Disadvantage: The clustering of risk factors and lack of protective factors among disadvantaged populations leads to cumulative health disadvantages that compound over time (Link & Phelan, 1995). This process helps explain why social gradients in lung disease often exceed expectations based solely on individual risk factor exposure.

2.5. The Paradox of Preventable Suffering

The burden of lung diseases is significant not only due to high prevalence but also because many cases are preventable. Most lung disease cases are attributable to modifiable risk factors such as tobacco use, air pollution, occupational exposures, and inadequate living conditions, which are linked to underlying social and economic inequities (Gakidou *et al.*, 2017). Consequently, populations with limited resources experience higher exposure to these risk factors and reduced access to prevention and treatment services. Limited access to clean drinking water and sanitation facilities contributes to the spread of respiratory infections (Centers for Disease Control and Prevention CDC, 2025). Food insecurity and malnutrition, common in poor communities, increase vulnerability to acute lower respiratory tract infections and tuberculosis, and are associated with more severe disease (Narasimhan *et al.*, 2013). These patterns illustrate how social determinants function as „fundamental causes" of disease, creating systematic disparities in health outcomes that persist over time and across different locations (Link & Phelan, 1995).

2.6. Social Determinants of Health. Conceptual Foundation

The social determinants of health framework provide the theoretical foundation for understanding how structural factors create and maintain health inequities. The World Health Organization released an operational framework for monitoring social determinants of health equity and actions addressing them, aimed at supporting countries in evidence-based policymaking to improve health equity (World Health Organization, 2019).

This framework recognizes five key domains that fundamentally shape health outcomes (Office of Disease Prevention and Health Promotion, 2020).

1. Economic Stability: Economic resources determine access to health-promoting resources and exposure to health-damaging conditions (Braveman *et al.*, 2011). Income level, employment security, and poverty status directly influence housing quality, neighborhood characteristics, healthcare access, and stress levels. For respiratory health, economic instability often translates to residence in areas with poor air quality, inability to afford smoking cessation interventions, and delayed healthcare seeking for respiratory symptoms (Adler & Stewart, 2010).

2. Education Access and Quality: Educational attainment serves as both a direct determinant of health literacy and an indirect pathway to better employment, income, and social status (Braveman & Gottlieb, 2014). Higher education levels are associated with greater knowledge of health risks, improved ability to navigate healthcare systems, and enhanced capacity for health-promoting behaviours. In the context of lung diseases, education influences understanding of tobacco risks, recognition of respiratory symptoms, and adherence to treatment regimens (Baker *et al.*, 2005).

3. Healthcare Access and Quality: The availability, accessibility, acceptability, and quality of healthcare services fundamentally determine disease prevention, early detection, and treatment outcomes (Braveman *et al.*, 2011). Healthcare access includes financial barriers, geographic accessibility, cultural competency, and system responsiveness. For lung diseases, healthcare access affects the availability of smoking cessation programs, respiratory rehabilitation services, and timely treatment for acute exacerbations.

4. Neighborhood and Built Environment: The physical environment shapes respiratory health through air quality, housing conditions, and exposure to environmental hazards (Diez Roux, 2007). Neighborhood characteristics, including proximity to industrial facilities, traffic density, green space availability, and housing quality, create differential exposure to respiratory irritants and pathogens. The dynamics between social determinants of health, disproportionate environmental exposures, and differential health outcomes are often specific to microgeographic areas (CDC, 2025).

5. Social and Community Context: Social cohesion, discrimination, and community support networks influence health through stress pathways, social norms, and collective efficacy (Berkman & Kawachi, 2000). Strong social connections provide emotional support, practical assistance, and positive health

behaviour modelling, while discrimination and social isolation increase stress and limit access to resources. For respiratory health, social context influences smoking behaviours, healthcare-seeking patterns, and adherence to treatment recommendations.

The graphical representation can be seen in Figure 1.

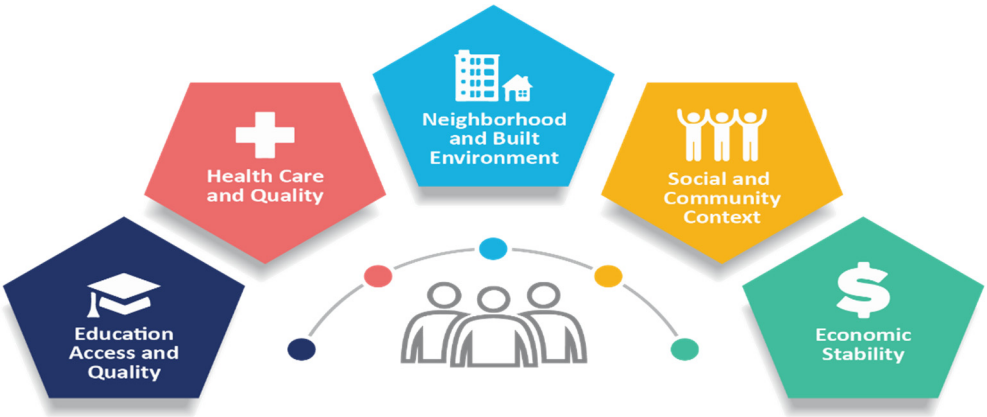

Figure 1. Key domains of social determinants of health
Source: U.S. Department of Health and Human Services, Healthy People 2030.

Pathways and Mechanisms

Social determinants influence lung disease outcomes through interconnected pathways (Marmot *et al.*, 2008):

***Direct Environmental Pathways*:** Social position determines exposure to respiratory hazards such as air pollution, occupational dust and chemicals, secondhand smoke, and poor housing conditions with inadequate ventilation or mold (WHO, 2015).

Behavioural Mediation Pathways: Social determinants shape health behaviours, including tobacco use, physical activity, dietary patterns, and healthcare utilization (Hiscock *et al.*, 2012). These behaviours directly influence lung disease risk and progression.

Psychosocial Stress Pathways: Social disadvantage creates chronic stress that affects immune function, inflammatory responses, and health behaviours (Cohen & Wills, 1985). Chronic stress compromises respiratory defenses and may accelerate disease progression.

***Healthcare Access Pathways*:** Social determinants affect access to preventive services, early detection programs, quality treatment, and disease management support (Braveman *et al.*, 2011). Differential healthcare access creates disparities in disease outcomes even when exposure levels are similar.

Life Course Accumulation: The life course perspective posits that socioeconomic disadvantages originating in childhood accumulate across the lifespan, producing adverse health outcomes in later years, while sustained

socioeconomic advantages contribute to comparatively favorable health in old age. Social determinants operate across the lifespan, with early life disadvantages creating cumulative health risks that may remain latent before manifesting as chronic conditions, such as respiratory disease, in adulthood (Dodge *et al.*, 2012). This framework emphasizes both the developmental origins of disease and the social processes that influence susceptibility to, or protection against, illness. Life course theory incorporates the influence of social and material environments, income inequality, stress, nutrition, health-related behaviours, gene–environment interactions, public safety, and other contextual factors, conceptualizing them as interrelated pathways that shape health trajectories from birth through aging (Cockerham *et al.*, 2017).

2.7. WHO's Sustainable Development Goal 3: The Policy Context. Global Health Governance Framework

The World Health Organization's Sustainable Development Goal 3 – „Ensure healthy lives and promote well-being for all at all ages" – provides the policy framework for addressing the lung disease burden (UN, 2015). This goal recognizes health as a fundamental human right and essential for sustainable development. SDG 3 includes specific targets relevant to lung disease prevention and control (WHO, 2024):

Target 3.3: Fight Communicable Diseases: „By 2030, end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases." This target addresses tuberculosis elimination and broader communicable disease control, acknowledging that infectious respiratory diseases pose major threats to global health security (WHO, 2021). Achieving this goal requires addressing both biomedical and social determinants of transmission and treatment outcomes.

Target 3.4: Reduce Non-Communicable Disease Mortality: „By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being." This target includes major non-communicable lung diseases such as COPD, asthma, and lung cancer (Thun *et al.*, 2013). Achieving it necessitates comprehensive approaches that address treatment access and the prevention of modifiable risk factors, particularly tobacco use.

Target 3.5: Prevent and Treat Substance Abuse: „Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol." While not explicitly mentioning tobacco, this target encompasses prevention and treatment strategies relevant to tobacco use disorder and its respiratory health consequences.

Target 3.8: Achieve Universal Health Coverage: „Achieve universal health coverage, including financial risk protection, access to quality essential health-care services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all." Universal health coverage is crucial for ensuring equitable access to lung disease prevention, diagnosis, and treatment services

(Braveman *et al.*, 2011). This target addresses healthcare access barriers that contribute to lung disease disparities.

***Target 3.A: Implement the World Health Organization Framework Convention on Tobacco Control*:** „Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate." This target specifically addresses tobacco control as essential for global health promotion, recognizing tobacco use as the leading preventable cause of lung disease worldwide (WHO Framework Convention on Tobacco Control, 2003).

Alignment with Social Determinants Approach

SDG 3's emphasis on promoting well-being „for all" acknowledges that health improvements must be equitably distributed across populations. This universal approach aligns with social determinants thinking by recognizing that health is produced by conditions of daily life rather than merely healthcare services. The goal's integration with other SDGs – including poverty reduction (SDG 1), education (SDG 4), clean water and sanitation (SDG 6), decent work (SDG 8), reduced inequalities (SDG 10), and climate action (SDG 13) – reflects the understanding that health outcomes are fundamentally shaped by social, economic, and environmental determinants.

2.8. Functional Capacity: A Critical but Underexplored Dimension. Conceptual Framework

Functional capacity is the ability to perform activities necessary for independent living and social participation (Spruit *et al.*, 2013). In the context of lung diseases, functional capacity encompasses respiratory function, physical endurance, cognitive performance, and social engagement capabilities. This multidimensional concept extends beyond traditional biomedical measures to include real-world functioning and quality of life (Langevin, 2024). Functional capacity is important as both an outcome measure and a mediating pathway between lung disease and mortality. Functional limitations often precede clinical diagnoses, making functional capacity assessment valuable for early intervention. Additionally, functional capacity decline may mediate the relationship between social determinants, lung disease, and adverse outcomes, including mortality.

2.9. Relevance to Social Determinants

Functional capacity serves as a pathway through which social determinants influence health outcomes. Social advantage provides resources for maintaining and improving functional capacity through access to rehabilitation services, assistive technologies, social support, and environmental modifications. Conversely, social disadvantage limits access to function-supporting resources and may accelerate functional decline through exposure to additional stressors and hazards.

3. Methodology

This study utilized two harmonized sources of secondary data:

– ***Eurostat Health Statistics Database*** – This database includes information on hospital discharges, causes of death, and social determinants such as housing, employment, and education.

– ***Global Burden of Disease Study (GBD)*** – This study provides standardized estimates of tobacco prevalence, second-hand smoke exposure, disability-adjusted life years (DALYs), and mortality by cause.

Population of Interest: Adults (15+ years) in the EU-27 from 2017 to 2021.

Key Variables

Outcomes (Eurostat & GBD):

- Pneumonia mortality (Eurostat „Causes of Death" sheet; ICD-10 J12–J18)
- Respiratory mortality (Eurostat and GBD)
- Hospital discharges due to respiratory conditions (Eurostat „Hospital Discharges" sheet)
- Decline in functional capacity (proxied via GBD DALYs and Eurostat discharges)

Exposures (GBD):

- Tobacco use categorized as current smokers, former smokers, and never smokers
- Cumulative pack-years
- Second-hand smoke exposure
- Use of electronic cigarettes

Social Determinants (Eurostat):

- *Income & Education:* captured in „Treatable and Preventable Mortality" and socioeconomic stratifications
- *Housing Conditions:* Proportion of people living in unoccupied or overcrowded dwellings as indicated in „People living in unoccupied."
- *Healthcare access:* proxy via preventable hospitalizations and mortality ("Treatable and Preventable Mortality")

4. Results

4.1. Tobacco use and smoking patterns

Table 1 shows the percentage of daily cigarette smokers aged 15 and older by sex in each of the EU-27 countries. It shows that there are big differences between regions and genders. For example, Eastern and Southern European countries (like Bulgaria, Latvia, and Greece) have higher smoking rates, especially among men. In contrast, Northern European countries (like Sweden and Finland) have lower rates. This aligns with what we know about how people in Europe smoke.

Table 1. Percentage of daily smokers of cigarettes among persons aged 15 and over, by sex

Countries	Men (%)	Women (%)	Countries	Men (%)	Women (%)
Bulgaria	37.6	20.7	**Lithuania**	29.1	9.5
Greece	29.9	17.9	**Poland**	23.0	14.2
Latvia	34.4	12.1	**France**	20.5	15.4
Germany	25.4	18.6	**Slovenia**	18.4	14.8
Croatia	25.1	19.2	**Italy**	20.5	12.7
Cyprus	30.1	12.8	**Belgium**	17.6	11.8
Slovakia	26.1	15.1	**Netherlands**	16.4	12.8
Austria	23.1	17.5	**Ireland**	15.0	12.7
Spain	23.2	16.4	**Denmark**	11.7	11.8
Malta	21.9	16.8	**Portugal**	16.4	7.2
Czechia	23.2	15.7	**Luxembourg**	11.7	9.2
Hungary	21.5	17.3	**Finland**	12.1	7.8
Estonia	25.2	13.5	**Sweden**	5.9	6.8
Romania	30.6	7.5			

Table 2 shows how common cigarette smoking is based on how much education a person has. In almost all countries, people with only lower secondary education smoke more than people with higher education. This shows the socioeconomic gradient in smoking, which means that people with less education are more likely to smoke.

Table 2. Share of daily smokers of cigarettes among persons aged 15 and over, by educational attainment level

Countries	At most, lower secondary education	Upper secondary and post-secondary non-tertiary education	Tertiary education
EU	18.6	21.9	12.7
Bulgaria	23.5	33.7	23.5
Greece	19.3	29.7	20.2
Latvia	23.1	27.5	11.5
Germany	24.9	24.6	13.5
Croatia	14.9	26.9	17.3
Cyprus	16.5	25.0	20.0
Slovakia	22.5	23.6	10.0
Austria	20.4	23.8	14.1
Spain	20.8	22.5	15.8
Malta	22.6	21.2	12.1
Czechia	21.6	22.3	7.9
Hungary	25.3	22.4	8.6
Estonia	23.1	23.6	10.6
Romania	13.4	21.7	17.8
Lithuania	14.5	25.0	11.0
Poland	17.6	22.9	8.2
France	18.5	19.8	15.5

Countries	At most, lower secondary education	Upper secondary and post-secondary non-tertiary education	Tertiary education
Slovenia	14.9	23.3	15.6
Italy	16.0	18.2	13.3
Belgium	17.2	18.4	9.4
Netherlands	19.2	17.3	6.8
Ireland	16.5	17.4	8.5
Denmark	15.0	14.8	7.6
Portugal	11.5	14.6	7.9
Luxembourg	13.8	12.9	7.2
Finland	10.7	13.0	5.4
Sweden	9.7	7.3	2.8

Table 3 puts smokers into groups based on how many cigarettes they smoke each day (<20 vs. ≥20). Countries such as Bulgaria and Croatia exhibit a greater prevalence of heavy smokers (≥20 cigarettes per day). This information is essential because higher consumption is linked to higher health risks.

Table 3. Share of daily smokers of cigarettes among persons aged 15 and over, by level of consumption

Countries	Less than 20 cigarettes per day	20 or more cigarettes per day
Bulgaria	15.8	12.9
Greece	12.8	10.8
Latvia	14.9	7.2
Germany	14.1	7.8
Croatia	10.2	11.6
Cyprus	11.6	9.7
Slovakia	15.1	5.3
Austria	12.1	8.2
Spain	14.8	4.9
Malta	12.9	6.6
Czechia	13.9	5.4
Hungary	12.8	6.5
Estonia	13.5	5.4
Romania	13.3	5.4
Lithuania	13.2	5.2
Poland	9.8	8.6
France	13.8	4.1
Slovenia	10.7	5.9
Italy	11.8	4.7
Belgium	9.7	4.9
Netherlands	11.7	2.9
Ireland	9.8	4.1
Denmark	8.6	3.1
Portugal	7.5	4.0
Luxembourg	7.5	3.0
Finland	7.1	2.8
Sweden	5.3	1.0

Table 4 shows how often people use electronic cigarettes or other similar electronic devices. Daily use is still pretty low (less than 2% of the EU), but occasional and past use is more common, especially in Poland and France. This could mean that there are more options for people who want to quit smoking, but it also makes people wonder about the health effects and the possibility of using both.

Table 4. Percentage distribution of the frequency of use of electronic cigarettes or similar electronic devices among persons aged 15 and over

Countries	Every day	Occasionally	Formerly
EU	1.7	1.9	4.8
Poland	4.6	1.4	6.1
France	3.4	3.2	9.2
Ireland	3.3	1.2	1.8
Czechia	1.9	2.3	2.4
Greece	1.7	1.1	1.3
Lithuania	1.6	1.8	2.8
Denmark	1.5	1.7	5.4
Estonia	1.5	1.6	6.1
Belgium	1.4	2.7	11.5
Germany	1.3	2.0	5.6
Italy	1.3	1.8	3.6
Slovakia	1.2	1.7	3.2
Cyprus	1.1	1.2	3.3
Latvia	1.1	1.9	2.8
Malta	1.1	1.2	4.0
Hungary	1.0	1.0	2.3
Netherlands	0.9	5.0	4.2
Portugal	0.9	0.8	3.2
Slovenia	0.9	0.9	2.7
Croatia	0.8	1.1	1.5
Finland	0.8	1.0	5.4
Austria	0.7	1.9	4.6
Bulgaria	0.6	1.4	4.3
Luxembourg	0.6	1.2	2.3
Spain	0.5	0.5	1.5
Sweden	0.5	1.1	2.0
Romania	0.3	1.4	2.6

4.2. Exposure to tobacco smoke

Table 5 illustrates the distribution of exposure to second-hand tobacco smoke among adults, categorized by frequency and duration. The EU average shows that more than 10% of adults are exposed for one or more hours every day. In Croatia (26.1%) and Bulgaria (17.1%), the daily exposure is much higher. This

shows that passive smoking is still a problem and can cause breathing problems even in people who don't smoke.

Table 5. Distribution of the frequency of exposure to tobacco smoke among persons aged 15 and over

Countries	One or more hours daily	Less than an hour daily	At least once a week	Less than once a week
Croatia	26.1	8.6	12.9	12.1
Bulgaria	17.1	12.2	10.5	15.0
Greece	19.4	8.6	16.6	17.8
Cyprus	16.9	6.8	7.4	11.3
Romania	11.8	8.7	10.2	17.6
Poland	14.5	5.8	5.0	10.1
Malta	12.4	7.0	4.9	7.2
Italy	10.7	5.4	8.1	8.0
Slovakia	8.8	5.1	10.3	15.1
France	7.8	5.7	7.9	8.1
Latvia	8.0	5.5	5.8	8.4
Austria	9.2	4.0	9.6	13.4
Germany	9.9	3.2	5.2	6.6
Hungary	8.4	4.2	3.9	10.3
Lithuania	5.7	4.5	6.2	11.9
Czechia	6.0	3.8	5.6	10.7
Estonia	4.8	5.0	4.1	8.9
Luxembourg	4.9	3.8	6.5	9.8
Slovenia	6.0	2.7	4.8	9.2
Ireland	6.3	2.0	2.6	3.4
Denmark	5.2	3.0	5.5	10.6
Portugal	3.7	4.0	8.7	10.8
Spain	5.1	2.4	2.9	3.1
Sweden	2.6	3.2	6.0	10.2
Finland	2.1	2.1	6.1	13.9

4.3. Mortality trends from pneumonia and respiratory diseases

The EU-27 had very different rates of death from pneumonia, with the highest rates in Eastern and Southern Europe (Eurostat „Causes of Death"). From 2017 to 2021, Table 6 shows the total number of pneumonia-related deaths by country. There is a lot of differences, with Poland, Romania, Germany, Italy, and France having the most people overall. The gradual rise in pneumonia deaths in some Eastern European countries, like Romania, over time is worrying.

Table 6. Total number of deaths caused by Pneumonia

Countries	2017	2018	2019	2020	2021
Belgium	4,414	4,770	4,414	3,444	2,871
Bulgaria	1,410	1,294	1,468	2,973	3,553

Countries	2017	2018	2019	2020	2021
Czechia	3,284	3,420	3,484	3,829	3,602
Denmark	1,813	1,950	1,663	1,496	1,482
Germany	19,609	20,259	18,548	15,927	14,119
Estonia	243	245	300	253	339
Ireland	1,088	1,058	1,004	759	709
Greece	1,188	1,154	1,163	1,115	1,048
Spain	10,222	10,415	9,384	8,768	6,799
France	13,936	14,335	14,545	11,572	10,424
Croatia	997	341	173	383	785
Italy	13,516	13,606	14,644	15,288	10,810
Cyprus	72	57	68	58	70
Latvia	399	453	380	362	426
Lithuania	575	648	539	595	550
Luxembourg	70	114	111	86	75
Hungary	1,125	1,066	1,101	1,100	1,187
Malta	120	123	170	167	145
Netherlands	3,546	3,729	3,374	2,730	2,597
Austria	1,300	1,307	1,148	906	712
Poland	15,988	17,917	18,269	19,794	18,361
Portugal	5,623	5,764	4,700	4,357	3,767
Romania	7,262	8,548	9,138	11,879	14,775
Slovenia	563	437	346	272	246
Slovakia	2,285	2,130	2,061	2,920	5,732
Finland	86	78	56	60	39
Sweden	1,842	1,920	1,713	1,349	1,174

Table 7 concentrates on pneumonia fatalities that are treatable and preventable, which act as indicators of the efficacy and accessibility of the health system. Countries with higher pneumonia death rates also have higher treatable mortality rates, which could mean that there are problems with access to or quality of healthcare.

Table 7. Treatable and Preventable Deaths from Pneumonia

Countries	2017	2018	2019	2020	2021
Belgium	557	599	559	505	461
Bulgaria	686	628	804	1,591	1,824
Czechia	929	982	959	1,109	1,197
Denmark	262	296	229	235	236
Germany	2,911	3,083	2,760	2,540	2,505
Estonia	73	77	88	85	105
Ireland	112	148	136	115	112
Greece	170	180	153	184	213
Spain	1,125	1,233	1,122	1,144	896
France	1,403	1,506	1,545	1,411	1,349

Countries	2017	2018	2019	2020	2021
Croatia	206	84	56	120	241
Italy	1,242	1,295	1,415	1,740	1,193
Cyprus	6	11	12	7	12
Latvia	189	185	174	156	216
Lithuania	235	269	268	305	277
Luxembourg	8	16	17	12	12
Hungary	404	343	363	436	488
Malta	13	20	33	30	20
Netherlands	403	454	390	345	385
Austria	156	160	121	102	76
Poland	4,605	5,566	6,208	6,977	6,870
Portugal	659	646	485	535	464
Romania	3,784	4,509	4,935	6,864	8,685
Slovenia	35	31	18	13	19
Slovakia	762	743	791	1,049	2,549
Finland	32	27	23	23	12
Sweden	208	260	248	200	180

Table 8 shows how many people died from respiratory diseases, such as pneumonia. Again, countries with a lot of people or a lot of problems, like Germany, Italy, Spain, Poland, and Romania, have the highest death rates. The data show that some Western European countries have been seeing fewer people since 2017, while some parts of Eastern Europe have seen numbers stay high or rise.

Table 8. Death caused by diseases of the respiratory system

Countries	2017	2018	2019	2020	2021
Belgium	12,242	13,108	12,319	10,465	9,208
Bulgaria	4,580	4,883	4,205	6,008	6,827
Czechia	8,097	8,364	8,248	8,339	7,805
Denmark	6,350	6,776	6,107	5,661	5,982
Germany	68,500	71,821	67,141	61,426	57,383
Estonia	558	658	600	514	618
Ireland	4,059	4,051	3,930	3,271	3,202
Greece	13,847	12,668	13,591	12,576	13,079
Spain	51,615	53,687	47,681	42,423	35,543
France	44,823	45,183	45,590	38,765	36,398
Croatia	3,163	2,376	2,333	2,239	2,522
Italy	53,372	51,756	53,657	57,113	45,229
Cyprus	595	532	657	622	521
Latvia	844	922	781	715	780
Lithuania	1,340	1,384	1,202	1,204	1,063
Luxembourg	314	388	387	324	299
Hungary	8,148	8,113	8,315	7,161	6,737
Malta	385	391	461	431	450
Netherlands	12,997	14,084	12,657	10,524	10,151
Austria	5,341	5,590	5,347	4,884	4,043
Poland	26,333	27,601	27,259	28,764	28,175

Countries	2017	2018	2019	2020	2021
Portugal	12,819	13,305	12,243	11,264	10,272
Romania	15,552	17,118	17,765	21,456	23,945
Slovenia	1,290	1,083	1,080	806	674
Slovakia	3,673	3,468	3,263	3,990	6,841
Finland	2,082	2,232	1,970	1,751	1,764
Sweden	6,705	6,980	6,178	5,554	5,079

4.4. Social determinants

Countries with high rates of overcrowding and low-income levels consistently had higher rates of pneumonia and respiratory deaths ("People living in unoccupied"). Table 9 shows how many people live in underoccupied homes based on their household type and income level. Countries in Northern and Western Europe (Ireland, Malta, Cyprus) have high percentages of people living in larger homes, while countries in Eastern Europe (Romania, Bulgaria, Hungary) have lower percentages, which means that the homes are too small or not in good condition. Because overcrowding is linked to respiratory infections, this helps explain why pneumonia rates are higher in these areas.

Table 9. Share of people living in underoccupied dwellings by household type and income quintile - , total population

Countries	2017	2018	2019	2020	2021
Belgium	65.0	58.6	58.5	58.5	59.4
Bulgaria	11.1	11.5	11.5	12.1	11.8
Czechia	25.6	26.8	27.3	27.3	27.2
Denmark	43.6	41.9	42.6	42.9	42.5
Germany	35.4	36.0	35.3	35.3	34.2
Estonia	29.3	31.2	29.9	30.3	27.9
Ireland	69.6	71.4	68.8	70.6	69.8
Greece	10.3	10.4	10.7	10.9	11.8
Spain	55.9	56.3	55.4	53.8	58.5
France	43.2	43.6	43.8	42.2	41.8
Croatia	11.0	11.6	12.0	12.7	13.8
Italy	15.3	14.9	14.2	15.9	15.4
Cyprus	70.8	71.4	70.2	70.4	72.2
Latvia	10.2	9.9	9.6	10.3	10.1
Lithuania	23.0	24.3	24.5	27.5	21.8
Luxembourg	55.5	53.7	54.0	49.9	50.0
Hungary	9.1	25.0	23.9	24.5	26.3
Malta	72.1	73.4	72.6	72.5	71.8
Netherlands	52.9	53.9	53.4	53.0	61.7
Austria	31.2	31.0	29.9	31.5	31.1
Poland	14.6	14.4	15.0	15.9	16.2
Portugal	36.8	36.1	36.9	36.3	33.8
Romania	6.9	7.3	7.7	7.1	7.2
Slovenia	28.9	30.4	32.0	33.1	34.7

Countries	2017	2018	2019	2020	2021
Slovakia	11.7	12.7	14.0	15.8	15.2
Finland	46.8	46.9	47.5	47.5	46.5
Sweden	38.5	37.5	37.6	37.5	38.4

4.5. Mediation effect

The decrease in functional capacity, assessed through Disability-Adjusted Life Years (DALYs) and hospital discharge trends (Eurostat), facilitated the correlation between tobacco consumption and mortality. Table 10 shows the number of people who leave the hospital with respiratory conditions for every 100,000 people. Countries with high discharge rates (Bulgaria, Lithuania, Romania) often have higher pneumonia death rates and worse social determinants, which shows how housing, healthcare access, disease burden, and outcomes are all connected.

Table 10. Hospital discharges by diagnosis, in-patients, per 100 000 inhabitants

Countries	2017	2018	2019	2020	2021
Belgium	311.2	322.8	320.8	506.3	463.1
Bulgaria	1,221.7	1,245.8	1,269.9	922.0	790.6
Czechia	280.6	297.7	291.1	456.9	869.1
Denmark	:	:	:	:	:
Germany	376.4	378.7	370.4	387.2	466.3
Estonia	320.0	323.8	332.1	293.6	804.8
Ireland	266.8	286.0	283.2	251.7	351.4
Greece	:	:	:	:	:
Spain	259.3	271.7	257.0	422.1	153.1
France	269.4	289.2	287.1	209.1	179.6
Croatia	337.1	324.2	350.4	452.9	756.6
Italy	241.7	250.9	255.3	182.0	139.7
Cyprus	90.1	87.8	88.0	49.0	587.3
Latvia	483.2	488.0	462.2	304.1	228.9
Lithuania	753.1	681.2	662.9	661.0	1,265.2
Luxembourg	:	:	:	:	:
Hungary	379.9	385.0	382.1	260.6	194.9
Malta	263.2	238.5	247.2	175.8	:
Netherlands	205.7	202.2	197.3	124.9	114.7
Austria	390.4	407.1	407.2	283.6	254.1
Poland	334.6	311.2	278.6	215.0	260.4
Portugal	:	394.7	376.9	282.2	217.2
Romania	627.7	647.4	625.2	895.9	1,061.4
Slovenia	429.1	412.0	440.6	507.8	805.8
Slovakia	356.1	354.7	361.8	363.9	840.5
Finland	699.1	665.7	:	453.0	413.3
Sweden	421.4	414.7	407.9	261.4	237.4

5. Conclusion

Social determinants profoundly influence respiratory health disparities throughout the EU Member States. Tobacco serves as a significant mediator, contributing to increased pneumonia mortality through functional deterioration. Addressing these inequities necessitates multi-tiered, equity-oriented policies that integrate preventative, social support, and targeted treatments in high-risk populations.

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