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Review

Does Air Pollution Aggravate Health Problems in Low-Income Countries? Verification from Countries Along the Belt and Road

Xiaocang Xu [1], Yanglin Zhong [1], Shuangshuang Cai [1], Lei Lei [1] and Jian Peng [2,*]

[1] School of Economics and Management/Institute of Sustainable Development, Huzhou University, Huzhou 313000, China; 03122@zjhu.edu.cn (X.X.); 2023381011@stu.zjhu.edu.cn (Y.Z.); 2023381019@stu.zjhu.edu.cn (S.C.); 2023381021@stu.zjhu.edu.cn (L.L.)
[2] College of Philosophy Law & Political Science, Shanghai Normal University, Shanghai 200234, China
* Correspondence: 1000497900@smail.shnu.edu.cn

Abstract: Goal 8 of the Sustainable Development Goals aims to promote sustained, inclusive, and sustainable economic growth. However, most of the countries along the Belt and Road are low-income countries in the initial stages of industrialization, which are also facing serious air pollution and health problems while promoting economic growth. This is also a fact that both China and its partner countries along the Belt and Road need to take into account when it comes to economic cooperation between China and countries along the Belt and Road. This review selected 91 papers from academic databases such as CNKI, Web of Science and Sci-hub from 2013 to 2024 to analyze the impact of air pollution on health in countries along the Belt and Road and compared it with countries not along the Belt and Road. The paper makes the following findings: First, air pollution is very harmful to general health and has produced specific diseases related to lung function and children's respiratory health in countries along the Belt and Road, similar to countries not along the Belt and Road. Second, mortality, mental health, and related health expenditures result from higher air pollution in Belt and Road countries more so than in non-Belt and Road countries. Therefore, when China conducts economic cooperation with countries along the Belt and Road, it should take the Sustainable Development Goals (SDGS) as the direction and fully consider local environmental pollution, social and economic issues, and health issues to ensure the long-term sustainable economic growth of the Belt and Road in the future.

Keywords: sustainable development goals (SDGS); the belt and road; air pollution; health; economic cooperation

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1. Introduction

The Sustainable Development Goal 8 proposed in the 2023 Global Sustainable Development Report (GSDR) aims to promote sustained, inclusive, and sustainable economic growth, which puts forward specific requirements for governments and people on issues such as the environment, society, economy, and health. As a global concern, environmental pollution not only has a major negative impact on human living environments but also poses a major threat to human health [1,2]. In 2015, the United Nations adopted the 2030 Agenda for Sustainable Development Goals, which put forward indicators such as climate change and sustainability, with particular emphasis on ecosystem services and promoting well-being in low-income countries [3]. Low-income countries are usually in the early stages of industrialization or urbanization, often accompanied by a large amount of pollutant emissions, and, therefore, face more serious air pollution problems. This paper

examines whether air pollution exacerbates health issues in low-income countries, with a focus on those along the Belt and Road.

On the one hand, the Belt and Road is an important international cooperation initiative proposed by China in 2013 to strengthen cooperation and exchanges in the economic, political, cultural, and other fields. The co-construction countries cover Asia, Africa, and other regions, and most of them are low- to middle-income countries with relatively backward economic development, low urbanization rates, and serious air pollution problems [4].

On the other hand, health issues are also prominent in countries along the Belt and Road. These countries generally lack medical resources, medical equipment, medicines and professionals, and basic medical services struggle to cover all residents. In addition, the incidence of infectious and parasitic diseases is often high, but these diseases may not be effectively treated due to the limited level of medical care [5,6]. The importance of a country's national health is immeasurable. It is related to economic development, social stability, cultural prosperity, and national image. It is widely accepted that air pollution is a threat to health, but the path and extent of its effects cannot be generalized [7–9]. Therefore, it is still of great significance to study air pollution and health problems in low-income countries along the route.

This paper will analyze and discuss domestic and foreign research results on whether air pollution aggravates health problems in low-income countries through five aspects. This paper fills a gap by focusing on low-income countries along the Belt and Road, an area with limited prior research. While there have been numerous articles examining the relationship between air pollution and health, few have focused specifically on countries along the Belt and Road. The countries along the Belt and Road are mostly low-income countries and face serious environmental pollution and health problems, posing serious challenges for the long-term sustainability of China's cooperation with them. Therefore, this paper systematically reviews the relevant studies on air pollution and health in low-income countries along the Belt and Road, hoping to explore the influencing factors of serious air pollution and health problems in these countries, and provide possible solutions for them.

2. Materials and Methods

The main purpose of this review is to explore whether air pollution aggravates health problems in low-income countries by summarizing previous studies and taking countries along the Belt and Road as cases.

2.1. Search Process

This paper uses keywords such as "pollute", "air pollution", "air contamination", "health", "health condition", "mental health", "environmental pollution", and "disease" to search the Web of Science for SCI-indexed papers, research reports, and works from 2013 to 2024, since the Belt and Road Initiative was launched in 2013.

It should be noted that Belt and Road countries are mainly concentrated in Asia, Africa, and other low- and middle-income countries, while the major European and American-developed countries such as the Group of Seven (the United States, Britain, France, Germany, Japan, Italy, and Canada) and Australia are not included. A small number of low- and middle-income countries, such as India, are also excluded because they have not signed a Belt and Road cooperation agreement with China.

2.2. Inclusion–Exclusion Criteria and Data Extraction Process

Using keywords to search for articles on different academic websites, a total of 127 articles were initially retrieved. Among them, 42 Chinese articles were retrieved using keywords such as "pollution", "air pollution", and "health". After removing 13 low cor-

relation articles, 29 were retained. Using keywords such as "low-income countries", "air pollution", "mental health", and "diseases", 85 English articles were discovered. Due to some articles only having abstracts, the content was too short, and there was limited available information; therefore, these 24 articles were excluded. In addition, 12 articles with poor correlation were also excluded, and 91 articles with high correlation were retained in the end.

Information extracted from all included papers included author, publication date, sample country, study methodology, study purpose, and key findings. All analysis results will be analyzed according to the process in Figure 1.

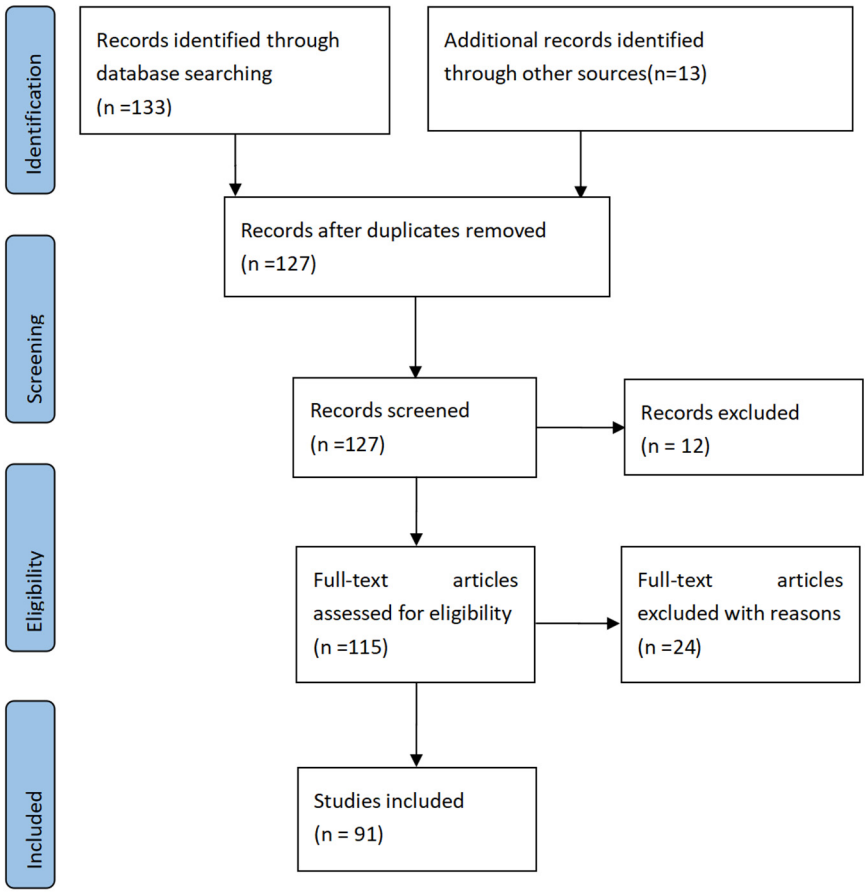


Figure 1. Data extraction process (PRISMA). Note: Moher, D.; Liberati, A.; Tetzlaff, J.; Altman, D.G.; The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med.* **2009**, *6*, e1000097. https://doi.org/10.1371/journal.pmed.1000097 [10].

Relevant information in the paper was first exported to an Excel database through Endnote and duplicate content was removed. The results were initially extracted by one researcher and then cross-checked by another researcher to ensure that all data were filtered and reviewed. If two researchers had different opinions, they jointly reviewed until a final agreement was reached.

2.3. Quality Assessment of the Literature

The Critical Appraisal Skills Program (CASP) was used to evaluate all 91 papers. The CASP checklists cover several categories, such as the CASP randomized controlled trial checklist, the CASP systematic review checklist, the CASP qualitative studies checklist and so on. This paper comprehensively considers the list of questions and selects five questions from it to evaluate the quality of the studies (shown in Table 1).

Table 1. Quality assessment of all studies.

Rank	Author	Was There a Clear Statement of the Aims of the Research?	Was the Research Design Appropriate to Address the Aims of the Research?	Was the Data Collected in a Way That Addressed the Research Issue?	Was the Data Analysis Sufficiently Rigorous?	Is There a Clear Statement of Findings?
1	Ali (2019) [11]	Yes	Yes	Yes	Yes	Yes
2	Hadley, M.B (2018) [12]	Yes	Yes	Yes	Yes	Yes
3	Fotourehchi (2016) [13]	No	Yes	Yes	Can't Tell	Yes
4	Yang et al. (2022) [14]	No	Yes	Yes	Yes	Yes
5	Zou et al. (2016) [15]	Yes	Yes	Yes	Yes	Yes
6	Peel et al. (2013) [16]	No	Yes	No	Can't Tell	Yes
7	Kim et al. (2020) [17]	Yes	Yes	Yes	Yes	Yes
8	Mendoza and Gonzalez (2024) [18]	Yes	Yes	Yes	Yes	Yes
9	Liu et al. (2021) [19]	Yes	Yes	Yes	No	Yes
10	Fan et al. (2019) [20]	No	Yes	Yes	Can't Tell	Yes
11	Millar et al. (2022) [21]	Yes	Yes	Yes	No	Yes
12	Tu et al. (2023) [22]	Yes	Yes	Yes	Can't Tell	Yes
13	Mannucci and Ranchini (2017) [23]	No	Yes	No	No	Yes
14	Li et al. (2023) [24]	Yes	Yes	Can't Tell	No	Yes
15	Anastasaki et al. (2021) [25]	Yes	Yes	Yes	Can't Tell	Yes
16	Ipek and Ipek (2021) [26]	Yes	Yes	Yes	Yes	Yes
17	Yu et al. (2024) [27]	No	Can't Tell	Yes	No	Yes
18	Sun and Li (2017) [28]	No	Yes	Yes	No	Yes
19	Liu et al. (2018) [29]	Yes	Yes	Yes	Yes	Yes
20	Hua et al. (2023) [30]	No	Yes	Yes	Can't Tell	Yes
21	Sram (2020) [31]	No	Yes	Yes	No	Yes
22	Ahmad et al. (2023) [32]	Yes	Yes	Yes	No	Yes
23	Ye and Huang (2022) [33]	Yes	Yes	Yes	Yes	Yes
24	Egondi et al. (2013) [34]	Yes	Yes	Yes	No	Yes
25	Tainio et al. (2013) [35]	No	Yes	Yes	Can't Tell	Yes
26	Schraufnagel et al. (2019) [36]	No	Yes	No	No	Yes
27	Fernandez-Navarro et al. (2017) [37]	Yes	Yes	Yes	Yes	Yes
28	Analitis et al. (2018) [38]	Yes	Yes	Yes	Yes	Yes
29	Lehtomaki et al. (2018) [39]	Yes	Yes	Yes	Yes	Yes
30	Horton et al. (2023) [40])	Yes	Yes	Yes	No	Yes
31	Dons et al. (2018) [41]	Yes	Yes	Can't Tell	No	Yes
32	Xu X et al. (2013) [42]	Yes	Yes	Yes	Yes	Yes
33	Maio et al. (2023) [43]	Can't Tell	Can't Tell	Yes	Can't Tell	Yes
34	Mou et al. (2016) [44])	Yes	Yes	Yes	No	Yes
35	Du and You (2022) [45]	Yes	Yes	Yes	Yes	Yes
36	Liu et al. (2013) [46]	Yes	Yes	Yes	No	Yes
37	Chen et al. (2021) [47]	Yes	Yes	Can't Tell	No	Yes
38	Zainal Abidin et al. (2014) [48]	Yes	Can't Tell	Can't Tell	No	Yes
39	Lelieveld et al. (2018) [49]	Yes	Yes	Yes	No	Yes
40	Raqib et al. (2022) [50])	Yes	Yes	Yes	Yes	Yes
41	Qu et al. (2022) [51]	Yes	Yes	Yes	Yes	Yes
42	Allen et al. (2013) [52]	Yes	Can't Tell	Yes	Yes	Yes

Table 1. *Cont.*

Rank	Author	Was There a Clear Statement of the Aims of the Research?	Was the Research Design Appropriate to Address the Aims of the Research?	Was the Data Collected in a Way That Addressed the Research Issue?	Was the Data Analysis Sufficiently Rigorous?	Is There a Clear Statement of Findings?
43	Mazidi and Speakman (2017) [53]	Yes	Yes	Yes	Yes	Yes
44	Lee et al. (2014) [54]	No	Yes	Yes	No	Yes
45	Knibbs et al. (2018) [55]	Yes	Can't Tell	Yes	Can't Tell	Yes
46	Rodriguez-Villamiza et al. (2015) [56]	Yes	Yes	Yes	Can't Tell	Yes
47	Rumchev et al. (2017) [57]	Yes	Yes	Yes	Yes	Yes
48	Nori-Sarma et al. (2021) [58]	Can't Tell	Can't Tell	Yes	Can't Tell	Yes
49	Nayak and Chowdhury (2018) [59]	Yes	Yes	Yes	Yes	Yes
50	Hao et al. (2018) [60]	Yes	Yes	Yes	Yes	Yes
51	Ceylan (2020) [61]	No	Yes	No	No	Yes
52	Xie et al. (2016) [62]	Yes	Yes	Yes	No	Yes
53	Zhao and Sun (2021) [63]	No	Yes	Yes	Yes	Yes
54	Wang et al. (2019) [64]	Yes	Yes	Yes	Can't Tell	Yes
55	Zhang (2022) [65]	Yes	Yes	Yes	No	Yes
56	Li and Jia (2021) [66]	No	Yes	Yes	Yes	Yes
57	Zhao (2020) [67]	Yes	Yes	Yes	Yes	Yes
58	Raeissi (2018) [68]	Yes	Yes	Yes	Yes	Yes
59	Jia et al. (2023) [69]	No	Yes	Yes	No	Yes
60	Usmani et al. (2021) [70]	Yes	Yes	Yes	No	Yes
61	Chen (2019) [71]	Yes	Yes	Yes	Yes	Yes
62	Song et al. (2022) [72]	Yes	Yes	Yes	Yes	Yes
63	Lee et al. (2020) [73]	Can't Tell	Yes	Yes	Can't Tell	Yes
64	Wang et al. (2024) [74]	Yes	Yes	Yes	No	Yes
65	Liu et al. (2013) [75]	Yes	Yes	Yes	No	Yes
66	Abe and Miraglia (2016) [76]	Yes	Yes	Yes	No	Yes
67	Apergis, N. et al. (2018) [77]	Yes	Yes	Yes	Yes	Yes
68	Badulescu, D. et al. (2019) [78]	No	Can't Tell	Yes	Yes	Yes
69	Gharehchahi et al. (2013) [79]	Yes	Yes	Yes	No	Yes
70	Newell et al. (2017) [80]	Yes	Yes	Yes	Can't Tell	Yes
71	Qiu et al. (2022) [81]	Yes	Can't Tell	Yes	Can't Tell	Yes
72	Ho et al. (2019) [82]	Yes	Yes	Yes	No	Yes
73	Xu et al. (2024) [83]	Yes	Yes	Yes	No	Yes
74	Chen et al. (2022) [84]	No	Yes	Yes	Yes	Yes
75	Xue et al. (2023) [85]	Yes	Yes	Yes	Can't Tell	Yes
76	Feng et al. 2019 [86]	No	Yes	Yes	No	Yes
77	Hekmatpour and Leslie (2022) [87]	Yes	Yes	Yes	Can't Tell	Yes
78	Boogaard et al. (2019) [88]	No	Can't Tell	Yes	Can't Tell	Yes
79	Ang'u et al. (2022) [89]	Yes	Can't Tell	Yes	Yes	Yes
80	Baharane and Shatalov (2024) [90]	Yes	Yes	Yes	No	Yes
81	Desouza et al. (2022) [91]	Can't Tell	Yes	Yes	Can't Tell	Yes
82	Fu et al. (2022) [92]).	Yes	Yes	Yes	No	Yes
83	Wang et al. (2023) [93]	Yes	Yes	Yes	No	Yes
84	Liu (2022) [94]	Yes	Yes	Yes	Yes	Yes
85	Kim and Radoias (2022) [95]	Yes	Yes	Yes	No	Yes
86	Wang and Lu (2020) [96]	No	Yes	Yes	Yes	Yes
87	Zhang and Zhang (2022) [97]	No	Yes	Yes	Yes	Yes
88	Zhu and Lu (2023) [98]	Yes	Yes	Yes	No	Yes
89	Yao and Luan (2023) [99]	Yes	Yes	Yes	No	Yes
90	Hu et al. (2021) [100]	Yes	Yes	Yes	Yes	Yes
91	Dong and He (2019) [101]	Yes	Yes	Yes	No	Yes

Note: https://casp-uk.net/casp-tools-checklists/ (accessed on 25 June 2024).

3. Results

3.1. Air Pollution and General Health

Air pollution has a direct and significant negative impact on the health of residents. For example, particulate matter in the air and toxic elements related to inhalable particulate matter can affect heart rate variability, blood pressure, vascular tension, blood coagulation, and atherosclerosis [11], leading to respiratory symptoms, cardiovascular problems, lung cancer, lung dysfunction, and asthma, even causing severe case mortality [12]. Some of the relevant studies are listed in Table 2.

Table 2. Air pollution and health status.

Category	Author	Sample	Issue	Method	Findings
Belt and Road countries	Fotourehchi (2016) [13]	60 developing countries	The impact of air pollutants on infant mortality and life expectancy at birth	Recursive simultaneous equation model	Improving socio-economic conditions can offset the adverse effects of air pollution
	Yang et al. (2022) [14]	China	Does income inequality exacerbate the impact of air pollution on physical health?	Hierarchical regression model	Air pollution has adverse effects on physical health
	Zou et al. (2016) [15]	Low-income countries	The "health" impact of air pollution on low-income countries	VECM	Environmental and air pollution pose a threat to the health of low-income countries
	Peel et al. (2013) [16]	Global	The potential impact of air pollution on human health	Qualitative analysis	Air pollution may have adverse effects on human health
	Kim et al. (2020) [17]	Indonesian-related data	The long-term effects of air pollution on mental health	Using natural experiments	Exposure to severe air pollution has significant and long-lasting consequences for mental health
	Mendoza and González (2024) [18]	Chile	The relationship between air pollution and SRH	OL and L multivariate models	The higher the level of air pollution, the lower the SRH in Chile
	Liu et al. (2021) [19]	Guangdong Province, China	Environmental degradation and accelerated pace of life	Poisson generalized additive model	Air pollution has an acute impact on the daily mortality rate of women
	Fan et al. (2019) [20]	The Beijing–Tianjin–Hebei region of China	The adverse effects of PM_{10} on the health of residents	Logarithmic linear exposure response function	The health hazards and economic impacts caused by PM_{10} cannot be ignored
	Millar et al. (2020) [21]	Goveld, Pumalanga Province, South Africa	Epidemic of adverse respiratory health consequences among adolescents in hot air pollution areas	Logistic regression	Teenagers living in HPA (High-Altitude Air Pollution Priority Area in South Africa) are adversely affected by air pollution
	Tu et al. (2023) [22]	168 key cities in China	The total health risk of air pollution	MAKESENS model and ARI	The overall decrease in air pollution and health risks in key cities
	Mannucci and Franchini (2017) [23]	Low-income countries	The impact of air pollution on the health of developing countries	Qualitative	Indoor air pollution poses a serious threat to human health
	Li et al. (2023) [24]	Baoding City, China	The impact of indoor air pollution on human health	Health risk assessment methods	Formaldehyde respiratory exposure poses a higher risk of cancer in adults
	Anastasaki et al. (2021) [25]	Rural Crete, Greece	Association between household air pollution and respiratory symptoms	Cross section research	Burning biomass within households may be harmful to them or their children's health
	Ipek and Ipek. (2021) [26]	Low-income countries	The impact of indoor air pollution on household health	Random effects panel discrete-ordered model, etc.	Indoor air pollution and other factors have adverse effects on human health
	Yu et al. (2024) [27]	Hangzhou, China	Health risks of residential waste rooms and surrounding environment	QMRA	The exposure risk of children is much higher than that of adults and the elderly
	Sun and Li (2017) [28]	China	The impact of air pollution on public health of residents	Health production function	Air pollution causes significant damage to the public health of residents
	Liu et al. (2018) [29]	China	The impact of air pollution on public health in China	Hierarchical linear model	The duration of good air quality is positively correlated with health
	Hua et al. (2023) [30]	Tianjin, China	The health effects of six conventional air pollutants	Quantitative assessment of disease burden	The improvement of air quality has achieved positive health benefits
	Sram (2020) [31]	Northern Bohemia	The impact of air pollution on population health in some areas of the Czech Republic	Neurobehavioral assessment system	Air pollutants have adverse effects on the health of the population in mining areas
	Ahmad et al. (2023) [32]	72 developing countries	The impact of air pollution	GMM	The continuous rise in air pollution has had a significant impact on the health of developing countries

Table 2. *Cont.*

Category	Author	Sample	Issue	Method	Findings
Belt and Road countries	Ye and Huang (2022) [33]	China	The long-term impact of the average concentration of $PM_{2.5}$ pollutants	K-means clustering algorithm and 2SLS	Air pollution has a long-term negative impact on the health level of middle-aged and elderly people in China
	Egondi et al. (2013) [34]	Korogoko and Vivandani	The association between perceived pollution and health risks among slum residents	Linear regression method	The perceived level of air pollution is positively correlated with the perceived health risks
Non-Belt and Road countries	Tainio et al. (2013) [35]	Poland	Adverse health effects caused by air pollution	RegCM3	Reducing exposure levels to air particulate matter pollution will reduce adverse effects on health
	Schraufnagel et al. (2019) [36]	USA, Western Europe	The health benefits of reducing pollution at different levels of intervention measures	Qualitative	Air pollution poses a serious threat to human health, affecting almost every person and organ in the world
	Horton et al. (2023) [40]	Wales, UK	How population risks associated with AP vary with age and poverty	Simple statistical analysis	Even low-level AP (outdoor air pollution) can harm health
	Dons et al. (2018) [41]	Dons E, Laeremans M et al.	Questionnaire survey	Mixed effects	The relationship between attention to the health impact of air pollution and the environment

3.1.1. Countries Along the Belt and Road

Most countries along the Belt and Road are experiencing rapid industrialization. With the expansion of production scale, energy consumption and industrial waste generation also increase, which makes air quality worse than in developed countries [13]. In addition, in the Belt and Road countries, most people are living in low-income living conditions. Yang et al. (2022) [14] and Zou et al. (2016) [15] believe that air pollution tends to have a more significant impact on the health of groups with lower economic levels.

First of all, outdoor air pollution such as nitrogen oxides (NOx) and haze have a great impact on human health [16,17]. An individual's perception of air quality and self-reporting of health impacts can reflect the impact of air pollution on health. On the one hand, the higher the level of air pollution, the lower the self-rated health status, as can be seen in research conducted in Chile [18]. On the other hand, air pollution not only directly harms people's physical health, but also indirectly affects the happiness of residents through health impacts [19]. Meanwhile, regions with different levels of economic development exhibit varying impacts on the health of residents when facing air pollution. Fan et al. (2019) [20] and Millar et al. (2022) [21] argue that in densely populated big cities and cities dominated by heavy industry, the health problems of residents caused by atmospheric particulate matter pollution are more significant, and the health prospects of adolescents exposed to severe air pollution for a long time are less optimistic. In addition, people face relatively higher health risks during spring and winter [22].

Secondly, indoor air pollution has also been well-established as harmful to human health. Especially in low-income countries that rely on biomass fuels as their main energy source [23]. Home and office renovations can lead to increased formaldehyde levels, and adults who are exposed long-term to such environments through breathing have a higher risk of cancer [24]. Anastasaki et al. (2021) [25] have noted that the use of unclean fuels for heating and cooking within households can produce harmful pollutants, significantly affecting the health of residents, especially children. Even households with better economic conditions may suffer from the negative impact of indoor air pollution due to the lack of access to clean energy [26]. Other scholars have focused their attention on the selection of home addresses to explore the impact of indoor air pollution on health. The biological aerosols emitted from residential waste rooms pose a hidden danger to the health and safety of on-site workers and surrounding residents [27].

Finally, many studies are studying whether air pollution control can improve public health levels. Research has revealed that considering factors such as economic development, public health measures, and environmental greening, the severity of the impact of air pollution on public health has significantly decreased [28]. Maintaining acceptable air quality levels is crucial for improving public health [29]. Furthermore, Hua et al. (2023) [30] have pointed out that improvements in air quality have led to positive health status improvements, with the reduction of sulfur dioxide (SO_2) emissions being the most significant contribution to health. Meanwhile, reducing PM_{10} pollution will significantly reduce diseases and deaths caused by air pollution, especially cardiovascular mortality [31]. Ahmad et al. (2023) [32] and Ye and Huang (2022) [33] unanimously pointed out that continuously strengthening pollution control measures can significantly improve the health status of elderly people to a certain extent and reduce their risk of chronic diseases. In addition, these measures have a positive impact on life expectancy and healthy life expectancy. During air pollution control, it is crucial to raise public awareness of pollution sources and potential health threats due to the positive correlation between perceived levels of air pollution and perceived health risks [34]. Future climates and fine particulate matter need to be considered in air control [35].

3.1.2. Comparison with Non-Belt and Road Countries

The health problems caused by air pollution in non-Belt and Road countries cannot be ignored [36]. For example, Fernandez-Navarro et al. (2017) studied industrial pollution and cancer in Spain [37]. Analitis et al. (2018) discussed the health effects of air pollution in Europe through temperature changes [38]. Lehtomaki et al. (2018) studied the health effects of ambient air pollution in Finland [39]. Even low levels of outdoor air pollution in Wales are harmful to human health [40]. Moreover, the impact of air pollution on health varies between urban and rural areas and between different sources of air pollution. For example, Dons et al. (2018) [41] found that nitrogen dioxide levels have a higher impact on health than $PM_{2.5}$.

In summary, air pollution poses a universal threat to human health on a global scale. Whether the Belt and Road countries are dominated by high-income countries, or by low-income countries, air pollution and the resulting health damage are the same. However, in contrast, high-income countries, due to earlier industrialization and more sophisticated environmental protection policies, have better air quality and public health than lower-income countries.

3.2. Air Pollution and Specific Diseases

There is a significant correlation between air pollution and specific diseases such as respiratory and cardiovascular diseases [42]. Even if the concentration of pollutants is at a low level, their potential harm cannot be ignored [43]. Some of the relevant studies are listed in Table 3.

Table 3. Air pollution and specific diseases.

Category	Author	Sample	Method	Findings
Belt and Road countries	Maio et al. (2023) [43]	Global	Qualitative	There is a causal relationship between air pollution and acute respiratory diseases
	Mou et al. (2016) [44]	Shanghai, China	Generalized linear Poisson regression model	Air pollution has a greater impact on the respiratory system of women, children, and the elderly
	Du and You (2022) [45]	China	VAR model and VECM model	There is a significant long-term equilibrium relationship between exhaust emissions and the burden of respiratory diseases

Table 3. *Cont.*

Category	Author	Sample	Method	Findings
Belt and Road countries	Liu et al. (2013) [46]	Guangdong Province, China	Poisson generalized additive model	Air pollution has an acute impact on the daily mortality rate of women
	Chen et al. (2021) [47]	Hangzhou, China	The generalized additive model of Pearson regression, etc.	Air pollutants have an impact on the occurrence of diseases in primary school students
	Zainal Abidin et al. (2014) [48]	Malaysia	Multiple logistic regression	Traffic related air pollution may be associated with asthma symptoms in children
	Lelieveld et al. (2018) [49]	Global	Comprehensive exposure response function	Most children die from lower respiratory tract infections caused by air pollution in low-income countries in Asia and Africa
	Raqib et al. (2022) [50]	Araihazar and Matlab, two rural subdivisions in Bangladesh	Multiple linear regression model	Long-term exposure to HAP using BMF can have adverse effects on B lymphocytes in rural women
	Qu et al. (2022) [51]	Hebei Xinxiang	Group research methods	Short term exposure to air pollution may be associated with neurological damage in the elderly
	Allen et al. (2013) [52]	Ulaanbaatar, Mongolia	LUR modeling and mobile monitoring	29% of cardiopulmonary deaths and 40% of lung cancer deaths in the city can be attributed to outdoor air pollution
Non-Belt and Road countries	Lee et al. (2014) [54]	Scotland	Bayesian local conditional autoregressive model	Air pollution is harmful to the respiratory health of Greater Glasgow
	Knibbs et al. (2018) [55]	12 cities in Australia	Cross-section study	Exposure to outdoor NO_2 is associated with adverse respiratory health effects in children
	Rodriguez-Villamiza et al. (2015) [56]	Canada	Qualitative analysis	Outdoor air pollution has adverse effects on the respiratory health of Canadian children
	Rumchev et al. (2017) [57]	Tirupur City, Coimbatore District, Tamil Nadu, southern India	Bivariate analysis	The respiratory symptoms of low-income women and children have increased
	Nori-Sarma et al. (2021) [58]	Mysore, India	Linear mixed-effect model	Air pollution is related to the deterioration of individual lung function

3.2.1. Countries Along the Belt and Road

Since most of the Belt and Road countries are at a low level of economic development, with the rapid development of urbanization and industrialization, the neglect of environmental protection has led to more serious air pollution problems, resulting in respiratory and cardiovascular diseases and other serious diseases.

First of all, air pollution can affect the respiratory system. $PM_{2.5}$, NO_2, and SO_2 are potential threats to the respiratory system, and air pollution has a particularly significant impact on the respiratory health of women, children, and the elderly [44]. Du and You (2022) [45] pointed out the interrelationship between air pollution, national health, and the economy. In the long run, there is a clear balance between per capita Gross Domestic Product (GDP), exhaust emissions, and Disability Adjusted Life Years (DALYs) due to respiratory diseases. The economic losses caused by respiratory diseases caused by air pollution will continue to increase.

Secondly, diseases caused by air pollution are especially prominent among women, children, and the elderly. For women, atmospheric pollutants such as nitrogen dioxide (NO_2), inhalable particulate matter (PM_{10}), and sulfur dioxide (SO_2) are highly susceptible to causing cardiovascular and cerebrovascular diseases in female residents [46]. Children are particularly sensitive to external environmental factors [47]. Zainal Abidin et al. (2014) [48] found that exposure to air pollution related to transportation is likely associated with the occurrence of asthma symptoms in children in Malaysia. The majority of children die from lower respiratory tract infections caused by environmental air pollution in low-income countries in Asia and Africa [49,50], which are basically Belt and Road countries. There are also studies indicating that short-term exposure to air pollution, combined with high-intensity physical labor, may be associated with damage to the nerve tissue of elderly people [51,52].

3.2.2. Comparison with Non-Belt and Road Countries

The problem of diseases caused by air pollution is also serious in non-Belt and Road countries, which are mainly high-income countries. For example, exposure to high en-

vironmental levels of $PM_{2.5}$ might lead to the disproportional risk of type 2 diabetes in mainland USA [53]. Lee et al. (2014) [54] collected air pollution concentrations in various regions of Scotland and found that in the Greater Glasgow region, particulate matter and nitrogen dioxide (NO_2) in the air had a negative impact on people's respiratory health such as children's lungs and immune systems. According to data from Australia [55] and Canada [56], air pollution has adverse effects on children's respiratory health. In India, as a low-income non-Belt and Road country, the impact of air pollution on individual lung function and health is equally serious [57,58]. Nayak and Chowdhury (2018) [59] proved that there was a positive and significant relationship between waste gas emissions levels and the days of respiratory illnesses in Odisha in India.

In summary, air pollution can cause various diseases, especially in the respiratory and cardiovascular systems. Exposure to air pollution can cause serious damage to the respiratory system. In underdeveloped countries along the Belt and Road, the rapid development of environmental pollution has exacerbated this problem, leading to a significant increase in respiratory diseases and other health problems among low-income groups. Due to low-income groups often residing in areas with poor air quality, poor housing, and socioeconomic conditions, the risk of respiratory diseases is increased. In contrast, although residents of high-income countries typically have better access to health care and protective measures, reducing the direct health damage caused by pollution, sensitive groups such as children and women are still highly susceptible, demonstrating the borderless nature of air pollution.

3.3. Air Pollution and Health Expenditure

Air pollution affects people's health expenditure by affecting their health level, which has been verified by many scholars. For example, Hao et al. (2018) [60] used the GMM estimation method and Ceylan (2020) [61] used the Bayesian optimized support vector regression model to verify this. Some of the relevant studies are listed in Table 4.

Table 4. Air pollution and health expenditure.

Category	Author	Sample	Issue	Method	Findings
Belt and Road countries	Xie et al. (2016) [62]	Pollutant emission data in the Beijing Tianjin Hebei region	Health issues caused by $PM_{2.5}$ pollution	Computable general equilibrium models	$PM_{2.5}$ pollution can cause additional health expenses
	Zhao and Sun Jian (2021) [63]	API and AQI in the Qinling and Huaihe regions of China	The impact of air pollution on the demand for commercial health insurance among residents	Fuzzy breakpoint regression	Air pollution has a significant positive impact on the demand for commercial health insurance
	Wang et al. (2019) [64]	2019 Global Burden of Disease Data	The global burden of cardiovascular disease attributed to household air pollution	Regression model	The decrease in cardiovascular disease burden attributed to household air pollution from 1990 to 2019
	Zhang (2022) [65]	$PM_{2.5}$ calculated by CIESIN in 30 provinces of China	The impact of air pollution on health capital at different stages of economic development	Panel threshold model	In recent years, the per capita health capital loss caused by air pollution has shown an exponential increase
	Li and Jia (2021) [66]	Balanced panel data for 2016 and 2018 in China	The impact of air pollution on the health level of residents	Fixed effect model	Women and low-income groups bear greater health and welfare losses due to air pollution
	Jia et al. (2023) [69]	Concentration data of $PM_{2.5}$, PM_{10}, and O_3 in Shanxi Province	The spatial impact of air pollution on public health	Spatial econometric models and ridge regression	The quality of atmospheric environment has a positive impact on the number of people undergoing health examinations
	Usmani et al. (2021) [70]	Data from five research sites from 2006 to 2016	The relationship between cardiopulmonary hospitalization and air pollution	ELSTM	There is a connection between air pollution and hospitalization for cardiovascular and pulmonary diseases
	Song et al. (2022) [72]	Health insurance demand and air pollution data from 283 prefecture-level cities in China	The impact of air pollution on the demand for health insurance	Mediating effect model	Air pollution has significantly increased the demand for commercial health insurance in both the short- and long-term

Table 4. *Cont.*

Category	Author	Sample	Issue	Method	Findings
Belt and Road countries	Lee et al. (2020) [73]	Exposure prevalence data from 183 countries	Health burdens associated with exposure to household air pollution	Meta analysis, etc.	The burden of diseases related to household air pollution has decreased worldwide
	Wang et al. (2024) [74]	Cross-sectional data from 135 countries from 1990 to 2015	The relationship between B-HAP changes and REC structural transformation	SLM, SEM etc.	The countries with high B-HAP are mainly middle- and low-income countries in Africa and Asia
Non-Belt and Road countries	Liu et al. (2013) [75]	Related data for India in 2006	The impact of outdoor air pollution on respiratory diseases	Cluster analysis	There is a strong correlation between respiratory disease diagnosis and emission intensity
	Abe and Miraglia (2016) [76]	Average pollutant levels in São Paulo	The health effects of air pollution	APHEKOM model	The reduction in air pollution levels will lead to a decrease in hospital stays

3.3.1. Countries Along the Belt and Road

In the Belt and Road countries, the capital strength of health investment is relatively weak due to the relatively low-income level. As a result, the quality of medical infrastructure and public health services is relatively poor, leading to higher health expenditures caused by air pollution.

Firstly, there is a significant correlation between air pollution and health expenditure. Although the proportion of health expenditure to GDP in low-income countries is relatively low, air pollution can cause additional health expenditure [62], and this impact has heterogeneity among different populations, mainly reflected in rural areas, among women and low-educated populations [63]. Wang et al. (2019) [64] used a spatial lag model (SLM) and spatial error model (SEM) to analyze data and found that countries with high household air pollution and health burdens are mainly concentrated in middle- and low-income countries in Africa and Asia. Air pollution may cause an exponential increase in per capita health capital losses [65]. Women will also bear greater health welfare losses due to air pollution [66], which will hinder the construction and improvement of medical infrastructure in low-income countries and have a negative impact on social welfare levels. According to the study of Zhao (2020) [67], O_3 pollution has a greater impact on personal medical expenditure in China. When O_3 pollution concentration increases by 10%, personal medical expenditure will increase by 14.6%. Raeissi (2018) [68] found that, for every 1.00% increase in the CO_2 index, public health spending, and private health spending would increase by 3.32% and 1.16%, respectively, between 1972 and 2014 in Iran.

Secondly, the impact of air pollution on health expenditures is mainly reflected in medical treatment and health insurance [69]. Usmani et al. (2021) [70] explored the relationship between cardiopulmonary hospitalization and air pollution using the Enhanced Long Short-Term Memory Model (ELSTM), and the results showed a correlation between the two. In addition to increasing health expenses by affecting hospitalization, air pollution has significantly increased the demand for commercial health insurance [71,72]. The increase in demand for commercial health insurance also indirectly reflects the enhancement of people's health awareness. In recent years, the burden of cardiovascular, pediatric, and maternal diseases related to household air pollution has decreased worldwide, but in most low-income countries, this disease burden is still high [73,74].

3.3.2. Comparison with Non-Belt and Road Countries

In the non-Belt and Road countries, there is also a strong correlation between outdoor air pollution intensity and medical treatment due to respiratory diseases (Liu et al., 2013 [75]). The level of pollution is positively related to the number of inpatients. The reduction in air pollution levels will reduce the demand for hospital care, because the number of inpatients will decrease [76]. Apergis, N. et al. (2018) [77] examined the impact of state-level CO_2 emissions on health care spending in the United States. Badulescu, D. et al. (2019) [78]

explored in depth the relative impact of environmental pollution and NCDS on health expenditure in European Union countries.

To sum up, the aggravation of air pollution has caused significant losses to the health capital of low-income countries along the Belt and Road, directly affecting the investment risk and social benefits of capital and having a certain negative impact on the construction and improvement of medical infrastructure. In addition, the aggravation of air pollution increases the number of inpatients due to respiratory diseases and heart and lung diseases, thus, increasing the demand for medical services, which may lead to or aggravate the shortage of medical resources in low-income countries along the Belt and Road. By contrast, the number of hospitalizations, disease burden, and other additional health expenditures caused by air pollution in high-income countries of the non-Belt and Road countries have a relatively obvious downward trend in recent years. The reasons for this difference could be a number of things; for example, the differences in the level of medical technology and facilities, and the pursuit of a balance between economic growth and environmental protection in different stages of industrialization and urbanization.

3.4. Air Pollution and Mortality Rate

Air pollutants have serious adverse effects on physical and mental health and even death. Some of the relevant studies are listed in Table 5.

Table 5. Air pollution and mortality rate.

Category	Author	Sample	Issue	Method	Findings
Belt and Road countries	Gharehchahi et al. (2013) [79]	Iranian census and air pollution Data	The impact of short-term air pollutants on health	Generalized additive model and AirQ model	Acute exposure leads to an increased risk of incidence rate
	Newell et al. (2017) [80]	Data related to low- and middle-income countries	The impact of air pollution exposure on cardiovascular health	Meta analysis	Short-term exposure is associated with increased cardiorespiratory incidence rate and mortality
	Qiu et al. (2022) [81]	Global	The impact of household air pollution on the lungs	Qualitative research	In low- and middle-income countries, household air pollution is associated with mortality.
	Ho et al. (2019) [82]	PSI calculation based on six air pollutants in Singapore	The relationship between air pollution and all-cause mortality rates	Conditional Poisson regression model and distributed lag nonlinear model	The daily average pollutant standard index is significantly positively correlated with mortality risk
	Xu et al. (2024) [83]	Six concentration data in Xi'an city	Characteristics of air pollution in Xi'an City and its impact on human health	AirQ2.2.3 model, etc.	The total mortality rates attributed to NO_2 and O_3 were 8.76% and 3.67%, respectively
	Chen et al. (2022) [84]	Panel data from 346 cities in China	The impact of average $PM_{2.5}$ concentration on population mortality rate	Exploratory spatial analysis and spatial regression methods	$PM_{2.5}$ concentration has a significant positive impact on population mortality rate
	Xue et al. (2023) [85]	Related data for 97 low- and middle-income countries	The association between long-term ozone exposure and mortality in children under 5-years-old	Cox model and nonlinear exposure response function	Ozone exposure has a significant impact on mortality rates in the age group of low- and middle-income countries
	Feng et al. (2019) [86]	Data on children and adults in eight EU countries and 53 non-EU countries	The impact of energy consumption on child and adult mortality rates	TMDN-DEA model	Child mortality rate higher than adult mortality rate
	Hekmatpour and Leslie et al. (2022) [87]	Data from 169 countries from 1991 to 2017	The trajectory of mortality caused by air pollution	GCM model	The global mortality rate caused by air pollution has been continuously decreasing
	Boogaard et al. (2019) [88]	Global	The impact of air pollution on health	Qualitative research	Death mainly occurs in low- and middle-income countries with increasing air pollution
	Ang'u et al. (2022) [89]	Relevant data from Vihiga County, Kenya	The impact of household air pollution on human health	AirQ+v 2.1 model	Turning to clean cooking techniques can avoid death cases
	Baharane and Shatalov (2024) [90]	Overall mortality rate, annual loss of life, etc., from 1990 to 2019	The total mortality rate caused by air pollution	Multilinear regression model	The total number of deaths caused by air pollution has decreased by 14.26%
Non-Belt and Road countries	Desouza et al. (2022) [91]	Population and health survey data in India	The relationship between air pollution and infant mortality rate	Wald test	There is a strong correlation between exposure to $PM_{2.5}$ and high neonatal mortality rate
	Fu et al. (2022) [92]	Annual average concentration of NO_2 and other pollutants in 2010	The relationship between air pollutants and the risk of hypertension	COX Risk Ratio Regression Model	Both exposure to single and multiple pollutants are associated with an increased risk of developing hypertension

3.4.1. Countries Along the Belt and Road

In the countries along the Belt and Road, especially those with low industrialization and weak economic development, the mortality rate caused by air pollution is high.

First of all, some researchers studied the relationship between air pollution and incidence rate in countries along the Belt and Road. Gharehchahi et al. (2013) [79] found that acute exposure to air pollutants will lead to an increased risk of incidence rate through the assessment of generalized additive model and AirQ models. Acute exposure belongs to the category of short-term exposure, so short-term exposure to particulate pollution has a certain relationship with the increase in incidence rate and even mortality of diseases [80].

Secondly, air pollution brings a higher death rate in the Belt and Road countries. Qiu et al. (2022) [81] found that household air pollution in low- and middle-income countries is associated with mortality from diseases such as acute respiratory infections, chronic obstructive pulmonary disease, and lung cancer. Moreover, even in high-income countries like Singapore, there is a significant correlation between the deterioration of air pollution and the increased risk of death [82]. In Xi'an, the mortality rates attributed to NO_2 and O_3 are as high as 8.76% and 3.67%, respectively [83]. Chen et al. (2022) [84] used spatial regression methods to find a significant positive relationship between urban $PM_{2.5}$ concentration and population mortality rate. In low- and middle-income countries, ozone exposure has a significant impact on the mortality rate of children under 5-years-old [85]. There is also a correlation between environmental exposure to $PM_{2.5}$ and neonatal mortality, ultimately leading to higher mortality rates in children than adults due to air pollution [86]. Compared with high-income countries, the mortality rate of air pollution in low- and middle-income countries is still higher [87–89].

Finally, although air pollution in most low-income countries along the Belt and Road is serious, the government's attention to pollution and prevention efforts are also increasing. Therefore, the total number of deaths caused by air pollution in some East African countries has declined in recent years, by 14.26% in the nearly 30 years from 1990 to 2019 [90].

3.4.2. Comparison with Non-Belt and Road Countries

Even in non-Belt and Road countries, there are deaths that can be directly attributed to air pollution. For example, Desouza et al. (2022) [91] studied the close relationship between environmental air pollution and infant mortality in India and found a strong correlation between environmental exposure to $PM_{2.5}$ and high neonatal mortality. Diseases caused by long-term exposure are usually more severe than those caused by short-term exposure. Therefore, whether exposed to a single or multiple pollutant environment, the risk of disease incidence will increase in the long run [92].

In summary, air pollution can affect the mortality rate of a country. Although the mortality rate from air pollution has decreased globally, this decline mainly occurs in high-income countries, and deaths caused by air pollution still remain at a relatively high level in low-income countries. The mortality rate directly attributed to NO_2 pollutants alone is as high as 8.76% in some regions. In addition, children's immune systems are still in the stage of formation and development, making it difficult to combat air pollutants such as ozone, nitrogen oxides, and particulate matter. Therefore, the mortality rate of children caused by air pollution is higher than that of adults. All these phenomena indicate the importance and urgency of pollution prevention and control in low-income countries along the Belt and Road.

3.5. Air Pollution and Mental Health

There is little research on the relationship between air pollution and mental health (see Table 6). The severity of mental health problems caused by air pollution can vary

from country to country due to differences in resource allocation, income levels, and medical conditions. Countries along the Belt and Road are mostly low- and middle-income countries and often face more severe social and economic development problems, such as poverty and lack of resources, which can lead to more prominent mental health problems that affect individuals' emotions, attitudes to life, and social behavior. For example, if people live in an environment with poor air quality for a long time and it is difficult to breathe fresh air and enjoy natural beauty, then their mental health will inevitably suffer.

Table 6. Air pollution and mental health.

Author	Sample	Issue	Method	Findings
Wang et al. (2023) [93]	Historical air quality data of Hotan City, Xinjiang from 2016 to 2021	The relationship between air quality and potential human health effects	Correlation analysis	The potential harm of air quality to the physical and mental health of residents is relatively high
Liu (2022) [94]	Daily monitoring data of air quality in 122 cities in China	Health depreciation status of air pollution	Health depreciation defect model, etc.	The days of extreme pollution have serious adverse effects on physical and mental health
Kim and Radoias (2022) [95]	Indonesian-related data	The long-term effects of air pollution on mental health	Using natural experiments	Exposure to severe air pollution has significant and long-lasting consequences for mental health
Wang and Lu (2020) [96]	Provincial PM_{10} data in China, etc.	The impact of air pollution on the mental health of the working population	Benchmark regression model	The increase in air pollution levels leads to a significant decrease in mental health levels
Zhang and Zhang (2022) [97]	Air pollution data from counties where Chinese respondents are located, etc.	The impact of air pollution on the mental health of residents	DID and 2SLS	Air pollution significantly reduces the mental health level of residents
Zhu and Lu (2023) [98]	2017 China General Social Survey Data	The impact of air quality on the health of residents	Regressive analysis	Air pollution has a significant negative impact on mental health
Yao and Luan (2023) [99]	2015 and 2018 China Health and Elderly Care Tracking Survey Data	Association between air pollution and depression in middle-aged and elderly populations	Binary logistic regression, etc.	Short-term exposure may increase depressive symptoms in middle-aged and elderly populations
Hu et al. (2021) [100]	Related data for 51 countries from 2010 to 2017	The heterogeneous effects of air pollution on mental health	Tobit random effects model, etc.	Air pollution significantly promotes an increase in depression
Dong and He (2019) [101]	Air pollutant concentrations and other data for each prefecture-level city in China	The correlation between air pollution and the mental health of middle-aged and elderly people	Generalized estimating equations	Air pollution affects mental health by harming physical health

Firstly, the potential harm of air quality to the mental health of residents is relatively high [93,94]. Kim and Radoias (2022) [95] found through a natural experiment in Indonesia that exposure to severe air pollution had significant and long-lasting consequences for mental health. Wang and Lu (2020) [96] showed that an increase in pollution levels led to a significant decrease in the mental health of the working population. Air pollution deteriorates people's mental health by deteriorating their physical health, reducing exercise, and increasing the risk of obesity [97]. In addition to the objective impact of air pollution on mental health, the perception of air pollution also has a significant negative impact on mental health [98].

Secondly, the impact of air pollution on mental health is mainly reflected in depression. Even short-term exposure to air pollution may increase the risk of depression symptoms in middle-aged and elderly populations [99]. Hu et al. (2021) [100] used the Tobit random effects model and mediation effect model, and found that air pollution significantly promotes the increase in depression, and this impact is partially regulated by physical health. Although air pollution can increase the severity of depression, its impact varies among different populations and may even have a significant negative impact on depression symptoms in women with lower socioeconomic status and those aged 45–64. The impact on other populations may be relatively weak [101].

In summary, air pollution has a significant negative impact on mental health. It can directly affect people's psychology and indirectly affect their psychological status through affecting physical health and changing their lifestyle habits. In addition, the impact of deteriorating air quality on mental health is heterogeneous, and the negative impact on women, middle-aged and elderly people, low-income groups, and those with low social status is often more significant. These groups are more likely to suffer from mental

illnesses such as depression when exposed to air pollution. Furthermore, mental health problems caused or exacerbated by air pollution are more pronounced in Belt and Road countries—which are predominantly low-income countries—than in high-income countries. The reasons may include the following: On the one hand, although air pollution is also a problem in high-income countries, governments may have developed and implemented stricter environmental policies and measures to reduce the level of air pollution, which to some extent reduces the mental health problems caused by air pollution. On the other hand, residents in high-income countries generally have higher health awareness and quality of life, pay more attention to their own health and exercise, and have a stronger perception of pollution and knowledge reserve on the hazards of pollution than residents in low-income countries.

4. Discussion

4.1. Main Argument

There have been some review studies on Sustainable Development Goals (SDGS), but their research objectives are mainly concentrated in developed countries such as Italy [3,102], and there are few studies on low-income countries. This paper takes low-income countries along the Belt and Road as the research objective and discusses the Sustainable Development Goals from the perspective of air pollution and health. Since its inception in 2013, the Belt and Road Initiative has been guided by the principles of extensive consultation, joint contribution and shared benefits, and has driven the economic development of all countries. In the process of promoting industrialization, low-income countries along the Belt and Road should not only pay attention to improving economic strength, but also to protecting the environment, improving air quality and improving the health of the population. This paper analyzes the relationship between air pollution and health in countries along the Belt and Road and draws the following conclusions.

First of all, air pollution does great harm to general health and produces specific diseases related to lung function and children's respiratory health in countries along the Belt and Road, which is similar to countries not along the Belt and Road. This shows that air pollution poses a universal threat to human health around the world. Air pollution causes various diseases, especially in relation to respiratory and cardiovascular systems. While non-Belt and Road countries are mostly high-income and residents generally have better access to health care and protection measures that reduce the direct health damage caused by pollution, sensitive groups such as children and women remain extremely vulnerable, demonstrating the borderless nature of the harm of air pollution.

Second, mortality rate, mental health, and associated health expenditure caused by air pollution in Belt and Road countries are higher than in non-Belt and Road countries. The reasons for this difference may include the following: On the one hand, non-Belt and Road countries are mostly high-income countries, and governments have developed and implemented stricter environmental policies and measures to reduce air pollution levels. At the same time, residents usually have a higher health awareness and quality of life, pay more attention to their own health and exercise, and have a stronger perception of pollution and knowledge reserve of pollution hazards. The level of economic development in these countries can also afford to spend more money on health care. On the other hand, most of the countries along the Belt and Road are low-income countries in the early stages of industrialization, and the government is more inclined to economic growth than environmental pollution remediation. As a result, these countries lack effective environmental policy development and enforcement, as well as inadequate funding for health care.

4.2. Policy Implications

Air pollution has a huge impact on the health and disease of people around the world, especially in countries along the Belt and Road, which are mostly low-income countries, and the mortality and mental health problems caused by air pollution are more serious. This is not only related to the insufficient implementation of environmental pollution control policies but is also related to the government and residents' insufficient awareness of the harm of environmental pollution. Therefore, this paper puts forward the following suggestions.

Firstly, from the environmental perspective of the Sustainable Development Goals (SDGS), countries along the Belt and Road should develop a better environmental regulation system and implement more effective air pollution control measures. For example, all cities in China have taken air pollution control as an important task since 2012. However, due to factors such as the level of economic development, there are certain differences in the supervision of environmental pollution control and air quality standards between the eastern region and the western region, which is also one of the reasons why some high-polluting industries have been transferred from Shanghai and other eastern regions to the four western regions [103]. At the same time, the spread of clean technologies and pollution control measures should be promoted through international cooperation and technology transfer to improve environmental governance capacity.

Secondly, from the social perspective of the Sustainable Development Goals (SDGS), the government of countries along the Belt and Road should strengthen public education and raise public awareness of air pollution sources and health risks, for example, by encouraging residents to take action to reduce emissions and provide targeted protection measures for specific groups with high sensitivity, such as children and women. For example, Anastasaki et al. (2021) found that rural areas on the Greek island of Crete experienced reductions in air pollution and respiratory diseases through local community engagement and encouraging households to use clean fuels instead of dirty fuels for heating and cooking [25].

Thirdly, from the health perspective of the Sustainable Development Goals (SDGS), the government of countries along the Belt and Road should gradually increase the proportion of health expenditure to GDP to reduce the public health expenditure and economic burden caused by air pollution. The main objective of increased health spending in low-income countries should be to ensure access to and quality of essential health services, such as vaccinations, maternal health, child nutrition support, and infectious disease control. This is essential to reduce deaths from air pollution and improve the health of the nation. For example, in analyzing mortality and disability-adjusted life years (DALY) in eight East African countries among the Belt and Road, Baharane and Shatalov (2024) found that while the health threat of air pollution remains, the total number of deaths due to air pollution has decreased by 14.26%. In particular, the death rate associated with lower respiratory tract infections (LRI) has decreased by 43.09% since the 1990s. This is due to the fact that these countries have greatly increased health spending and expanded the scope of basic health services for their populations [90]. Furthermore, international cooperation needs to be sought to secure financial assistance from high-income countries at relevant international conferences, such as the United Nations Climate Change Conference (COP29), which was recently held in Baku in November 2024, to help low-income countries improve their environmental governance capacity and reduce the spatial diffusion of air pollution.

Finally, from the economic perspective of the Sustainable Development Goals (SDGS), considering the economic development level and medical conditions of the Belt and Road countries, China's investment cooperation and industrial cooperation in these countries must take into account environmental pollution and health problems of the local peo-

ple [104]. Only in this way can the long-term sustainability of the Belt and Road construction be ensured; for example, China has provided financial support such as interest-free loans for environmental pollution control and health, infrastructure capacity building, technical assistance, and partial transfer to low-income countries along the Belt and Road, such as Cambodia and Myanmar. At the same time, in response to the needs of environmental governance and health, China can consider strengthening in-depth cooperation with these countries in the health industry and the new energy industry.

5. Conclusions

The Sustainable Development Goal 8 aims to promote sustained, inclusive, and sustainable economic growth. This paper explores the relationship between air pollution and health in low-income countries along the Belt and Road. which fills a gap by focusing on low-income countries along the Belt and Road, an area with limited prior research. The study found that countries along the Belt and Road share similarities with non-Belt and Road countries in terms of the health hazards of air pollution. However, mortality, mental health, and related health expenditures due to air pollution are higher in Belt and Road countries than in non-Belt and Road countries. Therefore, China should consider its long-term economic cooperation with countries along the Belt and Road in different aspects of the Sustainable Development Goals (SDGS), including environmental, social, economic and health aspects. Of course, our research still has some room for expansion. For example, the deep-seated reasons behind the differences in air pollution and health between Belt and Road countries and non-Belt and Road countries needs to be further explored. Finally, due to the limitation of authorities and resources, the collected literature cannot fully cover all low-income countries along the Belt and Road, and the relevant data and literature of some low-income countries are difficult to obtain.

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