

- Research Article
- [Published: 09 January 2022](#)

# Modeling mortality rates and environmental degradation in Asia and the Pacific: does income group matter?

- [Suborna Barua](#),
- [Bosede Ngozi Adeleye](#),
- [Darlington Akam](#),
- [Ifeoluwa Ogunrinola](#) &
- [Mohammad Musa Shafiq](#)

[Environmental Science and Pollution Research](#) **volume 29**, pages30548–30567 (2022)[Cite this article](#)

- **236** Accesses
- **1** Citations
- [Metricsdetails](#)

## Abstract

This two-dimensional study makes significant incursions into the health-environment literature by interrogating whether non-renewable energy moderates the impact of environmental degradation on mortality rates. It further aligns with the 2030 United Nations Sustainable Development Goals and 11, which aim to *ensure healthy lives and promote well-being for all at all ages and make cities and human settlements inclusive, safe, resilient and sustainable*. It contributes to the health-environment literature by investigating the intrinsic relationships among mortality rates, carbon emissions (environmental degradation), and non-renewable energy consumption. The study uses an unbalanced sample of 42 Asia and Pacific countries to determine (1) whether carbon emissions exaggerate the incidence of mortality rates and (2) if the interaction of non-renewable energy with carbon emissions

enhances or alters the impact of carbon emissions on mortality rates. Consistent findings from the panel spatial correlation consistent least-squares dummy variables (PSCC-LSDV) and two-step system generalized method of moments (GMM) techniques reveal that (i) carbon emissions exacerbate mortality rates; (ii) non-renewable energy consumption exhibit mortality-reducing properties; (iii) non-renewable energy attenuates the impact of carbon emissions on mortality rates, (iv) persistency in mortalities occurs; and (v) the health-environment-energy dynamics differ across income groups. The paper's conjecture is expected to channel a new line of discourse on how non-renewable energy influences the environment and health outcomes.

This is a preview of subscription content, [access via your institution](#).

Access options  
Buy single article

Instant access to the full article PDF.

34,95 €

Price includes VAT (Nigeria)  
Tax calculation will be finalised during checkout.

Buy article PDF

[Rent this article via DeepDyve.](#)

[Learn more about Institutional subscriptions](#)

## Data availability

---

Data are available in public sources and can be supplied upon request.

## Notes

---

1. For simplicity, *mortality rate* refers to both infant and under-5 mortality rate except where either is specifically mentioned.
2. No low-income classification.
3. Weighted least squares.
4. We use income groups rather than country dummies because the latter will require 42 dummy variables which will significantly weaken the efficiency of the estimator. Hence, 3 income group dummies are created

which align with the objectives of this paper. The dummy for high income countries is the base income group dummy variable.

5. The number of countries in each income group: high income (11), lower-middle income (20), and upper-middle income (11). Since the time span is only 11 years, only the lower-middle income countries meet the criteria for performing sys-GMM and because this will make a comparative analysis impossible, this approach is dropped. Hence, only the PSCC-LSDV approach is used for comparative analysis.
6. Total impact of carbon emissions on infant mortality rate is calculated as:  $\frac{\partial \ln MINF}{\partial CO_2 PC} = 0.4586 - 0.0427 ENUPC$ ; where *ENUPC* can be evaluated at the mean, lowest, or highest values.

## References

---

- Achilleos S, Al-Ozairi E, Alahmad B, Garshick E, Neophytou AM, Bouhamra W, Yassin MF, Koutrakis P (2019) Acute effects of air pollution on mortality: A 17-year analysis in Kuwait. *Environ Int* 126(March):476–483. <https://doi.org/10.1016/j.envint.2019.01.072>
- 

### [CAS Article](#) [Google Scholar](#)

---

- Adeleye N, Eboagu C (2019) Evaluation of ICT Development and economic growth in Africa. *NETNOMICS: Economic Research and Electronic Networking* 20(1):31–53. <https://doi.org/10.1007/s11066-019-09131-6>
- 

### [Article](#) [Google Scholar](#)

---

- Adeleye BN, Adedoyin FF, Nathaniel S (2020) The criticality of ICT-trade nexus on economic and inclusive growth. *Inf Technol Dev.* <https://doi.org/10.1080/02681102.2020.1840323>
  - Adusei M, Adeleye N (2020) Credit Information sharing and non-performing loans: the moderating role of creditor rights protection. *International Journal of Finance and Economics* 1–14. <https://doi.org/10.1002/ijfe.2398>
-

- Adusei M, Adeleye N, Okafor A (2020) Drivers of credit union penetration: an international analysis. *Managerial and Decision Economics*:1–14. <https://doi.org/10.1002/mde.3267>
  - Ali A, Audi M (2016) The impact of income inequality, environmental degradation and globalization on life expectancy in Pakistan: an empirical analysis. MPRA Paper No. 71112, February
  - Amuka JI, Asogwa FO, Ugwuanyi RO, Omeje AN, Onyechi T (2018) Climate change and life expectancy in a developing country: evidence from greenhouse gas (CO<sub>2</sub>) emission in Nigeria. *Int J Econ Financ Issues* 8(4):113–119
- 

### **[Google Scholar](#)**

---

- Arellano M, Bover O (1995) Another look at the instrumental variable estimation of error-components models. *J Econ* 68(1):29–51
- 

### **[Article Google Scholar](#)**

---

- Asongu SA, Le Roux S, Biekpe N (2017) Environmental degradation, ICT and inclusive development in Sub-Saharan Africa. *Energy Policy* 111(December):353–361
- 

### **[Article Google Scholar](#)**

---

- Balani E (2016) Environmental quality and its human health effects: a causal analysis for the EU-25. *Int J Appl Econ* 13(1):57–71
- 

### **[Google Scholar](#)**

---

- Barua S (2019) Financing sustainable development goals: a review of challenges and mitigation strategies. *Bus Strat Dev* 3(3):277–293
- 

### **[Article Google Scholar](#)**

---

- Barua S., Nath S.D. (2021) The impact of COVID-19 on air pollution: Evidence from global data. *Journal of Cleaner Production*, 126755. DOI: <https://doi.org/10.1016/j.jclepro.2021.126755> 8
-

- Barua S (2021a) Energy-Green growth and energy transition: An assessment on selected emerging economies. In: Shahbaz M, Tiwari A, Sinha A (eds) Energy-Growth Nexus in an Era of Globalization (Chapter 15). Elsevier, The Netherlands.
- 

### **[Google Scholar](#)**

---

- Barua S (2021b) Human capital, economic growth, and sustainable development goals: an evaluation of emerging economies. In: Shahbaz M, Mubarik MS, Mahmood T (eds) The Dynamics of Intellectual Capital in Current Era, Springer (Singapore)
  - Barua S, Aziz S (2021) Making Green Finance Work for the Sustainable Energy Transition in Emerging Economies. In: Shahbaz M, Tiwari A, Sinha A (eds) Energy-Growth Nexus in an Era of Globalization (Chapter 16). Elsevier, The Netherlands.
- 

### **[Google Scholar](#)**

---

- Barua S, Chiesa M (2019) Sustainable financing practices through green bonds: what affects the funding size? Bus Strateg Environ 28(6):1131–1147
- 

### **[Article Google Scholar](#)**

---

- Becker G (1994) The economic way of looking at behavior. J Polit Econ 1994 101(3):385–409. <https://doi.org/10.1086/261880>
- 

### **[Article Google Scholar](#)**

---

- Bellemare MF, Masaki T, Pepinsky TB (2017) Lagged explanatory variables and the estimation of causal effect. J Polit 79(3):949–963. <https://doi.org/10.1086/690946E>
- 

### **[Article Google Scholar](#)**

---

- Boachie MK, Ramu K, Põlajeva T (2018) Public health expenditures and health outcomes: new evidence from Ghana. *Economies MPDI* 6(58):1–25
- 

### **Google Scholar**

---

- Boontome P, Therdyothin A, Chontanawat J (2017) Investigating the causal relationship between non-renewable and renewable energy consumption, CO2 emissions and economic growth in Thailand. *Energy Procedia* 138:925–930. <https://doi.org/10.1016/j.egypro.2017.10.141>
- 

### **Article Google Scholar**

---

- Bouchoucha N (2020) The effect of environmental degradation on health status: do institutions matter?. *Journal of the Knowledge Economy* (Early view). <https://doi.org/10.1007/s13132-020-00680-y>
  - Cameron A, Trivedi P (2005) *Microeconometrics*. Cambridge University Press
- 

### **Book Google Scholar**

---

- CEBR (2020). *World Economic League Table 2021*. Centre for Economics and Business Research. Available at <https://cebr.com/wp-content/uploads/2020/12/WELT-2021-final-29.12.pdf>
  - Chaudhry SM, Ahmed R, Shafiullah M, Huynh TLD (2020) The impact of carbon emissions on country risk: evidence from G7 economies. *J Environ Manag* 265:110533
- 

### **Article Google Scholar**

---

- Chiesa MA, McEwen B, Barua S (2021) Does a Company's Environmental Performance Influence Its Price of Debt Capital? Evidence from the Bond Market. *The Journal of Impact and ESG Investing* 1(3):75–99. <https://doi.org/10.3905/jesg.2021.1.015>
  - Chewe M, Hangoma P (2020) Drivers of health in sub-Saharan Africa: a dynamic panel analysis. *Health Policy Open*, 1, 100013. [10.1016/j.hpopen.2020.100013](https://doi.org/10.1016/j.hpopen.2020.100013)
-

- Chiesa M, Barua S (2019) The surge of impact borrowing: the magnitude and determinants of green bond supply and its heterogeneity across markets. *Journal of Sustainable Finance & Investment* 9(2):138–161
- 

**[Article Google Scholar](#)**

---

- Dawson A (2010) State capacity and the political economy of child mortality in developing countries revisited: from fiscal sociology towards the rule of law. *Int J Comp Sociol* 51(6):403–422. <https://doi.org/10.1177/0020715210387522>
- 

**[Article Google Scholar](#)**

---

- Do QT, Joshi S, Stolper S (2018) Can environmental policy reduce infant mortality? Evidence from the Ganga Pollution Cases. *J Dev Econ* 133(August):306–325. <https://doi.org/10.1016/j.jdeveco.2018.03.001>
- 

**[Article Google Scholar](#)**

---

- Driscoll JC, Kraay AC (1998) Consistent covariance matrix estimation with spatially dependent panel data. *Rev Econ Stat* 80:549–560
- 

**[Article Google Scholar](#)**

---

- Franz J, FitzRoy F (2006) Child mortality in Central Asia: social policy, agriculture and the environment. *Central Asian Survey* 25(4):481–498. <https://doi.org/10.1080/02634930701210476>
- 

**[Article Google Scholar](#)**

---

- Gamage AU, Pearson D, Hanna F (2017) A review of climate change in South East Asian Countries and human health: Impacts, vulnerability, adaptation, and mitigation. *South East Asia Journal of Public Health* 6(2):3–10. <https://doi.org/10.3329/seajph.v6i2.31829>
- 

**[Article Google Scholar](#)**

---

- Grossman M (1972) On the concept of health capital and the demand for health. *J Polit Econ* 80:223–255

---

**[Article Google Scholar](#)**

- Hajat A, Hsia C, O’Neill MS (2015) Socioeconomic disparities and air pollution exposure: a global review. *Curr Environ Health Rep* 2(4):440–450. <https://doi.org/10.1007/s40572-015-0069-5>

---

**[CAS Article Google Scholar](#)**

- Hanif I (2018) Impact of fossil fuels energy consumption, energy policies, and urban sprawl on carbon emissions in East Asia and the Pacific: a panel investigation. *Energy Stra Rev* 21(April):16–24. <https://doi.org/10.1016/j.esr.2018.04.006>

---

**[Article Google Scholar](#)**

- Hanif I, Aziz B, Chaudhry IS (2019) Carbon emissions across the spectrum of renewable and non-renewable energy use in developing economies of Asia. *Renew Energy* 143:586–595. <https://doi.org/10.1016/j.renene.2019.05.032>

---

**[Article Google Scholar](#)**

- Hoechle D (2006) Robust standard errors for panel regressions with cross-sectional dependence. *Stata J* 7(3):281–312

---

**[Article Google Scholar](#)**

- Houston JF, Lin C, Lin P, Ma Y (2010) Creditor rights, information sharing, and bank risk taking. *J Financ Econ* 96:485–512

---

**[Article Google Scholar](#)**

---



- Issaoui F, Toumi H, Touili W (2015) Effects of CO2 emissions on economic growth, urbanization and welfare: application to MENA countries. Munich Personal RePEc Archive 65683
  - Jamison DT, Murphy SM, Sandbu ME (2016) Why has under-5 mortality decreased at such different rates in different countries? J Health Econ 48:16–25. <https://doi.org/10.1016/j.jhealeco.2016.03.002>
- 

### **[Article Google Scholar](#)**

---

- Jones AM, Rice N, Contoyannis P (2012) The Dynamics of Health in Jones, Andrew M., ed. The Elgar companion to health economics. Edward Elgar Publishing, 2012. p15
  - Khan SAR (2019) The nexus between carbon emissions, poverty, economic growth, and logistics operations-empirical evidence from southeast asian countries. Environ Sci Pollut Res 26(13):13210–13220. <https://doi.org/10.1007/s11356-019-04829-4>
- 

### **[Article Google Scholar](#)**

---

- Koplitz SN, Mickley LJ, Marlier ME, Buonocore JJ, Kim PS, Liu T, Sulprizio MP, DeFries RS, Jacob DJ, Schwartz J, Pongsiri M, Myers SS (2016) Public health impacts of the severe haze in Equatorial Asia in September-October 2015: Demonstration of a new framework for informing fire management strategies to reduce downwind smoke exposure. Environ Res Lett 11(9). <https://doi.org/10.1088/1748-9326/11/9/094023>
  - Kuruvilla S, Schweitze J, Bishai D, Chowdhury S, Caramani D, Frost L, Cortez R, Daelmans B, de Francisco A, Adam T, Cohen R, Alfonso YN, Franz-Vasdeki J, Saadat S, Pratt BA, Eugster B, Bandali S, Venkatachalam P, Hinton R et al (2014) Success factors for reducing maternal and child mortality. Bulletin of the World Health Organization 92:533–544. <https://doi.org/10.2471/BLT.14.138131>
- 

### **[Article Google Scholar](#)**

---

- Liu H, Fu M, Jin X, Shang Y, Shindell D, Faluvegi G, Shindell C, He K (2016) Health and climate impacts of ocean-going vessels in East Asia. Nat Clim Chang 6(11):1037–1041. <https://doi.org/10.1038/nclimate3083>
- 

### **[CAS Article Google Scholar](#)**

---

- Luni T, Majeed MT (2020) Improving environmental quality through renewable energy: evidence from South Asian economies. Int J Energy Water Resour 4(3):335–345. <https://doi.org/10.1007/s42108-020-00073-6>
- 

### **[Article Google Scholar](#)**

---

- Marlier ME, Defries RS, Voulgarakis A, Kinney PL, Randerson JT, Shindell DT, Chen Y, Faluvegi G (2013) El Niño and health risks from landscape fire emissions in southeast Asia. Nat Clim Chang 3(2):131–136. <https://doi.org/10.1038/nclimate1658>
- 

### **[CAS Article Google Scholar](#)**

---

- Matthew O, Osabohien R, Fagbeminiyi F, Fasina A (2018) Greenhouse gas emissions and health outcomes in nigeria: empirical insight from ARDL technique. Int J Energy Econ Policy 8:43–50
- 

### **[Google Scholar](#)**

---

- Nathaniel S, Anyanwu O, Shah M (2020a) Renewable energy, urbanization, and ecological footprint in the Middle East and North Africa region. Environ Sci Pollut Res 27(13):14601–14613. <https://doi.org/10.1007/s11356-020-08017-7>
- 

### **[Article Google Scholar](#)**

---

- Nathaniel S, Barua S, Hussain H, Adeleye N (2020b) The determinants and interrelationship of carbon emissions and economic growth in African economies: Fresh insights from static and dynamic models. Journal of Public Affairs (e2141). <https://doi.org/10.1002/pa.2141>
-

- Nathaniel SP, Barua S, Ahmed Z (2021) What drives ecological footprint in top ten tourist destinations? Evidence from advanced panel techniques. *Environmental Science and Pollution Research* 28(28):38322–38331. <https://doi.org/10.1007/s11356-021-13389-5>
  - Niebel T (2014) ICT and economic growth - comparing developing, emerging and developed countries. Paper presented at the IARIW 33rd General Conference, Rotterdam, the Netherlands, August 24-30, 2014
  - Nkalu CN, Edeme RK (2019) Environmental hazards and life expectancy in Africa: evidence from GARCH model. *SAGE Open* 1–8
  - Pandey S, Dogan E, Taskin D (2020) Production-based and consumption-based approaches for the energy-growth-environment nexus: evidence from Asian countries. *Sustain Prod Consump* 23:274–281. <https://doi.org/10.1016/j.spc.2020.06.006>
- 

### **[Article Google Scholar](#)**

- Pimentel D, Cooperstein S, Randell H et al Ecology of increasing diseases: population growth and environmental degradation. *Human Ecol* 35:653–668. <https://doi.org/10.1007/s10745-007-9128-3>
  - Rad EH, Vahedi S, Teimourizad A, Esmaeilzadeh F, Hadian M, Pour AT (2013) Comparison of the effects of public and private health expenditures on the health status: a panel data analysis in Eastern Mediterranean Countries. *Int J Health Policy Manag* 1:163–167
- 

### **[Article Google Scholar](#)**

- Rahman SMM, Barua S (2016) The design and adoption of green banking framework for environment protection: lessons from Bangladesh. *Australian Journal of Sustainable Business and Society* 2(1):1–19
- 

### **[Google Scholar](#)**

- Rahman MM, Rana RH, Barua S (2019) the drivers of economic growth in south asia: evidence from a dynamic system GMM approach. *J Econ Stud* 46(4):564–577
-

---

### **[Article Google Scholar](#)**

- Rana RH, Barua S (2015) Financial development and economic growth: evidence from a panel study on South Asian countries. *Asian Economic and Financial Review* 5(10):1159–1173
- 

### **[Article Google Scholar](#)**

- Rehman IH, Ahmed T, Praveen PS, Kar A, Ramanathan V (2011) Black carbon emissions from biomass and fossil fuels in rural India. *Atmospheric Chemistry and Physics Discussions* 11(4):10845–10874. <https://doi.org/10.5194/acpd-11-10845-2011>
- 

### **[Article Google Scholar](#)**

- Reidpath DD, Allotey P (2003) Infant mortality rate as an indicator of population health. *Journal of Epidemiology and Community Health* 57(5):344–346. [https://doi.org/10.1016/0898-1221\(86\)90032-5](https://doi.org/10.1016/0898-1221(86)90032-5)
- 

### **[CAS Article Google Scholar](#)**

- Remoundou K, Koundouri P (2009) Environmental effects on public health: an economic perspective. *Int J Environ Res Public Health* 6(8):2160–2178. <https://doi.org/10.3390/ijerph6082160>
- 

### **[Article Google Scholar](#)**

- Salim R, Rafiq S, Shafiei S, Yao Y (2019) Does urbanization increase pollutant emission and energy intensity? evidence from some Asian developing economies. *Appl Econ* 51(36):4008–4024. <https://doi.org/10.1080/00036846.2019.1588947>
- 

### **[Article Google Scholar](#)**

- Sarkodie SA, Strezov V, Jiang Y, Evans T (2019) Proximate determinants of particulate matter (PM<sub>2.5</sub>) emission, mortality and life expectancy in

Europe, Central Asia, Australia, Canada and the US. *Sci Total Environ* 683:489–497. <https://doi.org/10.1016/j.scitotenv.2019.05.278>

---

### **[CAS Article Google Scholar](#)**

- Shafiullah M, Khalid U, Shahbaz M (2020) Does meat consumption exacerbate greenhouse gas emissions? Evidence from US data. *Environ Sci Pollut Res* 28(9):11415–11429
- 

### **[Article Google Scholar](#)**

- Shahbaz M, Shafiullah M, Papavassiliou V, Hammoudeh S (2017) The CO<sub>2</sub>-Growth nexus revisited: a nonparametric analysis for the G7 economies over nearly two centuries. *Energy Econ* 65:183-193.3
- 

### **[Article Google Scholar](#)**

- Shahbaz M, Shafiullah M, Khalid U, Song M (2020) A nonparametric analysis of energy environmental Kuznets curve in Chinese provinces. *Energy Econ* 89:104814
- 

### **[Article Google Scholar](#)**

- Sharma R, Sinha A, Kautish P (2020) Does renewable energy consumption reduce ecological footprint? Evidence from eight developing countries of Asia. *Journal of Cleaner Production* 124867. <https://doi.org/10.1016/j.jclepro.2020.124867>
  - Shobande OA (2020) The effects of energy use on infant mortality rates in Africa. *Environmental and Sustainability Indicators* 5:100015
- 

### **[Article Google Scholar](#)**

- Sinha A, Shahbaz M, Balsalobre D (2017) Exploring the relationship between energy usage segregation and environmental degradation in N-11 countries. *J Clean Prod* 168:1217–1229. <https://doi.org/10.1016/j.jclepro.2017.09.071>
-

### **[Article Google Scholar](#)**

---

- Sirag A, Nor NM, Law SH, Abdullah NMR, Lacheheb M (2016) The impact of health financing and CO2 emission on health outcomes in Sub-Saharan Africa: a cross-country analysis. *GeoJournal* 82:1247–1261
- 

### **[Article Google Scholar](#)**

---

- Stern DI, Common MS, Barbier EB (1996) Economic growth and environmental degradation: the environmental Kuznets curve and sustainable development. *World Dev* 24(7):1151–1160. [https://doi.org/10.1016/0305-750X\(96\)00032-0](https://doi.org/10.1016/0305-750X(96)00032-0)
- 

### **[Article Google Scholar](#)**

---

- Streets DG, Gupta S, Waldhoff ST, Wang MQ, Bond TC, Yiyun B (2001) Black carbon emissions in China. *Atmos Environ* 35(25):4281–4296. [https://doi.org/10.1016/S1352-2310\(01\)00179-0](https://doi.org/10.1016/S1352-2310(01)00179-0)
- 

### **[CAS Article Google Scholar](#)**

---

- Stupnytska A, Wilson D (2007) The N-11: more than an acronym, Chapter 11 in *BRICS and Beyond*, pp. 129-150, Goldman Sachs. Available at <https://www.goldmansachs.com/insights/archive/archive-pdfs/brics-book/brics-chap-11.pdf>
  - Taghizadeh-Hesary F, Taghizadeh-Hesary F (2020) The impacts of air pollution on health and economy in Southeast Asia. *Energies*. <https://doi.org/10.3390/en13071812>
  - Teixeira PN (2014) Gary Becker's early work on human capital – collaborations and distinctiveness. *IZA Journal of Labour Economics* 3(12):2014. <https://doi.org/10.1186/s40172-014-0012-2>
- 

### **[Article Google Scholar](#)**

---

- UNICEF (2020) Levels & trends in child mortality: estimates developed by the UN inter-agency group for child mortality estimation, United Nations. Report available

at: <https://www.unicef.org/media/79371/file/UN-IGME-child-mortality-report-2020.pdf.pdf>

- Velasco E, Roth M (2012) Review of Singapore's air quality and greenhouse gas emissions: current situation and opportunities. J Air Waste Manag Assoc 62(6):625–641. <https://doi.org/10.1080/10962247.2012.666513>

---

### **Article Google Scholar**

- Wang Q, Liu Y, Pan X (2008) Atmosphere pollutants and mortality rate of respiratory diseases in Beijing. Sci Total Environ 391(1):143–148. <https://doi.org/10.1016/j.scitotenv.2007.10.058>

---

### **CAS Article Google Scholar**

- Weil DN (2014) Health and economic growth. Handbook of Economic Growth 2:623–682. <https://doi.org/10.1016/B978-0-444-53540-5.00003-3>

---

### **Article Google Scholar**

- WHO (2018) One third of global air pollution deaths in Asia Pacific. <https://www.who.int/westernpacific/news/detail/02-05-2018-one-third-of-global-air-pollution-deaths-in-asia-pacific>
- Wong CM, Vichit-Vadakan N, Kan H, Qian Z, Vajanapoom N, Ostro B, Wong CM, Thach TQ, Chau PYK, Chan KP, Chung RY, Qu CQ, Yang L, Thomas GN, Lam TH, Hadley AJ, Peiris JSM, Wong TW, Kan H et al (2008) Public health and air pollution in Asia (PAPA): a multicity study of short-term effects of air pollution on mortality. Environ Health Perspect 116(9):1195–1202. <https://doi.org/10.1289/ehp.11257>

---

### **CAS Article Google Scholar**

- World Bank (2020) World Development Indicators
- Yin P, Brauer M, Cohen AJ, Wang H, Li J, Burnett RT, Stanaway JD, Causey K, Larson S, Godwin W, Frostad J, Marks A, Wang L, Zhou M, Murray CJL (2020) The effect of air pollution on deaths, disease burden,

and life expectancy across China and its provinces, 1990–2017: an analysis for the Global Burden of Disease Study 2017. *The Lancet Planetary Health* 4(9):e386–e398. [https://doi.org/10.1016/S2542-5196\(20\)30161-3](https://doi.org/10.1016/S2542-5196(20)30161-3)

---

### [Article Google Scholar](#)

---

- Zaidi SAH, Danish H, F., & Mirza, F. M. (2018) The role of renewable and non-renewable energy consumption in CO 2 emissions: a disaggregate analysis of Pakistan. *Environ Sci Pollut Res* 25(31):31616–31629. <https://doi.org/10.1007/s11356-018-3059-y>
- 

### [CAS Article Google Scholar](#)

---

- Zakaria M, Tariq S, ul Husnain, M. I. (2020) Socio-economic, macroeconomic, demographic, and environmental variables as determinants of child mortality in South Asia. *Environ Sci Pollut Res* 27:954–964. <https://doi.org/10.1007/s11356-019-06988-w>
- 

### [Article Google Scholar](#)

---

[Download references](#)

## Author information

---

### Authors and Affiliations

- 1. Department of International Business University of Dhaka, Dhaka, Bangladesh**  
Suborna Barua
- 2. Department of Economics and Development Studies, Covenant University, Ota, Nigeria**  
Bosede Ngozi Adeleye & Ifeoluwa Ogunrinola
- 3. Regional Centre of Expertise (RCE) Ogun, Ogun, Nigeria**  
Bosede Ngozi Adeleye
- 4. Centre for Economic Policy and Development Research (CEPDeR), Covenant University, Ota, Nigeria**  
Bosede Ngozi Adeleye



**5. Department of Economics, University of Lagos, Lagos, Nigeria**

Darlington Akam

**6. Kabul University, Jamal Mina, Afghanistan**

Mohammad Musa Shafiq

Contributions

Barua contributed to the introduction, literature review, conclusion, policy implications, and prepared the overall manuscript for submission as a lead author. Adeleye conceptualized the project, wrote the abstract, crafted the model, analyzed the data, and contributed to the interpretation of the results; Ogunrinola contributed to the modeling; Akam contributed to results interpretation; and Shafiq contributed to conclusion and policy recommendation.

Corresponding author

Correspondence to [Suborna Barua](#).

## Additional information

---

Responsible Editor: Eyup Dogan

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Cite this article

Barua, S., Adeleye, B.N., Akam, D. *et al.* Modeling mortality rates and environmental degradation in Asia and the Pacific: does income group matter?. *Environ Sci Pollut Res* **29**, 30548–30567 (2022).

<https://doi.org/10.1007/s11356-021-17686-x>

[Download citation](#)

- Received 22 March 2021
- Accepted 18 November 2021
- Published 09 January 2022
- Issue Date April 2022

- DOI <https://doi.org/10.1007/s11356-021-17686-x>  
Keywords

- **Carbon emissions**
- **Environmental degradation**
- **Mortality rates**
- **Non-renewable energy**
- **Asia**

Over 10 million scientific documents at your fingertips  
Switch Edition

- [Academic Edition](#)
- [Corporate Edition](#)
- [Home](#)
- [Impressum](#)
- [Legal information](#)
- [Privacy statement](#)
- [California Privacy Statement](#)

- [How we use cookies](#)
- [Manage cookies/Do not sell my data](#)
- [Accessibility](#)

[Springer Nature](#)

© 2022 Springer Nature Switzerland AG. Part of [Springer Nature](#).