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Professional Profile

Dr. Moolgavkar has more than 40 years of experience in the fields of epidemiology, biostatistics, and quantitative risk assessment. He is internationally known for his work in developing mechanistically based dose-response models for carcinogenesis, and, specifically, for the two-stage clonal expansion (TSCE) model, also known as the Moolgavkar-Venzon-Knudson (MVK) model. As new scientific information becomes available, this model is extended and updated by Dr. Moolgavkar and colleagues and both the original and extended models have been used for analyses of epidemiological and toxicological data.

Dr. Moolgavkar has also been keenly interested in air pollution epidemiology and has published on the impact of criteria pollutants, including fine particulate matter (PM) and other criteria pollutants, on human health.

Dr. Moolgavkar retired from his position at the Fred Hutchinson Cancer Research Center in August 2015, where he was a Full Member between 1984 and 2007 and affiliate investigator beginning in 2007 and assumed the position of Emeritus Member. At the same time, he retired from his positions as Professor of Epidemiology and Adjunct Professor of Applied Mathematics at the University of Washington. He continues to be an Affiliate Professor of Applied Mathematics.

Dr. Moolgavkar has served on the faculties of the Johns Hopkins University, Indiana University, University of Pennsylvania, and the Fox Chase Cancer Center. He has been a visiting scientist at the Radiation Effects Research Foundation (RERF) in Hiroshima, the International Agency for Research on Cancer (IARC) in Lyon, France, and the German Cancer Research Center in Heidelberg, Germany. Dr. Moolgavkar has served on numerous review panels and as a consultant to the National Cancer Institute, U.S. Environmental Protection Agency (EPA), Health and Welfare, Canada, IARC, the California Air Resources Board (CARB), and the Chemical Industry Institute of Toxicology (CIIT) Centers for Health Research, and Health Effects Institute, among others.

Dr. Moolgavkar is the author or co-author of more than 180 papers and contributed chapters in the areas of epidemiology, biostatistics, and quantitative risk assessment, and has edited three books in these areas. He was the senior editor of a monograph, Quantitative Estimation and Prediction of Human Cancer Risk, published by the IARC. He is an elected member of the American Epidemiological Society. Dr. Moolgavkar has served on the editorial boards of Genetic Epidemiology and Inhalation Toxicology. In 2012, he stepped down from his position as an Associate Editor of Risk Analysis — An International Journal, but continues to serve on the editorial board.

Dr. Moolgavkar has published numerous epidemiological and toxicological papers on carcinogenesis, including, specifically, lung cancer, including lung cancer associated with smoking, radiation, diesel exhaust emissions and exposure to fibers, including asbestos. Dr. Moolgavkar was a member of the working group involved in the writing of the IARC monograph on tobacco smoking in 1986 (IARC monograph 38) and was an Invited Expert at the workshop, “Mechanisms of Fiber Carcinogenesis,” held

at IARC in Lyon, France, in early November of 2005. He was also the lead panelist for a symposium on fiber carcinogenesis held in Brussels, Belgium, in 2005.

Dr. Moolgavkar was given the Founders' Award by the CIIT Centers for Health Research in 1990, the Distinguished Achievement Award by the Society for Risk Analysis (SRA) in 2001, and the Outstanding Service Award by SRA in 2012. He is one of a few members of SRA to have received both the Distinguished Achievement and Outstanding Service Awards. He is a Fellow of SRA, the pre-eminent international scientific society for risk assessment.

Dr. Moolgavkar's research has been supported largely by grants from the National Institutes of Health, the U.S. Department of Energy, and EPA.

Academic Credentials & Professional Honors

Ph.D., Mathematics, Johns Hopkins University, 1973

M.B., B.S. (M.D.), University of Bombay, India, 1965

Fellow, Society for Risk Analysis

Outstanding Service Award, Society for Risk Analysis, 2012

Senior Fellow, Department of Epidemiology, University of Washington, 1976-1977

Postdoctoral Fellow, Departments of Pharmacology and Biophysics, Johns Hopkins Medical School, Baltimore, Maryland, 1966-1968

Elected Member, American Epidemiological Society

Distinguished Achievement Award, Society for Risk Analysis, 2001

Founders' Award, Chemical Industry Institute of Toxicology, 1990

Lester R. Ford Award of Mathematical Association of America, 1977

Faculty Research Fellowship of Indiana University, 1974-1976

Academic Appointments

Emeritus Member, Fred Hutchinson Cancer Research Center, 9/2015-present

Affiliate Professor, Department of Applied Mathematics, University of Washington, 9/2015-present

Professor, Department of Epidemiology, University of Washington, 6/1984-8/2015

Adjunct Professor, Department of Applied Mathematics, University of Washington, 2004-2015

Adjunct Professor, Department of Biostatistics, University of Washington, 1984-2009

Member, The Fred Hutchinson Cancer Research Center, Seattle, 1984-2008

Member, Graduate Faculty, University of Washington, 1984-present

Prior Experience

Adjunct Associate Professor, Department of Research Medicine, University of Pennsylvania School of Medicine, 1980-1984

Research Physician, The Institute for Cancer Research, Fox Chase Cancer Center, Philadelphia, 1979-1984

Clinical Assistant Professor, Department of Research Medicine, University of Pennsylvania School of Medicine, 1977-1980

Associate, American Oncologic Hospital, Philadelphia, 1977-1984

Epidemiologist, The Fox Chase Cancer Center, Philadelphia, 1977-1984

Member, Graduate Group in Epidemiology, University of Pennsylvania, 1977-1984

Assistant Professor of Mathematics, Indiana University, Bloomington, 1973-1977

Instructor in Mathematics, Johns Hopkins University, 1972-1973

Publications

Moolgavkar S, Chang ET, Luebeck EG. 2023. Multistage carcinogenesis: Impact of age, genetic, and environmental factors on the incidence of malignant mesothelioma. Environ Res. E-pub ahead of print. Available at https://doi.org/10.1016/j.envres.2022.114582.

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Moolgavkar S, Luebeck G. Multistage carcinogenesis: A unified framework for cancer data analysis. In Statistical Modeling for Biological Systems. Almudevar A., Oakes, D., Hall, J., (eds) Springer, Cham. https://doi.org/10.1007/978-3-030-34675-1_7, 115-133.

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Dewanji A, Moolgavkar SH. Choice of stratification in Poisson process analysis of recurrent event data with environmental covariates. Statist Med 2002; 21:3383-3393.

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Moolgavkar SH, Turim J, Brown RC, Luebeck EG. Long man-made fibers and lung cancer risk. Regulat Toxicol Pharmacol 2001; 33:138-146.

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Moolgavkar SH, Brown RC, Turim J. Biopersistence, fiber length, and cancer risk assessment for inhaled fibers. Inhal Toxicol 2001; 13:755-772.

Moolgavkar SH, Luebeck EG, Turim J, Brown RC. Lung cancer risk associated with exposure to man-made fibers. Drug Chem Toxicol 2000; 23:223-242.

Moolgavkar SH, Hazelton WF, Luebeck EG, Levy D, Sheppard L. Air pollution, pollens, and admissions

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Dewanji A, Moolgavkar SH. A Poisson process approach for recurrent event data with environmental covariates. Environmetrics 2000; 11:665-673.

Moolgavkar SH. Air pollution and hospital admissions for diseases of the circulatory system in three U.S. metropolitan areas. J. Air Waste Manage Assoc 2000; 50:1199-1206.

Moolgavkar SH. Air pollution and daily mortality in three U.S. counties. Environ Health Perspect 2000; 108:777-784.

Moolgavkar SH. Air pollution and hospital admissions for chronic obstructive pulmonary disease in three metropolitan areas in the US. Inhal Toxicol 2000; 12(Suppl 4):75-90.

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Grasl-Kraupp B, Luebeck G, Wagner A, Loew-Baselli A, De Gunst M, Waldhor T, Moolgavkar S, Schulte-Hermann R. Quantitative analysis of tumor initiation in rat liver: Role of cell replication and cell death (apoptosis). Carcinogenesis 2000; 21:1411-1421.

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Selected Invited Presentations

Moolgavkar SH. False discoveries: Challenges for understanding the environment. AAAS annual meeting, San Diego, February 2010.

Moolgavkar SH. Effects of education and primary prevention on lung cancer mortality trends. Erasmus University, Rotterdam, June 2009.

Moolgavkar SH. Multistage carcinogenesis and epidemiologic studies of cancer. University of Rochester Symposium in honor of Professor Andrei Yakovlev, April 2009.

Moolgavkar SH. Clonal expansion and carcinogenesis. International Conference on Systems Biology in Radiation Carcinogenesis, Munich, Germany, February 2007.

Moolgavkar SH. Epidemiology of colon cancer. AEK Cancer Congress, Frankfurt, Germany, February 2007.

Moolgavkar SH. Multistage carcinogenesis and epidemiologic studies of cancer. Distinguished Seminar Series, Fox Chase Cancer Center, PA, October 2005.

Moolgavkar SH. Multistage carcinogenesis and lung cancer prevention. IARC Seminar Series, Lyon, France, July 2004.

Moolgavkar SH. Radiation-induced gestational mutations and cancer. COSPAR meeting, Paris, France, July 2004.

Moolgavkar SH. Multistage carcinogenesis and radiation risk assessment. International Congress of Radiation Research, Brisbane, Australia, August 2003.

Moolgavkar SH. Cancer models and risk assessment. Environmental Mutagen Society, Annual Meeting, Miami, May 2003.

Moolgavkar SH. Methodological issues in time-series analyses of air pollution data. Meeting the Environmental Challenge of the 21st Century, Monterey, CA, March 2003.

Moolgavkar SH. Multistage carcinogenesis and risk assessment. International Biometrics Conference, Homburg, Germany, March 2001.

Moolgavkar SH. Multistage models of carcinogenesis: Historical perspective, overview, implications for radiation carcinogenesis. International Workshop on Mathematical Models in Radiation Carcinogenesis, Kyoto, March 2001.

Moolgavkar SH. Modeling altered hepatic foci: issues and outstanding problems. 6th European Meeting on Hepatocarcinogenesis, Vienna, September 1999.

Moolgavkar SH. Intermediate lesions in carcinogenesis. Netherlands Institute for Health and the Environment Seminar Series, 1997.

Moolgavkar SH. Multistage model for lung cancer. International meeting of the Bernoulli Society, Calcutta, India, 1997.

Moolgavkar SH. Stochastic cancer models: Application to analyses of solid cancer incidence in the cohort of A-bomb survivors. Keynote Speaker, International symposium on low-dose and low-dose-rate radiation, Stratford-on-Avon, UK, 1997.

Moolgavkar SH. Stochastic models for estimation and prediction of cancer risk. International Symposium on Statistics in the Environment, Enschede, The Netherlands, 1997.

Moolgavkar SH. Time-series analyses of air pollution data. International Symposium on Health Effects of Particulate Air Pollution, Prague, 1997.

Moolgavkar SH. Multistage carcinogenesis, benzene exposure and leukemia risk. Berkeley Symposium on Benzene and Leukemia, Napa Valley, 1996.

Moolgavkar SH. Mutations and cell proliferation in cancer risk assessment. AACR International Workshop on Risk Assessment, Whistler BC, 1994.

Moolgavkar SH. Analysis of altered foci in rodent hepatocarcinogenesis experiments. European Toxicology Meeting, Mainz, Germany, 1993.

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Moolgavkar SH. Analysis of altered foci in rodent hepatocarcinogenesis experiments. International Workshop on Mouse Liver Tumors, Washington DC, 1992.

Moolgavkar SH. Cancer models and low-dose extrapolation of risk. Workshop on Risk Assessment and Low Dose Extrapolation, Zurich, Switzerland, 1992.

Moolgavkar SH. Cell proliferation and carcinogenesis. International Conference on Cell Proliferation in Carcinogenesis, NIEHS, North Carolina, 1992.

Moolgavkar SH. Multistage carcinogenesis and risk assessment. International Toxicology Conference, Rome, Italy, 1992.

Moolgavkar SH. A population perspective on multistage carcinogenesis. Princess Takamatsu Cancer Congress, Tokyo, Japan, 1991.

Moolgavkar SH. Cancer models. International Workshop on Biophysical Modelling of Radiation Carcinogenesis, Padua, Italy, 1991.

Moolgavkar SH. Carcinogenesis models: An overview. Hanford Symposium on Health and the Environment, Battelle PNL, Richland, WA, October 1990.

Moolgavkar SH. Analyses of altered foci in rat hepatocarcinogenesis experiments. University of Vienna Cancer Center, Vienna, Austria, July 1990.

Moolgavkar SH. Multistage models of carcinogenesis. University of Tübingen Seminar Series, Tübingen, July 1990.

Moolgavkar SH. Analyses of intermediate lesions in experimental carcinogenesis. German Cancer Research Center, Heidelberg, Germany, June 1990.

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Moolgavkar SH. Biologically-based cancer risk assessment. Society for Risk Analysis, Annual Meeting, San Francisco, CA, 1989.

Moolgavkar SH. Multistage carcinogenesis and radiation risk assessment. Radiation Research Society, Annual Meeting, Seattle, WA, 1989.

Moolgavkar SH. The role of somatic mutations and cell replication kinetics in quantitative cancer risk assessment. International Conference on Chemically Induced Cell Proliferation: Implications for Risk Assessment, Austin, TX, 1989.

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Moolgavkar SH. A two-stage model for carcinogenesis and its implications for risk assessment. University of Nebraska Medical Center, May 1988.

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Moolgavkar SH. Curvature and inference in exponential families: Application to Relative Risk Regression Models. Carleton University, Ottawa, Canada, March 1988.

Moolgavkar SH. Cox regression for the innocent bystander. Fox Chase Cancer Center Seminar, Philadelphia, PA, December 1987.

Moolgavkar SH, Prentice R. Modern statistical methods in chronic disease epidemiology. Biopharmaceutical Section of ASA (tutorial and short course), Newark, NJ, December 1987.

Moolgavkar SH. Biologically motivated two-stage model for carcinogenesis. 17th Conference on Toxicology, Wright-Patterson Air Force Base, Dayton, OH, November 1987.

Moolgavkar SH. Two-stage model for carcinogenesis. University of Wisconsin Seminars, "Curvature and Inference in Exponential Families: Application to Relative Risk Regression Models," Department of Human Oncology, Madison, OH, November 1987.

Moolgavkar SH. Two mutation model for cancer risk assessment. EPA Toxicology and Microbiology Seminar Series, Cincinnati, OH, October 1987.

Moolgavkar SH. Origin invariant relative risk functions: Multi-stage models for cancer risk assessment. American Statistical Association Annual Meeting, San Francisco, CA, August 1987.

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Moolgavkar SH. A cohort analysis of smoking and cancers of the lung, bladder and pancreas. School of Public Health grand rounds, Department of Biostatistics Seminar on General Relative Risk Regression Models for Epidemiologic Studies, University of Pittsburgh, Pittsburgh, PA, January 1987.

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Editorships & Editorial Review Boards

Editorial Board, *Inhalation Toxicology*, 2006-2008

Guest Editor, *Modeling and Data Analysis in Cancer Studies*, special issue of Mathematical and Computer Modelling, 33(12-13), 2001

Associate Editor, *Risk Analysis—An International Journal*, 2000-2011

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Editor, *Risk Analysis - An International Journal*, special issue on impact of reduced tobacco smoking on lung cancer mortality in the U.S., 1975-2000

Senior Editor, *Quantitative Estimation and Prediction of Human Cancer Risk*, International Agency for Research on Cancer, Scientific Publications 131, 1999

Editor, *Scientific Issues in Quantitative Cancer Risk Assessment*, Birkhauser, Boston, 1990

Co-Editor, *Modern Statistical Methods in Chronic Disease Epidemiology*, John Wiley, 1986

Editorial Board, *Genetic Epidemiology*, 1984-1988