

<b>Course title:</b> Economics of Health and Environment				
<b>Course code:</b> MPE 154		<b>No. of credits:</b> 4	<b>L-T-P:</b> 41-13-4	<b>Learning hours:</b> 56
<b>Pre-requisite course code and title (if any):</b> Microeconomics (MPE 131)				
<b>Department:</b> Department of Policy Studies				
<b>Course coordinator:</b> Dr Sukanya Das			<b>Course instructor:</b> Dr Sukanya Das	
<b>Contact details:</b> sukanya.das@terisas.ac.in				
<b>Course type:</b> Elective			<b>Course offered in:</b> Semester 3	
<b>Course description:</b> This course introduces students to environment – health linkages and underscores the health outcomes related to exposure to air and water pollution other toxic substances, variations in the climate and food and energy sources, and environmental policy. It helps to build up the key concepts and applying tools and techniques of economic evaluation of life and health and associated health care markets. Upon completion of the course, students would have gained knowledge about the methods, data sources, and models and specifications used in analysis of environment and health from an economist’s perspective.				
<b>Course objectives</b>				
<ol style="list-style-type: none"> <li>1. To provide students with a thorough knowledge of concepts on environmental health impacts.</li> <li>2. To decide whether a particular evaluation is necessary for quantifying environmental pollution and choose the appropriate technique and undertake analysis.</li> <li>3. Apply economic tools appropriately to analyze issues in health care and public health</li> <li>4. Develop a critically constructive style of analysis of issues in health care organization, delivery, and financing, as well as health policy.</li> <li>5. Integrate current literature on economic concepts, methods, and applications to issues in health care and public health.</li> </ol>				
<b>Course content</b>				
<b>Module</b>	<b>Topic</b>	<b>L</b>	<b>T</b>	<b>P</b>
1	<b>Introduction to environmental health</b> 1.1 Environment-human interaction 1.2 Environmental impact on human health 1.3 Exposure, dose, response 1.4 Risk assessment and management	4	1	0
2	<b>Economic evaluation of health</b> 2.1 The relevance of health economics 2.2 Approaches to the economic evaluation of health 2.3 Microeconomic tools for health economics 2.4 Statistical tools for health economics	5	3	0
3	<b>Cost effectiveness analysis</b> 3.1 Average cost-effectiveness ratio 3.2 Incremental cost-effective ratio 3.3 Distributional cost-effectiveness analysis in addressing health equity and health inequalities 3.4 Case studies	2	1	0
4	<b>Cost- Utility Analysis</b> 4.1 Disability Adjusted life years 4.2 Quality Adjusted life years Practical session with the WHO data sets for calculation of DALY and QALY	6	2	4
5	<b>Human capital Approach</b> 5.1 Grossman model 5.2 Cost of Illness	6	2	
6	<b>Health impacts from Air and water pollution</b> 6.1 Types of data and specifications used- 6.2 Quantification of health impact of outdoor and indoor air pollution applying several methodologies.	6	2	

	6.3 Quantification of health impacts of water pollution applying the methodologies			
7	<b>Climate change and health impacts</b> 7.1 Climate change and health – vector borne and water borne diseases and impact of heat have 7.2 Methodologies used for addressing climate change and health impacts	8	2	
8	<b>Impact evaluation of policies in the area of environmental health</b> Case studies from low and middle-income countries	4		
	<b>Total</b>	41	13	4

**Evaluation criteria:**

- **Test 1:** Written test [end of module 1 and 2] - 10%
- **Test 2:** Assignments [end of module 3 and 4] -30%
  - I. Assignments will be given as an individual or group to judge the clarity of the methods they have learnt and its area of application
  - II. The structure of submission: Research question, Outline of the methodology, data source, and interpretation of results.
  - III. Indicators of assessment: content and structure and quality of the report (weightage: 80%); presentation of the report in the class (weightage: 20%).
- **Test 3:** Term paper and presentation [end of all modules] - 30%
  - I. Students will be asked to write a term paper (in 5000 words) on a given topic.
  - II. The structure of submission: (i) Title and abstract (ii) Introduction (iii) Literature review (iv) Description of the issue that you will discuss and how it relates to the country you are studying (v) Discussion of the policies the government has enacted or plans to enact to address the problem and an analysis of those policies. (vi) Conclusion summarizing major points.
  - III. Indicators of assessment: (i) research question, (ii) maintaining word limit, (iii) content and clarity (iv) (v) adequate referencing.
- **Test 4:** Final exam [end of all the modules] :Written test - 30%

**Learning outcomes:** By the end of the course, students will:

- command on the foundations of the key concepts relating environment and health [test 1]
- develop competences with the tools and how to implement them [test 2]
- build confidence in writing term paper [test 3]
- understand linkages between environment and health, concepts, theoretical and methodological understanding with case studies and a brief overview of the health care incentives and financing. [test 4]

**Pedagogical approach:** Class interaction, teaching and discussion, group assignment, case studies presentation

**Course Reading Materials**

**CORE**

**Module 1 - Introduction to environmental health**

Zweifel, Peter, Friedrich Breyer, and Mathias Kifmann. *Health economics*. Springer Science & Business Media, 2009

Lopez, A. D., & Murray, C. C. (1998). The global burden of disease, 1990–2020. *Nature medicine*, 4(11), 1241.

Prüss-Üstün, A., Mathers, C., Corvalán, C., & Woodward, A. (2003). Introduction and methods: assessing the environmental burden of disease at national and local levels.

Confalonieri, U., B. Menne, R. Akhtar, K.L. Ebi, M. Hauenque, R.S. Kovats, B. Revich and A. Woodward, 2007: Human health. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press.

**Module 2**

**Module 2 Economic evaluation of health**

Zweifel, Peter, Friedrich Breyer, and Mathias Kifmann. *Health economics*. Springer Science & Business Media, 2009.

### **Module 3 Cost effectiveness analysis**

Folland, S., Goodman, A. C., & Stano, M. (2007). *The economics of health and health care* (Vol. 6). Upper Saddle River, NJ: Pearson Prentice Hall.

Zweifel, Peter, Friedrich Breyer, and Mathias Kifmann. *Health economics*. Springer Science & Business Media, 2009.

Raikou, M and McGuire, A. Measuring costs for cost-effectiveness analysis in Jones, A., editor *The Elgar Companion to Health Economics*, Cheltenham, Edward Elgar

Rudmik, L., & Drummond, M. (2013). Health economic evaluation: important principles and methodology. *The Laryngoscope*, 123(6), 1341-1347.

Cookson, Richard, Andrew J. Mirelman, Susan Griffin, Miqdad Asaria, Bryony Dawkins, Ole Frithjof Norheim, Stéphane Verguet, and Anthony J. Culyer. "Using cost-effectiveness analysis to address health equity concerns." *Value in Health* 20, no. 2 (2017): 206-212.

### **Module 4 Cost- Utility Analysis**

Folland, S., Goodman, A. C., & Stano, M. (2007). *The economics of health and health care* (Vol. 6). Upper Saddle River, NJ: Pearson Prentice Hall.

Zweifel, Peter, Friedrich Breyer, and Mathias Kifmann. *Health economics*. Springer Science & Business Media, 2009.

Sassi, F. (2006). Calculating QALYs, comparing QALY and DALY calculations. *Health policy and planning*, 21(5), 402-408.

Anand, S., & Hanson, K. (1997). Disability-adjusted life years: a critical review. *Journal of health economics*, 16(6), 685-702

### **Module 5- Human capital Approach**

Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political economy*, 80(2), 223-255.

Zweifel, Peter, Friedrich Breyer, and Mathias Kifmann. *Health economics*. Springer Science & Business Media, 2009

### **Module 6 - Health impacts from Air and water pollution**

#### ***Air pollution***

Arcenas, A., Bojö, J., Larsen, B. and R. Ñunez, Fernanda (2010): The Economic Costs of Indoor Air Pollution: New Results for Indonesia, the Philippines, and Timor-Leste, *Journal of Natural Resources Policy Research*, 2: 1, 75 — 93

Chay, K. and Greenstone, M. 2003. The Impact of Air Pollution on Infant Mortality: Evidence from Geographic Variation in Pollution Shocks Induced by a Recession, *Quarterly Journal of Economics*

Cropper, M. L., Simon, N. B., Alberini, A. and Sharma, P.K. 1997. The Health Effects of Air Pollution in Delhi, India (December). World Bank Policy Research Working Paper

Ostro, B. D., 1983. The effects of air pollution on work loss and morbidity, *Journal of Environmental Economics and Management*, Vol. 10(4)

Ransom, M. and C. A. Pope. 1995. External Health Costs of a Steel Mill. *Contemporary Economic Policy*, 13.

Hubbell, B. J. 2006. Implementing QALYs in the Analysis of Air Pollution Regulations, *Environmental and Resource Economics*, 34(3), 34:365–384

#### ***Water Pollution***

Clasen, T. F. and L. Haller. 2008. Water Quality Interventions to Prevent Diarrhoea: Cost and Cost-Effectiveness, *Public Health and the Environment*, World Health Organization,

Harrington, W., & Portney, P. R. (1987). Valuing the benefits of health and safety regulation. *Journal of urban Economics*, 22(1), 101-112.

### **Module 7 Climate change and health impacts**

Markandya, A and A. Chiabai. 2009. Valuing Climate Change Impacts on Human Health: Empirical Evidence from the Literature, *International Journal of Environmental Research and Public Health*, 6, 759-786

Deschenes, O., M. Greenstone and J. Guryan. 2009. Climate Change and Birth Weight, *American Economic Review Papers and Proceedings*, 99(2)

Kumar, R., P. Jawale and S. Tandon. 2008. Economic impact of climate change on Mumbai, India Regional Health Forum, Volume 12, Number 1.

Sachs, J. & P. Malaney. 2002. The Economic and Social burden of Malaria, *Nature* 415, 680-685 (7 February 2002)

Vogel, L., Hey, J. V., Faria, S. H., Spadaro, J. V. (2015). *Health impacts of atmospheric pollution in a changing climate*(No. 2015-03).

Trærup, S. L., Ortiz, R. A., Markandya, A. (2010). The health impacts of climate change: a study of Cholera in Tanzania.

### **Module 8 – Impact evaluation of policies in the area of environmental health**

Liu, Hai-Ying, Alena Bartonova, Mathilde Pascal, Roel Smolders, Erik Skjetne, and Maria Dusinska.

"Approaches to integrated monitoring for environmental health impact assessment." *Environmental health* 11, no. 1 (2012): 88.

Pattanayak, Subhrendu K. *Rough guide to impact evaluation of environmental and development programs*. SANDEE, 2009.

R E Glasgow, T M Vogt, and S M BolesAMC Cancer Research Center, Denver, CO 80214, USA.

glasgowr@amc.org "Evaluating the public health impact of health promotion interventions: the RE-AIM framework.", *American Journal of Public Health* 89, no. 9 (September 1, 1999): pp. 1322-1327.

### **OTHERS**

#### **Module 1- Module 1 - Introduction to environmental health**

Forouzanfar, M. H., Afshin, A., Alexander, L. T., Anderson, H. R., Bhutta, Z. A., Biryukov, S., ... & Cohen, A. J. (2016)Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *The Lancet*, 388(10053), 1659-1724.

#### **Module 2 Economic evaluation of health**

Folland, S., Goodman, A. C., & Stano, M. (2007). *The economics of health and health care* (Vol. 6). Upper Saddle River, NJ: Pearson Prentice Hall

#### **Module 3 Cost effectiveness analysis**

Asaria, Miqdad, Susan Griffin, and Richard Cookson. "Distributional cost-effectiveness analysis: a tutorial." *Medical Decision Making* 36, no. 1 (2016): 8-19.

Ramachandran, A., Snehalatha, C., Yamuna, A., Mary, S., & Ping, Z. (2007). Cost-effectiveness of the interventions in the primary prevention of diabetes among Asian Indians: within-trial results of the Indian Diabetes Prevention Programme (IDPP). *Diabetes Care*, 30(10), 2548-2552.

Goldie, S. J., Sweet, S., Carvalho, N., Natchu, U. C. M., & Hu, D. (2010). Alternative strategies to reduce maternal mortality in India: a cost-effectiveness analysis. *PLoS medicine*, 7(4), e1000264.

Rose, J., Hawthorn, R. L., Watts, B., & Singer, M. E. (2009). Public health impact and cost effectiveness of mass vaccination with live attenuated human rotavirus vaccine (RIX4414) in India: model based analysis. *Bmj*, 339, b3653.

#### **Module 4 Cost- Utility Analysis**

Simoens, S. (2010). Health economic assessment: cost-effectiveness thresholds and other decision criteria. *International journal of environmental research and public health*, 7(4), 1835-1840.

Murray, C. J., Vos, T., Lozano, R., Naghavi, M., Flaxman, A. D., Michaud, C., ... & Aboyans, V. (2012). Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet*, 380(9859), 2197-2223.

#### **Module 6 - Health impacts from Air and water pollution**

##### ***Air pollution***

Smith, K. R. (2000). National burden of disease in India from indoor air pollution. *Proceedings of the National Academy of Sciences*, 97(24), 13286-13293.

Smith, K. R., & Mehta, S. (2003). The burden of disease from indoor air pollution in developing countries: comparison of estimates. *International journal of hygiene and environmental health*, 206(4-5), 279-289.

Calthrop, E., & Maddison, D. (1996). The dose—response function approach to modelling the health effects of air pollution. *Energy Policy*, 24(7), 599-607

##### ***Water Pollution***

Dasgupta, P. 2004. Valuing health damages from water pollution in urban Delhi, India: A production function approach, *Environment and Development Economics* 9 (1)

Pattanayak, S. K., Yang, J. C., Whittington, D., & Bal Kumar, K. C. (2005). Coping with unreliable public water supplies: Averting expenditures by households in Kathmandu, Nepal. *Water Resources Research*, 41(2).

Hutton, G., L. Haller, J. Bartram. 2007. Economic and health effects of increasing coverage of low-cost household drinking-water supply and sanitation interventions to countries off-track to meet MDG target.

#### **Module 7 Climate change and health impacts**

Bosello, F., Roson, R., Tol, R. S. (2006). Economy-wide estimates of the implications of climate change: Human health. *Ecological Economics*, 58(3), 579-591.

Das, S., & Smith, S. C. (2012). Awareness as an adaptation strategy for reducing mortality from heat waves: evidence from a disaster risk management program in India. *Climate Change Economics*, 3(02), 1250010.

Ingole, Vijendra, Joacim Rocklöv, Sanjay Juvekar, and Barbara Schumann. "Impact of heat and cold on total and cause-specific mortality in Vadu HDSS—a rural setting in Western India." *International journal of environmental research and public health* 12, no. 12 (2015): 15298-15308.

Das, Saudamini. "Effects of Climate Change and Heat Waves on Low Income Urban Workers: Evidence from India 1

Patz, J. A., Campbell-Lendrum, D., Holloway, T., Foley, J. A. (2005). Impact of regional climate change on human health. *Nature*, 438(7066), 310.

McMichael, A. J., Woodruff, R. E., Hales, S. (2006). Climate change and human health: present and future risks. *The Lancet*, 367(9513), 859-869.

#### **Module 8 – Impact evaluation of policies in the area of environmental health**

Ferraro, Paul J. "Counterfactual thinking and impact evaluation in environmental policy." *New Directions for Evaluation* 2009, no. 122 (2009): 75-84.

Lagarde, Mylene, Andy Haines, and Natasha Palmer. "Conditional cash transfers for improving uptake of health interventions in low-and middle-income countries: a systematic review." *Jama* 298, no. 16 (2007): 1900-1910.

Bryce, Jennifer, Cesar G. Victora, Jean-Pierre Habicht, J. Patrick Vaughan, and Robert E. Black. "The multi-country evaluation of the integrated management of childhood illness strategy: lessons for the evaluation of public health interventions." *American journal of public health* 94, no. 3 (2004): 406-415

Rocha, Romero, and Rodrigo R. Soares. "Evaluating the impact of community-based health interventions: evidence from Brazil's Family Health Program." *Health economics* 19, no. S1 (2010): 126-158.

Chapter 5- Health policy making and planning in Collins, Charles, and Andrew Green. *Valuing health systems: A framework for low and middle income countries*. SAGE Publications India, 2014.

<b>Advanced Reading Material</b>
<b>Additional information (if any): Journals</b> Lancet, Journal of health economics, PLOS ONE.
<b>Student responsibilities:</b> Attendance, feedback, discipline: as per University rules.

**Prepared by:** Sukanya Das

**Course reviewers:**

1. Prof Indrani Gupta, Professor and Head, Health Policy Research Unit (HPRU),, Institute of Economic Growth, New Delhi
2. Prof Indrani Roy Chowdhury, Associate Professor (Economics),Centre for the Study of Regional Development (CSR),JNU, New Delhi.