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# Industrialization, Greenhouse Gas Emission And Its Health Outcomes In South Asian Countries

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**Abstract:**
The aim of the following study is to show the environmental consequences of industrialization and greenhouse gas emissions in selected South Asian countries for the time period 2000–2020 by using PMG-ARDL. Infant mortality is a dependent variable while industrialization, greenhouse gas emissions, urbanization, and renewable and nonrenewable energy consumption are used as independent variables. The results show that industrialization and greenhouse gas emissions have a positive impact on infant mortality rates, while renewable energy and urbanization have a negative impact on infant mortality. Furthermore, the results show that there is cross-sectional dependency among all variables in selected countries, which reveals that all these countries should make collaborative strategies to decrease infant mortality rates to cope with the problem of health issues.

**Keywords**: Industrialization, Greenhouse Gas, Emissions, Renewable Energy, Non-Renewable energy, Infant Mortality,

## Introduction

Advanced health facilities and a clean environment are vital for economic and human development. Different countries in the world have different situations in different sectors of the economy. Child mortality appears as a global challenge issue, with dangerous consequences for the human race, because child mortality is defined as a child under the age of five who survives. There are many social, environmental and economic factors that are affecting the adult and infant mortality rate. According to the United Nations International Children's Emergency Fund (UNICEF), children’s survival has improved significantly in recent decades, with 1 in 11 children dying before their fifth

birthday in 1990 compared to 1 in 26 in 2017. United Nations Children's Fund (UNICEF), 2019.

Energy is essential for every country's economic growth, since it provides the basis for progress in all economic sectors. However, the benefits of utilizing energy in various economies differ due to differences in energy use and the type of energy used in different economies. Nowadays, all over the world, energy consumption is increasing rapidly because energy consumption is essential for industrialization, production of electricity, and running the other sectors of the economy. Different countries in the world use different kinds of energy resources. Most developed countries use clean energy, which is environmentally friendly and not harmful to human health because it produces little to no amount of pollution. However, non-developed and underdeveloped countries preferred cheap energy, also known as non-renewable energy, which is inexpensive but harmful to health and the environment. Global energy demand is increasing as a result of its importance.

Renewable energy is environmentally friendly and most advanced countries have adopted renewable energy resources. Developing countries also need to adopt these kinds of sources, but the production of renewable energy resources is less than non-renewable resources.

The release of greenhouse gases (GHG) from nonrenewable energy sources is the primary cause of environmental degradation and air pollution, which in turn causes infant mortality. The earth's temperature would be lower if greenhouse gases were not present, but their abundance is harmful to the environment and human health. Because of greenhouse gas emissions, global warming has become a great threat to human health. Furthermore, global warming is linked to CO2 emissions, which are produced by humans. different human activities. Carbon emissions, such as those caused by the emission of greenhouse gases and carbon dioxide, have, on the other hand, resulted in negative externalities all over the world.
This is because energy use, especially fossil fuels, has proven to have a detrimental effect in the form of environmental damage, poor health outcomes, and lower life expectancy, along with industrialization. (Mesagan and Ekundayo, 2015). Both types of energy use have impact on human health differently. Renewable energy is not harmful to health and it does not increase the mortality rate in Sub-Saharan Africa. Health problems and high mortality were caused by industrial production and the use of coal energy in rural areas of the country (Hanif (2018).

The textile industry is the biggest cause of air pollution. According to the WHO report, PM air pollutants increased 5% in the host country due to the industrial sector and traffic. This particular matter had small particles which could easily enter the human body and cause respiratory diseases and harm to the human body. PM air pollutants are created through the use of energy, which is primarily non-renewable. As the population of the

host nation grows at a rapid rate, so does the amount of energy consumption. To meet the expansion of theeconomy as a whole, industrialization will rise to make energy usage grow more energyand thus create PM air pollution.
The child mortality rate has declined sharply in the last three decades. The ratio of child deaths before reaching the age of five was 1 out of 11, while it was 1 out of 27 in 2019. Despite all this progress, child mortality is still a major issue that needs urgent concern. About 14,000children under the age of five die each day[*]. Industrialization is vital for economic wellbeing,and energy is as essential for industrialization as fuel is for running cars and other fuel-consuming machinery. So, energy consumption is critical for every country's development since it serves as the foundation for growth in all areas of the economy.

The present research also finds that how much greenhouse gases, industrialization, and both kinds of energy consumption have an impact on the infant mortality rate. The greenhouse gas emissions, smoke, and other issues generated by industrialization and the consumption of non-renewable energy are the great issues of South Asian countries which have badly impacted human health and have increased the mortality rate. From 2015 to 2020, Pakistan had the highest child mortality rateof all South Asian countries for every 1000 births. 61 infant deaths are estimated in Pakistan,32 in India, 28 in Nepal, 27 in Bangladesh, and 8 in Sri Lanka.

**Literature Review:**

Jensen et al., (2013) investigated the relationships between health and greenhouse gas emissions in the case of the UK Their findings showed that greenhouse gases are negatively related to health benefits. The research indicated some measures to reduce greenhouse gas emissions by the year 2030. Results indicated that health would be improved if greenhouse gas emissions were reduced in the case of the UK, and a systematic plan of action concerning transport, food, and agriculture sectors must be chosen to reduce greenhouse gas emissions toimprove health.

Astrom et al. (2016) elaborated on the impact of weather patterns on population health before and after industrialization in the case of a single country, Sweden, over the period from 1800 to 1950. According to the generalized additive regression used in the analysis, both factors, higher temperature and higher amount of precipitation reduce the mortality rate in the medium and long run.

Hanif (2018) estimated the impact of renewable and nonrenewable energy consumption on human health in the case of sub-Saharan Africa during the period from 1995to 2015. For the analysis of the data, the author used the GMM (generalized method of the moment). The findings showed that for heating, cooking, and lighting, people mostly used both fossil fuels and solid fuels in sub-Saharan Africa, which caused tuberculosis

[*] https://data.unicef.org/topic/child-survival/under-fivemortality/#%3A~%3Atext%3DThe%20global%20under-five%20mortality%20rate%20declined%20by%2059%20per%2Ca%20matter%20of%20urgent%20concern

and increased mortality among human beings, 11 which reduced life expectancy. While the use of renewable energy does not generate greenhouse gases that give positive outcomes for human health.

Maathew et al., (2018) investigated the long-run impact of greenhouse gas emissions on health outcomes in Nigeria from 1985 to 2016. The Autoregressive distributed lag model (ARDL) was used to estimate the impacts of GHG emissions on health. According to the findings, greenhouse gas emissions harm life expectancy and have a positive with the mortality rate. Increasing government health care expenditure would improve public health.

Safdar et al., (2019) checked the impact of energy consumption and environmental degradation on the economic growth of 50 developing countries during the period from 1990 to 2016. By using the pooled mean group method, findings showed that environmental degradation and the use of energy are a danger to human health. The research suggests that these countries should use renewable energy. Renewable energy will increase economic development without affecting the environment or human health.

Hanif et al., (2019) elaborate on the causal links among nonrenewable energy, growth, CO2 emissions, and human capital in the case of 15 developing Asian countries during theperiod from 1990 to 2013. The ARDL model was used to analyze the panel data. The results indicated that advanced economic growth increased the level of CO2, which is the cause of environmental degradation in these Asian countries.

Maji and Sulaiman (2019) investigated the impact of renewable energy on economic growth in the cases of 15 West African countries over the period from 1995 to 2014. The study used the panel dynamic ordinary least squares for analysis. The findings confirmed that in these countries, nonrenewable energy consumption slows economic growth and increaseshealth risks, whereas clean energy consumption is not harmful to human health or the environment. The policy measures suggest that clean energy should be used in West African countries.

Usmani et al., (2020) explored the impact of fossil fuels and industrialization on climate change in the case of Malaysia. The land-use regression model is used for analyses. Findings indicate that air pollution is a significant problem in Malaysia due to industrialization in recent times and due to climate change mortality also increasing.

Safdar et al., (2020) evaluated the impact of greenhouse gases, non-renewable energy consumption, renewable energy consumption, population growth, industrialization, and environmental degradation on human health, with a key emphasis on TB incidents in the caseof a single country, Pakistan, from 1986 to 2017. The results revealed that the use of nonrenewable energy positively correlated with tuberculosis. The findings also suggested that the use of renewable energy improved the environment, reducing greenhouse gases and improving human health.

Majeed et al. (2021) elaborated on the impact of energy consumption on human healthin 155 countries. The results indicated that health is improved by using clean energy and that it increases the expectancy of life and decreases mortality. Research has shown a positive relationship between clean energy and life expectancy, while negatively related to mortality.

Naeem et al. (2021) investigated the impact of CO2, income inequality, and urbanization on infant mortality in the case of Pakistan during the years 1975 to 2013. Simple regression is used for analysis. Results indicated that increased healthcare facilities were similarly shown to reduce children's mortality for a short period, but the connection reversed in the long run. In the near term, urbanization looked to be a factor that reduced child mortality. While wealth disparity continues to be inversely associated with the death of children.

**Data and Methodology:**

This section specifies the variables that will be analyzed to determine the effects of energy, industrialization, and greenhouse gas emissions on human health in the case of selected SouthAsian countries. The variables are chosen based on their theoretical and empirical implications. The dependent variable is infant Mortality and the independent variables include industrialization, greenhouse gas emissions, urbanization, nonrenewableenergy, and renewable energy consumption.

a: **Time Period:**

The time period is selected during 2000-2020 to check the impact of different factors on themortality rate in the case of selected South Asian countries

b: **Sources of Data:**

To check the impact of energy, greenhouse gas emissions, and industrialization on infant mortality in South Asian countries, The study used secondary data and the World Development Indicator (WDI) is the source of the data.

c: **Model specification:**

In this model, we took greenhouse gas emissions, industrialization, urbanization, nonrenewable and renewable energy consumption as independent variables and checked the impact of all these variables on the infant mortality rate.

Infant Mortality rate = f (Greenhouse gases, industrialization, urbanization, non-renewable energy, renewable energy)

Inf Mort = f (GHGE, INDS, URB, NONRE, RENE)

Here, infant mortality is the function of greenhouse gas emission, industrialization, urbanization, nonrenewable energy, and renewable energy consumption.

$$Inf\ Mort = \alpha 0+\alpha 1GHGEit+\alpha 2INDSit+\alpha 3URBit+\alpha 4\ NONREit+\alpha 5\ RENEit+\mu it$$

Whereas,
INF Mort = Death crude rate as the proxy of infant mortality rate.
GHGE = total greenhouse gas emission.
INDS = Industrialization.
URB = life in a big city ass the proxy of urbanization
NONRE = fossil fuels energy as proxy of non-renewable energy.
RENE = energy use as proxy of renewable energy.
μ = erro term
i =countries
t = time period

The study used the panel ARDL technique to check the long-run association among dependent and independent variables. In the above model, α0 is intercept while α1, α2, α3, α4 and α5 arethe coefficients of independent variables. Greenhouse gas emission industrialization and non-renewable energy consumption are positively related to infant mortality while urbanizationand renewable energy consumption are negatively related to infant mortality.

**Results and Discussion**

This segment gives unit root and ARDL estimates of this model. The results are as follows:

a: Unit Root test:

To check whether the data is stationary or not, we use the panel unit root test presented by Dickey and Fuller. The results attained by this test are as follows.

**Table 1: Unit Root Test:**

| Variables | Level Of Stationary |
|---|---|
| **Infant Mortality** | I (0) |
| **Greenhouse Gases Emissions** | I (0) |
| **Industrialization** | I (0) |
| **Urbanization** | I (0) |
| **Nonrenewable Energy** | I (1) |
| **Renewable Energy** | I (1) |

**Source:** By using E-views 11 researcher's own calculations.

The results show that the stationary level of all the selected variables for the model is high. There exists a mixed stationary level at the level I (0) or first difference I (1) since certain variables become stationary at a level while others become stationary at the first difference. For themixed stationary level panel, the ARDL approach is suitable. Before going to discuss the panel ARDL results, we check the co-integration of variables by using the KAO test. This estimation method has been demonstrated for this purpose.

**Table 2: Panel co-integration Results of Dependent and Independent Variables:**

| | Panel Co-integration | |
|---|---|---|
| | **T-Statistics** | **Prob*** |
| **KAO Test** | **-1.974551** | **0.0242** |

**Source:** By using E-views11researcher'scalculation.

Table 2 displays the results of the Co- integration test. Results indicate that there is a long-term relationship among the dependent and independent variables in the case of some South Asian countries.

**ARDL Estimates of Model:**

Table3 gives the results of the short-run and the long run of ARDL

**Table 3: ARDL Estimates of Model:**

| **Panel ARDL Long Run Results** | | | | |
|---|---|---|---|---|
| **Variables** | **Coefficient** | **St. Error** | **t-Statistics** | **Prob.*** |
| **GHGE** | 0.0012 | 3.58E-06 | 3.330784 | **0.002** |
| **INDS** | 0.059 | 0.014158 | 4.159117 | **0.000** |
| **URB** | -0.105 | 0.032658 | -3.213249 | **0.003** |
| **NONRE** | 0.098 | 0.016535 | 5.961142 | **0.000** |
| **RENE** | -0.013 | 0.002493 | -5.575273 | **0.000** |
| **Panel ARDL Short Run Results** | | | | |
| **Variables** | **Coefficient** | **St. Error** | **t-Statistics** | **Prob.*** |
| **COINTEQ01** | -0.133161 | 0.048142 | -2.766001 | **0.0085** |
| **D(GRHG)** | 7.70E-06 | 1.09E-05 | 0.705671 | **0.4845** |
| **D(GRHG(-1))** | 9.49E-06 | 1.35E-05 | 0.703968 | **0.4855** |
| **D(INDS)** | -0.016367 | 0.012232 | -1.338010 | **0.1885** |
| **D(INDS(-1))** | -0.002568 | 0.001125 | -2.282325 | **0.0279** |
| **D(URB)** | -0.378358 | 0.415648 | -0.910284 | **0.3681** |
| **D(URB(-1))** | -0.748874 | 1.172475 | -0.638712 | **0.5267** |
| **D(NONRE)** | -0.019763 | 0.006124 | -3.227265 | **0.0025** |
| **D(NONRE(-1))** | -0.006738 | 0.014681 | -0.458958 | **0.6487** |
| **D(RENE)** | 0.002983 | 0.001617 | 1.844719 | **0.0725** |
| **D(RENE(-** | 0.000372 | 0.000681 | 0.545939 | **0.5881** |

| | | | | |
|---|---|---|---|---|
| **1))** | | | | |
| **C** | **1.040980** | **0.516604** | **2.015044** | **0.0507** |

**Source:** By using E-views11 researcher's calculation.

The panel ARDL technique is used to define the long-run association between dependent and independent variables in the table above. The independent variable greenhouse gas emission has a coefficient value of 0.0012 which reveals a positive and significant association with infantmortality rate. According to the findings, every unit increase in greenhouse gas emissions causes a 0.0012-unit increase in infant mortality. The results are displayed in some preceding studies, such as Haines et al. (2006) and Nowak, D. J. (2019).

The industrialization has a 0.058 coefficient value which reveals a positive and significant association with infant mortality rate. The positive and statistically significant findings revealed that one unit increase in industrialization causes a 0.0588-unit increase in mortality rate. The positive and significant association has also been discussed in previous studies like Hanashim, & Tomobe. (2012) , Xu, C et al (2019) and Usmani et al (2020).

The next independent variable is urbanization, and its coefficient value is -0.105 which shows a negative and significant relationship with the infant mortality rate. This result reveals that a one-unit increase in urbanization will cause an a-0.105unit decrease in the infant mortality rate. These results are also discussed in preceding studies such as Bandyopadhyay, S., & Green, E. (2018) and Vögele, J. (2000), and Davenport, R. J. (2020).

Renewable energy is another independent variable that has a coefficient value of 0.098 which shows a positive and significant relation between infant mortality rate and non-renewable energy consumption. The results explain that a one-unit increase in the use of non-renewable energy consumption led to a 0.098 unit increase in the infant mortality rate. These results are also discussed in preceding studies such as Anser et al. (2020) and Asghar et al. (2019).

Finally, renewable energy as an independent variable has a coefficient value of-0.0134, which indicates the negative and significant relationshipbetween infant mortality rate and renewable energy consumption. The results indicate that a one-unit increase in renewable energy consumption -0.013898 decrease in infant mortality rate results is also discussed in previous studies such as Ogundipe et al. (2018), Hanif (2018), and Ito (2017).

So, all the long-run outcomes of Panel ARDL shows the significant effect of all independent variables i.e. greenhouse gas emission, industrialization, urbanization and both kind of energy uses the dependent variable infant mortality rate in case of south

Asian countries. Greenhouse gas emissions, industrialization, and non-renewable energy consumption are significantly and positively related to the infant mortality rate, while renewable energy andurbanization have a negative but significant association with the infant mortality rate

To check the cross dependency between different variables, cross-sectional dependency tests apply

**Table 4: Cross-Sectional Dependency Test:**

| Test | INFMR | GHGE | INDS | URB | NONRE | RENE |
|---|---|---|---|---|---|---|
| **Breusch-paganLM** | 124.40* | 178.70* | 8.68* | 143.92* | 81.90* | 10.552* |
| **Pesaran scaledLM** | 25.580* | 37.723* | -0.29* | 29.945* | 16.07* | 21.359* |
| **Bias-corrected scaledLM** | 25.455* | 37.598* | -0.41* | 29.820* | 15.95* | 21.234* |
| **Pesaran CD** | 8.0287* | 13.326* | -0.09* | -1.425* | 8.021* | 8.3313* |

**Source:** ByusingE-views11 researcher's calculation.

[Notes: *,**and ***denotethe10%,5%and 1% levels of significance, respectively.]

The above table shows the cross-sectional dependence among the variables. All variables aresignificant at 10% so we reject the null hypothesis and accept our alternate hypothesis that there is the dependency between any two cross-sections.

## Conclusion

Although industrialization is vital for the economic growth of any country, it is not possible without energy consumption. So, energy consumption is necessary for the development of any economy, but it also has significant disadvantages for the environment and human health.The study examines both renewable and non-renewable energy use by the industrial sectors and the consequences these have on human health. The main emissions of greenhouse gases from industry originate from fossil fuel energy-burning and from specific chemical processes needed to manufacture products from raw materials. The findings of an earlier investigation are described in this study, and references for more information are also provided. The sources from which the data is collected are also discussed. This research examined the use of renewable and nonrenewable energy by the industrial sector, as well as the impacts of both types of energy on infant and adult mortality. Energy obtained from renewable energy sources such as the sun, wind, and the air is safe for human health and does not contribute to

greenhouse gas emissions. However, the energy obtained from nonrenewable energy sources,particularly from the use of fossil fuels, generates greenhouse gases that are hazardous to the environment as well as to residents' health and increase total mortality. In selected South Asian countries, both types of energy are used to meet energy demands, so both types of energy are examined in this study. Mortality is still a key concern with the improvement of technology and health services, which we highlighted in the entire research.

Previous research has shown that non-renewable energy use is the cause of greenhouse gas emissions, which cause environmental degradation and are damaging to human health, increasing newborn mortality and adult mortality, which is being studied in several studies. There is relatively little research that covers industrialization, greenhouse gas emissions, urbanization, both kinds of energy consumption, and their general relationship to mortality rate, and only a few papers are present in this respect. Therefore, we investigated this issue. Non-renewable energy consumed by the industrial sector generates greenhouse gasemissions and causes air pollution that is the cause of the adult and infant mortality rate. Ash and greenhouse gas emissions are not guaranteed with renewable energy. Our research discovered a negative relationship between child mortality and renewable energy use, demonstrating that renewable energy usage does not increase child mortality. Our findings support preceding research [Hanif et al (2018); Safdar et al (2020)]

**Recommendations**

Several policy measures should be advantageous for policymakers to establishpolicies that may be useful in reducing the infant mortality rate caused by energy use. Someof these are as follows:

- We should switch from non-renewable to renewable energy sources since nonrenewable energy has a significant health cost.

- To prevent air pollution and harm to human health, environmentally friendlyenergy generation techniques must be implemented.

- It is suggested that the best energy-obtaining knowledge be formed across all energy-consuming sectors so that they can convert to environmentally friendly energy sources and reduce infant and adult mortality rates.

- Access to renewable energy should be less expensive than any non-renewable energysource to boost the economy and reduce the infant and adult death rate

- The government and the public should plant more and more trees to clean up the environment. Trees absorb the Co2 and clean the environment, this strategy

improveshuman health.

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