PhD in Data Sciences for Global Health

Applicant Brochure

OVERVIEW

The PhD program in Data Sciences for Global Health, jointly offered by BITS Pilani and the One Health Trust (OHT):

- offers training in global health issues and cutting-edge research methodology with rigorous fieldwork and data analysis.
- provides full-time, advanced education in global health, plus expertise in qualitative and statistical/quantitative skills leading to an interdisciplinary degree.
- have faculty with vast research experience in infectious disease dynamics; antimicrobial resistance; vaccines and immunization; environmental health; gender, equity, and livelihoods; health and development; health systems; and economics.

Students will spend part of their tenure in the program at the BITS Pilani Hyderabad campus and the other period housed at the Nimai Valley Center, the One Health Trust's future headquarters for global health research, education, and action.

Living on the campus will provide opportunities for experiential learning through exposure to conventional and cutting-edge practices, such as ancient regenerative farming techniques that may provide a way to deal with carbon sequestration and livestock rearing techniques that provide alternatives to antibiotic usage. Through visits to nearby agricultural communities and discussions with top scientific and policy experts, students will gain valuable experience with real world implications in their training as global health professionals.

ABOUT ONE HEALTH TRUST (OHT)

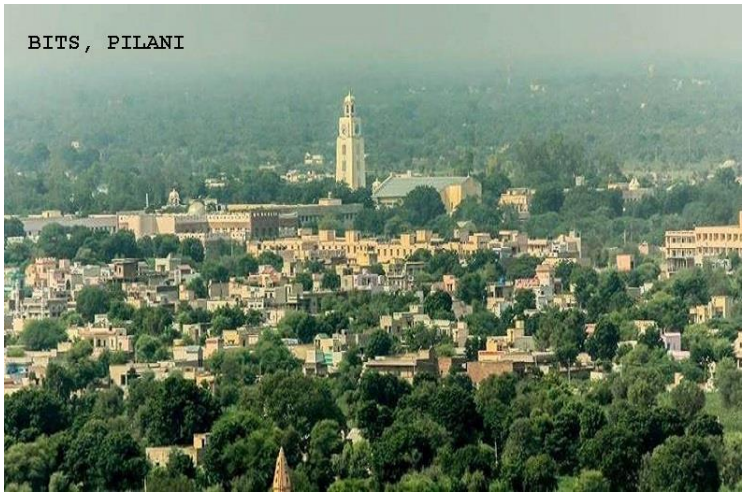
The One Health Trust uses research and stakeholder engagement to improve the health and well-being of our planet and its inhabitants. OHT builds on the work of the Center for Disease Dynamics, Economics & Policy (CDDEP), which for more than a decade conducted vitally important research on major global health challenges, including COVID-19, antimicrobial resistance, hospital infections, tuberculosis, malaria, pandemic preparedness and response, vaccination, medical oxygen shortages, and noncommunicable diseases. OHT's work now expands to take on issues related to climate change, biodiversity protection, and the effect of human diets on the planet.

One Health Trust believes that answers to the world's most critical questions lie between disciplines. Accordingly, OHT researchers employ a range of expertise—economics, epidemiology, disease modeling, risk analysis, clinical and veterinary medicine, geographic information systems, and statistics—to conduct actionable, policy-oriented research.

OHT has offices in Washington, D.C., and Bangalore, India, with researchers based in North America, Africa, and Asia. Our projects lead to policy recommendations and scientific studies published in leading journals. We are experienced in addressing country-specific and regional issues as well as global challenges. Our research is renowned for innovative approaches to design and analysis, and we communicate our work to diverse stakeholders.

OHT is opening a world-class research hub at the Nimai Valley Center, located just outside Bangalore.

ABOUT BITS PILANI



BITS Pilani offers undergraduate, postgraduate, and PhD programs to over 17,500 students across its campuses in Pilani, Goa, Hyderabad, Mumbai, and Dubai. BITS Pilani was declared an Institution of Eminence by the Ministry of Education, Government of India in 2020.

QS World University Subject Rankings 2022 has ranked BITS Pilani globally at

i) 101-150 in Pharmacy
ii) 501-550 in Chemistry
iii) 551-600 in Physics & Astronomy

BITS Pilani was ranked among the top 300 in QS World University Graduate Employability Rankings 2022 and within the top 8 in India. In the NIRF 2022 rankings, BITS Pilani was ranked 5th in Pharmacy, 18th in the University category. In QS Asia University Rankings 2022, BITS Pilani was ranked 194th, the only private institute from India in the Asia Top 200, and 18th in India. The Institute secured over Rs 375 crore in external research grants in the last 5 years. State of the art facilities were developed to support cutting edge research, led by students and about 925 faculty members. The Scopus h-index is 140, with about 20,905 publications and over 20,5012 citations as per Scopus Database. Recently, BITS Pilani was chosen by the Department of Science and Technology, Government of India (GoI) to establish a Technology Innovation Hub on Bio-Cyber Physical Systems with a grant of Rs 125 Cr., the only non-Government institute amongst the 25 chosen nationally for this prestigious grant.

NIMAI VALLEY CENTER

"The campus is surrounded by forest land on three sides and its agricultural land on the fourth side. A place as beautiful as this demands a beautiful campus. We are building about 20,000 sq. ft of office area and 20,000 sq. ft of accommodation, all of which is designed in a manner to be close to nature. Of the ten acres, a quarter of the land is returning the land to forest land. So, the actual campus building is surrounded by forest, agriculture, and water bodies."

– Founder and President, Ramanan Laxminarayan, Director, OHT

Set on ten acres in a breath-taking valley in Nandi Hills in Karnataka (India) surrounded by forest and farmland, it is located just 40 minutes north of Bangalore International Airport. The **Nimai Valley Center** brings together the natural environment, agriculture, animals, and human health in the spirit of One Health. It is in a natural setting to inspire global conversations, ideas, and action.

The center spans 42,000 sq. ft of space for cutting edge research labs, smart classrooms and, accommodation for visiting researchers and doctoral students. It will be surrounded by lush forests, natural reservoirs, and fields for organic agricultural practices.

The Nimai Valley Center envisions to

- **Inspire** – Provide serene environments to stimulate creativity and intellectual discourse.
- **Integrate** – Pay homage to local customs in its architecture and cultural relevance.
- **Innovate** – It will be a solar-powered campus with net zero carbon emissions and zero water waste along with organic farming to support on-campus dining.

HOUSING AND ACCOMMODATION

- Students are encouraged to spend time on the BITS Pilani, Hyderabad campus or OHT India campus, contingent on their research area and stage of their program.
- OHT will be able to provide housing on campus (expected completion: 2024/2025).
- Students are expected to cover their cost of stay/living at both institutions.

HOW TO APPLY

Applications to the PhD program are invited from candidates with a master's degree in any basic science or arts discipline. We also accept applications from candidates with a bachelor's degree in medical/dental/veterinary/ pharmaceutical/ alternative health sciences and engineering. Applicants from other fields are also encouraged to apply.

Application portal: www.bitsadmission.com

Application package

- A statement of research purpose (max. two pages) indicating the candidate's academic background, broad research interests, career goals, and details of how a PhD in Data Sciences for Global Health will advance their career.
- Two letters of recommendation

Shortlisted applicants will be interviewed about their knowledge of global health, data sciences, and research interests. OHT will participate in the interviewing panel. There will be no written exam, but grades from previous written exams will be considered.

MINIMUM ELIGIBILITY CRITERIA

- ME / MTech / MPharm / MBA / MPhil: minimum of 60% aggregate
- MSc/BE/BPharm or an equivalent degree: minimum of 60% aggregate
- MA: minimum of 55% aggregate
- MBBS/BDS/BVSc/MD/MDS/MVSc/BAMS/BHMS/BUMS/allied

We welcome applications from all professional, geographic, cultural, and socioeconomic backgrounds. There is no age restriction for applicants. Meeting the minimum eligibility criteria does not guarantee admission into the PhD program. All admitted candidates will be required to do the standard course work in the first two semesters of the program.

FINANCIAL AID

All successfully admitted students would have financial support through the following two sources:

- **Self-funded fellowships**: UGC/CSIR NET JRF, DBT JRF/SRF, ICMR JRF/SRF, DST Inspire Fellowships.
- **BITS-OHT doctoral fellowships:** The fellowship provided by BITS Pilani is Rs. 28,000/ month during the first year. The fellowship can be enhanced to Rs. 31,000 per month from the second year onwards. The fellowship can further be enhanced to Rs. 35,000 per month after the second year based on the student's performance and output. The fellowship is provided for up to five years from the date of admission.

PROGRAM CURRICULUM AND REQUIREMENTS

The students must complete six core courses covering three main subjects (24 credits) during the first year. The course work in the first year is expected to help students build a strong theoretical foundation in global health and equip them with data management and analysis skills. Before the end of their second year, students will defend their thesis proposal and research plan. From their third year onwards, PhD candidates will present their work at seminars, conduct fieldwork, and communicate their research outcomes through research papers that will together form a PhD dissertation. Students must maintain a minimum grade of D and CGPA of 5.50 throughout all semesters. Each academic year will have two semesters.

First year

The first year will be conducted at BITS. The students must complete six core courses:

- Global Health Management I and II
- Data Sciences (includes Research Methodologies) I and II
- Health Economics and Policy I and II

A qualifying exam will be held at the end of the first year. Students will be promoted to the second year only if they pass at least two of their main subjects. The exam will include a written test and viva on the courses taught. BITS and OHT will jointly conduct the written exam and viva.

Second year

- In the second year, students will draft a detailed research proposal to undertake thesis work and submit to their advisory committee for review. The students should take independent study/classes from faculty members from BITS-Pilani or OHT, in their research areas of interest (directed individual study), as they work on their research proposal and papers. A rotation method can be used to learn from various faculty members. Students are also encouraged to learn grant writing from their notional supervisor(s) and apply for research grants. At the end of each semester, students are expected to submit term papers based on their research.
- Students are strongly encouraged to find a potential advisor(s) during their second year. The main advisor will be from BITS Pilani, and their co-advisor can be from OHT. Students will also choose a doctoral advisory committee (DAC) consisting of two members, from among the faculty members of BITS Pilani and OHT.

- A candidacy/oral exam will be held at the end of the fourth semester. The exam will include an oral presentation on the research proposal developed in the second year. The proposal will be defended in the presence of a peer group and faculty of the concerned departments. Following the approval of the research proposal, students can then register for thesis units (maximum of 10 units per semester). A minimum of 40 thesis units should be completed to submit the thesis for examination.

Third year through finishing the PhD program (fifth semester and beyond)

After advancing to Ph.D. candidacy, students are expected to present their progress at least twice each semester to their supervisors and DAC. Additionally, they are expected to submit progress reports to their respective DAC members at least once per semester. Students are also encouraged to present their research in seminars or conferences organized by BITS, OHT, and elsewhere.

- Field Work: Students are required to undertake field visits at OHT's Nimai Valley Center. They may conduct quantitative or qualitative data collection corresponding to their research interests.
- Dissertation Defense: The student will prepare their thesis in consultation with their team of supervisors and present/defend to their DAC. They will be required to write three research papers, which will form their dissertation, and publish in peer-reviewed journals to graduate.

Degree completion

The PhD candidate must submit the thesis within five years to successfully complete their degree. Students may be allowed to seek an extension from the Doctoral Counseling Committee (DCC) through their Doctoral Research Committee (DRC), based on the project's requirements and circumstances.

CAREER OPPORTUNITIES

Public health is a data-driven field. With diversity of public health data rapidly increasing, the demand for public health data scientists with expertise in collating and wrangling complex and granular health data is on the rise. The need to communicate these results to stakeholders and policymakers is also a need of the hour.

This program is ideal for students who are seeking new roles as public health data scientists in government, non-profit, and for-profit organizations in the public health and biomedical fields, as well as working professionals already employed in such organizations, who would like to use data more effectively to advance their missions.

- Understand potential sources of bias in data sources relevant to public health
- Formulate data-driven questions using existing data sources
- Wrangle and transform data to perform meaningful analyses
- Apply appropriate statistical methods to draw scientific conclusions from data
- Apply methods for big data to reveal patterns, trends, and associations
- Visualize and interpret data and succinctly communicate results and findings

The partnership between one of the top life sciences programs in the world and a leading health research think tank, the BITS-OHT program will provide our graduates distinction in competitive career environments.

This course offers an excellent platform into exciting career opportunities. Here you will get the chance to perform research in the real world, with a range of exciting research project opportunities including positions in data science and AI in large pharmaceutical companies and health data companies.

MEET YOUR ADVISORS

Dr. Ramanan Laxminarayan

Dr. Laxminarayan is the Founder and President of the One Health Trust, founded as the Center for Disease Dynamics, Economics & Policy (CDDEP). He is a senior research scholar at Princeton University. He is an affiliate professor at the University of Washington, senior associate at the Johns Hopkins Bloomberg School of Public Health, and a visiting professor at the University of Strathclyde in Scotland. Dr. Laxminarayan chairs the board of GARD-P, a global product development partnership created by the World Health Organization, that aims to develop and deliver new treatments for bacterial infections. He is founder and board chair at HealthCubed, which works to improve access to healthcare and diagnostics worldwide. He holds a PhD in Economics from University of Washington.

Dr. Laxminarayan's work has been widely covered in major media outlets including the New York Times, Washington Post, Associated Press, BBC, Financial Times, CNN, the Economist and Science. His research includes over 300 books, book chapters, and peer-reviewed papers in leading journals in science, medicine, and economics.

Dr. Eili Klein

Dr. Klein conducts research on the role of behavior in the spread of infectious diseases. He has authored numerous publications on the evolution and spread of antimicrobial drug resistance, with particular reference to the emergence of antibiotic and antimalarial drug resistance. Dr. Klein is an assistant professor in the Department of Emergency Medicine at Johns Hopkins University. He holds a PhD in Ecology and Evolutionary Biology from Princeton University.

His research interests include patterns of antimicrobial drug resistance and the influence of behavior on disease spread.

Dr. Thomas Van Boeckel

Dr. Thomas Van Boeckel is a spatial epidemiologist working at ETH Zurich as an SNF assistant professor. He is also a visiting fellow at the One Health Trust. He has previously held positions at Princeton, Oxford, and originally obtained his PhD from the Free University of Brussels.

Dr. Thomas Van Boeckel's research lies at the interface of science and policy. His objective is to accelerate the international response to the rapid rise of antimicrobial resistance. Specifically, he will pioneer the development of a novel type of platform to automate epidemiological data collection and using geospatial methods he will map the geographic distribution of four common drug-resistant pathogens found in animals. His broad research interests are in the fields of Antimicrobial Resistance, Disease Mapping, Spatial Epidemiology, Livestock Production Systems.

Dr. Vijay Chandru Reddy

Dr. Vijay Chandru Reddy is an academic turned entrepreneur who is also the co-founder and chairman of Strand Life Sciences. He has held academic and research positions at Purdue University, MIT and IISc, Bangalore. He holds a PhD in operations research from MIT.

Dr. Vijay Chandru Reddy has co-authored the book *Optimization Methods for Logical Inference*, published by Wiley Interscience in 1999. He is also a founder of the Association of Biotech led Enterprises (ABLE) and continues to serve as an executive council member. He is one of the inventors of the Simputer. Dr. Reddy was named a Technology Pioneer of the World Economic Forum in 2006 for his work with Strand Life Sciences and biotechnology.

Dr. Madhav Marathe

Madhav Marathe is an endowed Distinguished Professor in Biocomplexity, Director of the Network Systems Science and Advanced Computing (NSSAC) Division, Biocomplexity Institute and Initiative, and a tenured Professor of Computer Science at the University of Virginia. Dr. Marathe is a passionate advocate and practitioner of transdisciplinary team science. During his 25-year professional career, he has established and led a number of large transdisciplinary projects and groups. Dr. Marathe has published more than 500 articles in peer reviewed journals, conferences, workshops and technical reports. Mentoring and training next generation scientists has been his life-long passion. He has mentored more than a dozen staff scientists, and (co)-advised more than 30+ doctoral students, 20+ MS students and 15 postdoctoral fellows. He holds a PhD in Computer Science from University of Albany-SUNY.

His areas of expertise are network science, artificial intelligence, high-performance computing, computational epidemiology, biological and socially coupled systems, and data analytics.

Dr. Anil Vullikanti

Anil Vullikanti is a Professor in the Dept of Computer Science and the Biocomplexity Institute at the University of Virginia. He was a postdoctoral associate at the Max Plank Institute for Computer Science, and then at the Los Alamos National Lab. His papers have been nominated for best paper awards at Supercomputing 2016 and AAAI 2013. He holds a PhD from IISc, Bangalore.

His research interests are broadly in the areas of randomized algorithms, combinatorial optimization, distributed computing, dynamical systems and network science, machine learning, and AI, and their applications to epidemiology, public health and modeling, analysis and protection of critical infrastructures.

Dr. Deepshikha Batheja

Dr. Batheja has ongoing transdisciplinary work in health and economics, such as designing and assessing the value of Biobanks using the conjoint experiment method, examination of acceptability and willingness to pay for COVID-19 self-testing kits in developing countries (WHO project) and studying the impact of oxygen concentrators on alleviating oxygen shortages in India with IFMR. A key thread in her research has been the impact of gender on economic and health outcomes.

Her research has received funding from the International Growth Center (IGC), JPAL under their Post-Primary Education (PPE) Initiative, BLUM Initiative, China-India Visiting Scholars Fellowship, and the MSD Fellowship for Global Health. Her research work has been featured in World Bank Development Impact Blog, Ideas for India, IGC Blogpost, and Hindustan Times. Dr. Batheja received her PhD in Economics from University of California, Riverside.

Her broad research interests are in the fields of development, health economics, and labor economics.

Dr. Giridara Gopal Parameswaran

Dr. Gopal works on building mathematical models for understanding disease dynamics and estimating the cost-effectiveness of interventions targeting specific pathogens like influenza, Pneumococcus among others. Dr. Gopal was previously involved in COVID-19 research in India and is one of the leads of iCART, the team behind www.covidtoday.in, which provides daily updates of epidemiologic indicators at the national and sub-national levels in India.

He holds a Ph.D. from the Centre for Community Medicine, in the All-India Institute of Medical Sciences (AIIMS), New Delhi.

His interests include applied epidemiology, operational research, infectious disease modeling, health economics, machine learning/artificial intelligence, policy research, and health system strengthening through digital technology innovations.

Dr. Geetanjali Kapoor

Dr. Kapoor develops partnerships for the control of infectious diseases and mitigation of antimicrobial resistance. She is supporting the establishment of the world's first One Health Demographic and Health Surveillance System, a platform for implementing longitudinal studies across communicable and non-communicable diseases. She contributed to the development of the African antibiotic treatment guidelines for common bacterial infections and syndromes and India's national infection prevention guidelines and state action plans for AMR control. She is also a member of the Joint Programming Initiative on Antimicrobial Resistance (JPIAMR) scientific advisory board and WHO Advisory Group on the bacterial priority pathogen list.

Dr. Kapoor is a clinical microbiologist by training at Jawaharlal Nehru Medical College, Aligarh, India, and holds a Master's in Public Health from Johns Hopkins University.

Her research interests are antimicrobial resistance surveillance, infectious disease and outbreak management, health systems strengthening, and health policy formulation.

Dr. Erta Kalanxhi

Dr. Kalanxhi leads OHT's efforts to advocate the value of vaccines as a critical tool for mitigating antimicrobial resistance in low- and middle-income countries and collaborates with the World Health Organization to develop policy briefs on the implementation of national strategies for antimicrobial resistance. Additionally, Dr. Kalanxhi contributes to the Mapping Antimicrobial Resistance and Antimicrobial Use Partnership project, which aims to close the knowledge gap on antimicrobial use and resistance in 14 African countries.

Dr. Kalanxhi received a Ph.D. in cancer research from the University of Oslo and an MSc in epidemiology from the London School of Hygiene and Tropical Medicine.

Dr. Arindam Nandi

Dr. Nandi's research at the One Health Trust focuses on the value of vaccines, including their long-term health, cognitive, and schooling benefits, and reductions in antimicrobial resistance in low- and middle-income countries. He is currently working on a disease modeling project estimating the health and economic benefits of the pneumococcal, rotavirus, and HiB vaccines in the Indian context, and another project evaluating the impact of COVID-19 on children's vaccination outcomes. In the recent past, he has jointly led the largest ever field study of the cost of delivering routine vaccination in seven Indian states.

Previously, Dr. Nandi worked as an associate at The Population Council. He received his PhD in Economics from the University of California, Riverside.

His research interests include health economics, public health, and demography.

Dr. Samantha Serrano

Dr. Serrano writes country of origin expert witness testimony reports for asylum cases in North America and Europe related to healthcare access and gender-based and disability-based violence in Guatemala and Brazil. Prior to working at OHT, she taught classes at the Federal University of São Paulo Medical School and other universities on qualitative research methods and social determinants of health. She has worked as a consultant on policy related to migration and COVID-19 response in Latin America and as a multilingual health educator.

Dr. Serrano received her Sc.D. from the Federal University of São Paulo Medical School (UNIFESP-EPM) in Collective Health, where she conducted ethnographic research on the healthcare and care work experiences of Bolivian immigrant women in São Paulo.

Dr. Gary Lin

Dr. Lin's current research at the One Health Trust is in computational epidemiology and system science. He utilizes computational modeling to capture the dynamic behaviors of complex systems. These studies better inform policymakers and can lead to optimal public health outcomes. Dr. Lin primarily focuses on infectious diseases (e.g., COVID-19 and antimicrobial-resistant organisms), health behavior (e.g., meat consumption), and community resilience (e.g., food security, heatwaves). His other research interests include health disparities, improving biomedical research, international development, environmental sustainability, and healthcare decision support.

Dr. Lin has contributed to numerous projects with sponsors like the MIT Collaborative Initiatives, Bloomberg American Health Initiative, Bill and Melinda Gates Institute for Population and Reproductive Health, National Science Foundation (NSF), and the Center for Disease Control and Prevention (CDC).

Dr. Lin received his Ph.D. in Civil and Systems Engineering from Johns Hopkins University.

Dr. Siddhi Camila Lama

Dr. Lama's scientific interests span a wide range of fields and include topics such as biomedical device development, neuromodulation, the brain gut-axis, food deserts, public health ethics, green polymer research, renewable energy, and a One Health approach to infectious disease epidemiology.

Dr. Lama received her Ph.D. in Bioengineering from the MIT Portugal program at the Instituto Superior Técnico, Universidade de Lisboa.