

## REPORT

# International Symposium in New Delhi addresses emerging challenges in Health Analytics and Disease Modeling

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**T**HE International Symposium on Health Analytics and Disease Modeling (HADM), 2018 was held during March 8-9, 2018, at the National Academy of Medical Sciences (NAMS) auditorium, New Delhi. It was co-organized by Public Health Dynamics Laboratory (PHDL) of Graduate School of Public Health (GSPH), University of Pittsburgh, USA, and the National Institute of Medical Statistics of Indian Council of Medical Research (ICMR-NIMS), New Delhi, and Science Health Allied Research Education (SHARE), Hyderabad, India.

The two-day international symposium brought together health experts, practitioners and researchers from various disciplines including computer science, applied mathematics and statistics, public health, biostatistics, epidemiology, health policy research and more to discuss opportunities and challenges in health analytics and disease modeling.

### Symposium Day 1

On Day 1 of the symposium, Dr. M. Vishnu Vardhana Rao, Director of ICMR-NIMS discussed the importance of Health Analytics and Disease Modeling for evidence-based health research and policy making.

Professor Mark Roberts, Director of PHDL, in his keynote talk on 'Mathematical modeling as a tool for improving population health' emphasised on the link between predictive models and health policies. He provided examples of agent-based disease modeling for various communicable and non-communicable diseases.

Prof. Saumyadipta Pyne, Scientific Director of PHDL, delivered a plenary talk on 'Modeling of high-dimensional human immuno-phenotypic diversity' in which he discussed statistical platforms to rigorously model complex immunologic phenotypes in big cohorts for predicting vulnerabilities and strengths in terms of population health and biosecurity.

Dr. Kaja Abbas from the London School of Hygiene & Tropical Medicine, UK, spoke about 'Modeling epidemiological and economic impact of vaccines' by describing the various stages of an infection using a dynamic agent-based model to evaluate spread of infection and policy decisions.

Prof. Daphne Lopez from the Vellore Institute of Technology, Vellore, spoke on 'Climate and dengue modeling:



Keynote lecture by Prof. Mark Roberts of University of Pittsburgh at HADM, 2018

a big data analytics perspective'. She discussed models to integrate climate data and health data for understanding the inter-relationships between disease outbreaks and climate change.

Prof. Nirmal Kumar Ganguly, former Director General of ICMR, delivered a special talk addressing the challenge of data sharing mechanisms. He noted that health analytics and disease modeling could help protect the identity of patients and ensure more efficient medical practices worldwide.

Dr. Wilbert Van Panhuis from PHDL delivered the second plenary talk on 'Improving data access and standardization for epidemic modeling in global health'. Using the example of integrative dengue data analysis across Southeast Asia, he discussed Project Tycho to explain the importance and benefits of data access and standardization. He commented on the need for data transparency and building modeling capabilities to integrate disease surveillance.

Dr. Marc Choisy from the University of Montpellier, France, presented a case study in which traditional surveillance systems were harnessed to create big data for modeling dengue in Vietnam and parts of Southeast Asia.

Dr. Olivier Telle from the Centre National de la Recherche Scientifique (CNRS), France, spoke on the climatic and socio-economic factors of dengue transmission in a city like Delhi based on his research conducted at the Centre for Policy Research, New Delhi.

The first day of HADM 2018 symposium concluded with a panel discussion on 'Communicable Disease Modeling'. Panel discussants were Professors Arvind Pandey (former Director, ICMR-NIMS) and Mark Roberts (PHDL).

### Symposium Day 2

Day 2 of the symposium started with a keynote talk by Prof. Roni Rosenfeld from the Carnegie Mellon University, Pittsburgh, USA, on 'Forecasting Epidemics'. He underscored the predictive ability of models for evidence-based policymaking and timely prevention of the spread of outbreaks. He also discussed one-of-a-kind-events like Ebola, SARS, across season forecasting, within season forecasting, nearcasting, nowcasting and backcasting.

Prof. Carmen Molina-Paris from the University of Leeds, UK, presented (via Skype) her plenary talk on 'A mathematical model of CD8+ Tcell responses calibrated with human Yellow fever vaccine data'. She described models to track antigen-specific cellular expressions and quantify human immune responses to diseases.

Dr. Martin Lopez-Garcia from the University of Leeds, UK, presented his work on 'Mathematical models for a better understanding of the life cycle of infection causing bacteria'. He explained how dose-response probabilities at the individual level could be used to estimate the airborne propagation of potential biological targets.

Dr. Himanshu K. Chaturvedi from ICMR-NIMS discussed the complexity of disease modeling for malaria using the SEIR model and geospatial data.

Dr. Prashant Mathur, Director of ICMR-National Centre for Disease Informatics and Research (NCDIR), Bangalore, discussed the importance of population registries in facilitating cancer research, healthcare planning & monitoring, policy formulation, health impact assessment, guiding hospital administration, and increasing awareness.

Dr. M. Vishnu V. Rao, Director of ICMR-NIMS, delivered a talk on 'Big Data Analytics in nutrition and health' where he discussed cluster analysis as a means for logical grouping of observations in large nutrition datasets.

Dr. Hukum Chandra from ICAR-Indian Agricultural Statistics Research Institute (IASRI), New Delhi, discussed 'Small area estimation by combining demographic health survey and census data'. Using examples of health data from Bangladesh, he talked about the merits of small area estimation in overcoming sample size challenges and generating representative and reliable estimates.

Dr. P.S. Reddy, the Chairman of SHARE India and Professor of Medicine at University of Pittsburgh, delivered a special talk on 'Healthcare delivery during the information age' where he discussed the future of medicine and upcoming trends including personalized medicine, precision medicine, predictive medicine, and participatory medicine.

Dr. Indranil Mukhopadhyay from the Indian Statistical Institute (ISI), Kolkata, described a new approach to tackle big data by dividing a problem into more tractable components under certain conditions.

Dr. D.K. Shukla, former Director-in-charge of ICMR-NIMS, chaired a panel discussion on 'Health informatics for non-communicable diseases'. Dr. Clareann Bunker, Emeritus Associate Professor of Epidemiology in the University of Pittsburgh, delivered the closing remarks at the end of this highly enriching two-day international symposium. Dr. Ajit Mukherjee, ICMR-NIMS presented a vote of thanks to express gratitude to all stakeholders involved in the detailed planning and successful execution of the symposium.



Attendees of HADM 2018 at the National Academy of Medical Sciences, New Delhi

## Conclusion

The two-day International Symposium on Health Analytics and Disease Modeling showcased several important aspects of big data analytics for health including agent-based disease modeling, disease forecasting, challenges of big data, modeling and simulation packages and data repositories developed in different parts of the world.

Predictive and forecasting models for communicable diseases like dengue, malaria, etc., were addressed for evidence-based policy making. In particular, the symposium attendees learned about model driven approaches to health analytics and policy such as the Framework for Reconstructing Epidemic Dynamics (FRED) developed by the Public Health Dynamics Laboratory (PHDL) of the University of Pittsburgh (<http://fred.publichealth.pitt.edu/>).

In addition to model-driven approaches, data-driven approaches to health analytics such as Project Tycho® (<https://www.tycho.pitt.edu/>) were also discussed. Developed by PHDL, University of Pittsburgh, Tycho® is a freely available online resource that aims to advance the availability and usage of global disease surveillance data through implementation of the FAIR data standards (namely, Findability, Accessibility, Interoperability and Reusability of data).

HADM 2018 was partly funded by the GSPH Dean's grant from the U.S. National Institutes of Health (NIH) Fogarty International Center, and support from ICMR. University of Pittsburgh, ICMR-NIMS, SHARE India and Health Analytics Network (<http://www.healthanalytics.net/HADM2018/>) were co-organizers of this event.

According to Prof. Saumyadipta Pyne, Chair of the HADM 2018 Symposium Organizing Committee, the cutting-edge interdisciplinary research that was presented by the symposium's national and international speakers drives home the point that the time is right for India to incorporate systematic model-driven and data-driven approaches to address key challenges in public health and policy.

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