

For the Common Fund DSI-A Web site
Additional information for applicants to DS-I Africa Research Hubs (U54) FOA

Applications submitted in response to the DS-I Africa Research Hubs (U54) FOA may propose research that is cross-cutting or more specifically focused on a disease or health area that falls within the broad areas of data science for health discovery and innovation. The Common Fund supports research that covers the spectrum of biomedical and behavioral research, so innovative approaches in any area within the NIH mission are encouraged.

All NIH Institutes and Centers participate in Common Fund programs. Potential applicants are strongly encouraged to contact NIH Staff early in the application process to discuss the alignment of their technical proposal with the goals of the DS-I Africa program. Technical Assistance Sessions and teleconferences will be held for potential applicants to this FOA and companion FOAs. NIH staff will be available to answer questions related to this FOA. Location, time, date, and connection information will be announced in an NIH Guide Notice and will be posted on the DS-I Africa website.

Examples of topics that may be addressed by DSIA include, BUT ARE NOT LIMITED TO the following:

Topics that align with FIC Mission: FIC is dedicated to advancing the mission of the NIH by supporting and facilitating global health research conducted by U.S. and international investigators, building partnerships between health research institutions in the U.S. and abroad, and training the next generation of scientists to address global health needs. Therefore, FIC is interested in a diversity of global health research topics that address the priority health needs of low- and middle-income countries and fit the above research objectives. FIC's interests are guided by [FIC's strategic plan](#) and include the following:

- supporting research efforts that include significant and innovative data science-related capacity building through individuals, institutions, and networks to meet future and evolving global health challenges;
- stimulating innovation in the development and implementation of technologies and other locally relevant solutions to address global health problems; and
- advancing data science research that addresses prevention and control of the dual burden of communicable and non-communicable diseases and disabilities.

Topics that align with NCI Mission:

Cancer Data Aggregation and Analytic Tool Development – Topics of interest in this area include, but are not limited to:

- the creation of a pan-Africa multi-omics or imaging data commons along with data aggregation and harmonization tools to facilitate interoperability, sharing, and discovery for a specific prevalent cancer or one that exists within a unique ecological niche in Africa;
- computational approaches for cancer risk factor surveillance that merge and harmonize public health data sources with non-traditional sources, especially those relating to the emergence of tobacco use as a major public health threat on the continent;
- machine learning approaches to improve cancer surveillance on the continent not limited to, but including modeling and sampling approaches to build robust cancer registration estimates from sparse datasets, algorithms to extract tumor features automatically from pathology reports to reduce human resource needs, pattern recognition in population data to enable prediction of treatment outcomes, etc; and
- the development and/or mining of other large, well-annotated cancer datasets to allow for AI algorithm development to aid in cancer discovery.

Development and Translation of New and Enabling Technologies – Topics of interest in this area include, but are not limited to:

- development of new cancer technologies for basic and clinical cancer research, specifically those enhancing experimental and analytical capabilities, enabling citizen science, designing new capabilities for advancing clinical diagnostic measurements in cancer patients, and improving predictive modeling approaches;
- development and translation of affordable point-of-need technologies for cancer prevention,

detection, diagnosis, and treatment leveraging novel machine learning/artificial intelligence/computer vision tools for data analytics, computer-assisted detection and diagnosis, or treatment planning, with particular emphasis in this topic placed on tools geared towards screening and diagnostics in doctor's offices, clinic, and other local care settings;

- novel analytic tools focused on delivering more-precise individualized assessments of cancer risk, allowing people at increased risk to receive the most appropriate medical care to manage that risk; and
- technologies and approaches for behavioral interventions to prevent cancer that leverage novel data sources, new and emerging sensors, and emerging machine learning approaches.

Topics that align with NHGRI Mission: Within the areas of human genome research, areas of interest include:

- applications using genomic data to improve human health, integrating genomic data with other data types, and developing novel genomics analysis methods and resources that support:
 - genomic sciences;
 - informatics;
 - implementation of genomics in clinical care (genomic medicine); and
 - effectiveness of genomic-based diagnostics, risk assessments, and interventions.

Priority will be given to applications that improve infrastructure and bioinformatics capacity needed to support genomics research and associated data sharing. The specific research topic proposed should apply across a broad spectrum of diseases and health conditions and should not be specific to just one disease, except to the extent that a particular disease may serve as a model with broader applicability.

Applicants are encouraged to consider the unique opportunities for African research, including:

- extensive genomic diversity, migration, and admixture;
- diseases and health conditions prevalent on the African continent;
- environmental exposures and health-related conditions; and
- local health priorities.

Topics that align with NHLBI Mission: Within the areas of heart, lung, blood, and sleep (HLBS) diseases, areas of interest include data science research to improve the health of Africans, build local and continental research capacity, remove collection and sharing bias, and promote the equity and benefits of research:

Data Generation:

- Define, generate, and incorporate data from mobile health, sensors, or environmental exposures apps and novel integrative systems biology and analytical approaches that capitalize on the data-rich domains of genetics, epigenetics, transcriptomics, metabolomics, proteomics, environmental exposures, electronic health records, phenotypic and ontologic information, and biomedical imaging to define disease subtypes, predict risks, and identify therapeutic targets and develop precision medicine treatments.

Data Integration:

- Integration of registry data, mobile device and research datasets to facilitate research on epidemiology of HLBS diseases, the molecular genomics and other omics, pathobiology and natural history across the lifespan for diseases such as congenital heart disease, rheumatic heart disease, chronic lung diseases, and hemoglobinopathies.

Data Utilization:

- Innovative use of multidimensional data from a variety of sources (e.g., molecular, social, behavioral, environmental exposures, wearable sensor, self-reported data) to develop African specific risk score for cardiovascular diseases, African standard for lung functions, predictive and actionable models of weight gain, weight loss, and weight loss maintenance and to clarify the role of obesity and its management in the risk, prevention, and treatment of cardiopulmonary, cardiovascular, and sleep disorders. Develop and implement robust methods to return the data or findings back to the community in real time if possible, and in accordance with appropriate privacy protections.

Analytical Tools Development:

- Development, application, and sharing of robust and multidimensional data-analytical and theoretical methods, mathematical modeling, and computational simulation techniques to better understand and predict fundamental mechanisms of HLBS systems, including gene, protein, metabolomic, and metabolic regulatory networks and the impact of environmental exposures on those networks;
- Interoperability of developed analytical resources, including data standards and technical interoperability (e.g. adapting GA4GH standards).

Hypothesis-Driven Research:

- Explore creative and innovative methods to integrate and analyze data from population and cohort research to generate hypotheses and to expedite bedside-to-basic “reverse translation all the way back to bedside;” and beyond;
- Bold, new bioinformatic and biostatistical methods and approaches to improve the analysis of big data.

Local-Level Data/Small Area Analysis:

- Creative use of local-level data from small area analyses using novel analytical techniques; with coordinated access to data, well-planned sample analyses, and integration with the DS-I Africa Open Data Science Platform to leverage existing deeply phenotyped cohorts to accelerate translational research and promote the discovery of key druggable target pathways that lead to the development of novel and precise treatments for HLBS diseases. When feasible, functions to inform community organization to promote healthy lifestyles.

Training:

- Build local capacity for innovative research and research training in data science disciplines (such as Artificial Intelligence, Machine Learning, Deep Learning, Healthcare Data Analytics, Public Health Data Analytics, Imaging Analytics, Predictive Analytics, and Bioinformatics) for the creation, management, analysis, and integration of complex, large data sets in support of data-driven discovery in HLBS diseases relevant to the African context that include, but not limited to hypertension, obesity, rheumatic heart disease, chronic respiratory diseases, and hemoglobinopathies such as thalassemia and sickle cell disease.

NHLBI’s interests in data science are driven by the [NHLBI Strategic Vision](#) objective to leverage emerging opportunities in data science to open new frontiers in HLBS research. New technologies, from “omics” platforms to high-throughput screening, have generated vast amounts of data that have the potential to provide new insights into the preemption and precise treatment of heart, lung, blood, and sleep (HLBS) disorders. Unfortunately, only a small portion of this data is optimally assessed and incorporated into practice, both domestically and internationally. Developing innovative approaches to the integration, analysis, and interpretation of data from multiple sources will be essential. This information can then be used effectively to understand pathobiological, social, and behavioral determinants associated with HLBS health and disease and to improve patient outcomes.

Topics that align with NIA Mission: Within the areas of aging research, interests include:

- data-driven and computational approaches for examining health and aging (including age-related disparities, life-course patterns, and/or generational differences) in diverse populations in Africa by merging and harmonizing various data sources (e.g., health surveillance data, longitudinal cohort surveys, genetic data, biomarker data), including non-traditional data (mobile banking data);
- technologies to improve the capacity of vital registration systems in Africa, including mortality data;
- data-driven approaches to better understand the prevalence and risk factors of HIV-associated neurocognitive disorders among Africans of different age-groups;
- machine learning and artificial intelligence approaches to studying genetic, biologic, environmental and behavioral risk factors for and/or underlying causes of Alzheimer’s disease-related dementias (AD/ADRD) in Africa;
- tools and technologies for the development of new approaches to provide formal and informal care in distinct regions of Africa that are experiencing Alzheimer’s disease-related dementias

(AD/ADRD) and/or the dual burden of communicable diseases and non-communicable diseases; and

- tools and technologies to reduce disability and/or slow additional decline among persons in Africa with cognitive, sensory, or motor disabilities as they continue to age.

Topics that align with NIAID Mission: Within the areas of immune-mediated and infectious diseases including endemic, emerging, and re-emerging infectious diseases, sexually transmitted infections including HIV/AIDS, neglected tropical diseases and antimicrobial resistance, areas of interest include:

- computational approaches and data sharing practices to accelerate the discovery and development of:
 - new therapeutics, diagnostics and vaccines for infectious diseases including tuberculosis other antimicrobial-resistant infections;
 - innovative therapies to address immune disorders, allergy and autoimmunity;
 - analytical tools to integrate and analyze diverse and multiscale infection and vaccination data to uncover correlates of protection and signatures of effective responses;
 - computational models that can predict protective responses to infection or vaccination and immunity; and
 - approaches to mine electronic health records, data from digital health devices and social media to generate evidence to enhance findings from clinical trials.
- development of data visualization and analysis tools to increase access to knowledge from data that is relevant at the local, country and regional level in Africa and globally.
- surveillance and modeling of infectious disease and vector dynamics and transmission networks to address endemic and epidemic infectious diseases and to:
 - understand the risk for emerging and re-emerging outbreaks including GIS platforms to enable geolocation of disease, risk and resilience; and
 - predict the impact of intervention strategies in specific locations and environments.
- development of demographic tools to assist local, regional, national and continent-wide public health planning especially during disease outbreaks and public health emergencies.

Topics that align with NICHD Mission: Within the areas of child health and human development, interests include:

- research and training in areas relevant to human development, including: preconception health; fertilization; pregnancy; childbirth; prenatal/postnatal, child development; contraception; nutrition/growth; developmental origins of health and disease (DOHaD); infectious diseases; population dynamics; intellectual/developmental disabilities; trauma/injury; and rehabilitation medicine (For more information about NICHD supported research, please visit [NICHD Supported Research Networks and Initiatives](#));
- research and training that utilizes the mining of the [NICHD Data and Specimen Research Hub](#) (DASH) and other large datasets, which will enable the development and improvement of artificial intelligence (AI) algorithms to reduce mortality and morbidity among populations in Africa;
- a data science approach that integrates maternal/offspring, paternal, clinical and demographic variables combined with biologic data sources such as genomics, metabolomics and the microbiome for the identification of targets for prevention;
- further exploration of ethical considerations related to the conduct of research and data collection specific to special populations noted above, given the inconsistent implementation of ethical guidelines across organizations and countries;
- research and training inclusive of participants with disabilities and/or with rehabilitation needs (see the [NICHD in Strategic Plan](#) for further information); and
- the use of data science to study physical rehabilitation, health management, health outcomes, and community participation for people with disabilities (PWD), in settings with limited resources and clinical support.

Topics that align with NIDDK Mission: Within the areas of chronic kidney disease (CKD), interests include:

- broad efforts related to the building of data driven resources to allow for clinical studies that address factors pertaining to the development and/or progression of CKD;

- supporting research training and collaborative infrastructure building;
- supporting implementation of integrative and state-of-the-art analytic approaches; and
- advancing research on prevention and implementation of measures to decrease CKD burden.

High priority areas include clinical studies that address factors pertaining to the development and/or progression of CKD. Factors to be considered include clinical variables, environmental exposures and -omics. Primary diseases of interest are glomerulonephritides, sickle cell nephropathy, HIV-1, environmentally-induced disease, and hypertension- and diabetes-attributed kidney diseases.

Topics that align with NIEHS Mission: Within the areas of environmental health including exposures to air pollution, pesticides, e-waste, metals, or other toxic chemical exposures, interests include:

Data management and integration:

- advance data readiness of existing environmental health datasets, including making data accessible, structured, quality-controlled, and well-annotated, with appropriate privacy/security protections;
- create or improve standards for the collection of new environmental health data derived from exposure science technologies (e.g., mobile health, sensors, biomarkers of environmental exposures); and
- promote interoperability, aggregation, and harmonization of complex environmental health data to enable research and public health applications (e.g., integrating geospatial data from climate, satellite, or air monitoring sources with disease surveillance or other population data).

Tool or methods development:

- improve environmental exposure surveillance or exposure science approaches by applying machine learning, AI, or related computational approaches; and
- develop or expand informatic tools and statistical methodologies to analyze multi-dimensional environmental exposure data, gene-environment interaction (GxE) data, and related complex data (e.g. imputation techniques for missing observations, novel methodologies for chemical mixtures).

Application to environmental health research questions and translation to public health:

- apply AI or related computational approaches to better understand the impact of the environmental exposures on health outcomes; and
- develop or apply tools and technologies (e.g., mobile health approaches) for prevention/intervention such as community-based or similar strategies to reduce hazardous environmental exposures.

Topics that align with NIMH Mission: Within the areas of mental health, areas of interest include:

- stimulating innovation in the development and implementation of mental health data driven technologies and other locally relevant solutions to address global mental health problems;
- studies that harness mobile technology and machine learning approaches to identify individuals at acute high risk for suicide and/or to deliver interventions to reduce risk for suicide;
- advancing mental health research on prevention and control of the dual burden of communicable and non-communicable diseases;
- development of new mental health technologies for clinical studies, specifically those enhancing experimental and analytical capabilities and those that aim to design new capabilities for advancing clinical diagnostic measurements in psychiatric patients and care for patients in distinct regions of Africa experiencing mental health crisis;
- efforts associated with building data science-related research capacity through individuals, institutions, and networks to meet future and evolving global mental health challenges;
- machine learning approaches to improve mental health surveillance on the continent not limited to, but including modeling and sampling approaches to build robust mental health registration estimates from sparse datasets;
- algorithms to extract mental health features automatically from clinical reports to reduce human resource needs, pattern recognition in population data to enable prediction of treatment outcomes;
- development and translation of affordable point-of-need technologies for mental prevention,

detection, diagnosis, and treatment leveraging novel tools for data analytics, computer-assisted detection and diagnosis, or treatment planning, especially applicable for screening and diagnostics in doctor's offices, clinic, and other local care settings;

- novel analytic tools focused on delivering more-precise individualized assessments of mental health risk, allowing people at increased risk to receive the most appropriate medical care to manage that risk;
- data-driven and computational approaches for examining developmental trajectories of mental health (including disparities, life-course patterns, and/or generational differences) in diverse populations in Africa;
- advancing data readiness, accessibility, quality-control and annotation of existing mental health datasets with improved security for the collection of new mental health data derived from exposure science technologies;
- improving mental health through the study of environmental exposure surveillance or exposure science approaches by applying machine learning, AI, or related computational approaches;
- developing or expanding informatic tools and statistical methodologies to analyze multi-dimensional environmental exposure data, gene-environment interaction (GxE) data, and related complex data (e.g. imputation techniques for missing observations, novel methodologies for chemical mixtures);
- advancing tools for remote and continuous patient care for chronic mental health conditions in rural and/or urban settings; and
- implementing or strengthening eHealth/mHealth data collection, standardization or reporting for mental health patients and research participants.

Topics that align with NINDS Mission: Within the areas of neurological disorders and stroke, areas of interest include:

- advancing remote patient care and monitoring tools for chronic neurological conditions in rural and/or urban settings;
- further refinement of point of care diagnostics and screening tools for early and accurate neurological disease detection;
- enabling greater access to more timely and continuous neurological care through cost reductions or novel technology dissemination strategies;
- improving the remote transmission and clinical utility of neurological imaging technologies to rural hospitals and clinics;
- implementing or strengthening eHealth/mHealth data collection, standardization or reporting for neurological patients and research participants;
- improving stroke risk factor surveillance and statistical modeling at the community and national level; and
- developing algorithmic methods for extracting data from public health records.

High priority disease areas include stroke and other cerebrovascular diseases, epilepsy, migraine, nervous system infections and sequelae, Parkinson's disease and other neurodegenerative disorders, neurotrauma, neurodevelopmental disorders, and the neurological consequences of Coronavirus Disease (COVID-19) and HIV/AIDS (NINDS Disorder Index http://www.ninds.nih.gov/disorders/disorder_index.htm).