

## PROJECT SUMMARY/ABSTRACT

Trauma and other surgically treated conditions are a crippling, unaddressed burden of disease that disproportionately impacts sub-Saharan Africa (SSA) globally. The Data Science Center for the Study of Surgery, Injury, and Equity in Africa (D-SINE-Africa) is a strategic partnership between the University of Buea (Buea), the University of California (Los Angeles (UCLA) and Berkeley), the Cameroonian Ministry of Public Health, the African Institute for Mathematical Sciences in Cameroon, and the University of Cape Town in South Africa. D-SINE Africa will address the intersection of health disparities with the risk factors and outcomes associated with injury and surgical disease in SSA. Although more abundant than ever, data is still a limited resource in low- and middle-income countries. Our approach views “big data” available in SSA as an opportunity to develop sustainable data-constrained approaches appropriate for resource-constrained settings. Thus, data science will be harnessed to address our Hub’s two main goals which are;1) to decrease the burden of injuries and surgical diseases through improved surveillance, prevention, and treatment; and 2) to improve access to quality surgical care in Cameroon and other SSA countries. These goals will be achieved through three specific aims: 1) Research 2) Networking and 3) Capacity Building. These aims implemented through three cores (Administrative, Data Management and Analysis, and Capacity Building Cores) and two Research Projects that will be conducted in Cameroon, South Africa, and Uganda. Research Project 1 - Health Equity Surveillance addresses the urgent gap in rapid socioeconomic (SES) estimation necessary to track health equity in acute care settings by applying a clustering algorithm to existing publicly available Demographic and Health Surveys data sets for SSA. Research Project 2 – Trauma Follow Up Prediction aims to improve trauma outcomes by using machine learning to optimize a mobile phone-based screening survey that will identify which trauma patients would benefit from further care after they are discharged from the hospital, again using a data reduction “big data to small data” approach in line with the Hub’s commitment to sustainable data use practices. These projects utilize common data sources (Cameroon Trauma Registry), have harmonizing themes (injury, equity, and data reduction), and will yield findings that can be used together (e.g., identification of SES groups vulnerable to poor follow up care). The Hub has innovatively built community engagement vehicles into the Internal Advisory Board to promote a multi-faceted approach to building trust with research participants and end-users. D-SINE Africa efforts will drive innovation and impact in data science, injury, and equity research to improve access to surgical disease prevention and care, including those whose SES conspires to increase their vulnerability to injury and surgical conditions while reducing consistent surgical care access. D-SINE Africa’s strategic partners joint infrastructure are available for use by its members and DSI-Africa consortium at large.

## PROJECT NARRATIVE

Injuries and other surgically treated diseases comprise a significant burden of disease in Cameroon and other sub-Saharan African (SSA) countries with deep inequities that are particularly unmasked in acute care settings. D-SINE Africa Hub will focus on the intersection between injury and equity, leveraging data science to decrease the impact of trauma, surgical disease, and disparities on the population of Cameroon and SSA by promoting collaborative research, networking, and capacity building with an emphasis on equity.

## FACILITIES AND OTHER RESOURCES

### A. University of Buea

#### A.1. Campus

The University of Buea (UB) was founded as a university center in 1985 but became a full university in 1993, after a national effort to reform higher education in Cameroon. Situated on Malingo street in the capital of the Southwest, a primarily Anglophone Region, UB is one of only two English-speaking universities within the broader bilingual context of Cameroon. UB is located approximately 70 kilometers from Cameroon's largest city and economic hub, Douala. Approximately 300 full-time and 200 part-time faculty instruct 12,000 students through five main faculties: Arts; Education; Health Sciences; Science; and Social and Management Sciences. Degree programs offered include Bachelors, Masters, PhD, and MD degrees. The campus consists of a network of lecture halls and laboratories for both teaching and research. The majority of buildings at UB have fiber-optic internet cable access, with an affordable internet café on campus providing Wi-Fi access.

#### A.2. Department of Public Health and Hygiene

UB's Department of Public Health and Hygiene exists under the umbrella of the Faculty of Health Sciences. The Department offers undergraduate- (Bachelors) and graduate- (Masters and Doctoral) level degrees in Public Health Sciences. The Department's educational goal is to train public health experts in core public health methods to strengthen Cameroon's capacity to address national and international public health issues. Practical experience is integrated into trainees' degree programs through collaborations between UB and other governmental and non-governmental organizations (NGOs), such as the Cameroonian Ministry of Public Health, the World Health Organization (WHO), and local and national NGOs. These ties allow students to have internships at various points throughout their training, during which they apply the skills gained from didactic teaching. These relationships create a network of resources than can be leveraged through UB for other research programs.

#### A.3. Library and Information Resources

UB's libraries are concentrated in two buildings: the Main Library and the Annex Library, which are both located near the Faculty of Arts Building. The Main Library contains the open book collection, as well as general references. The Annex Library contains a number of more specialized collections, including special collections, archives, and alternative media resources, such as audio and microfilm resources. UB's libraries recently benefited from a collaborative partnership with the University of Twente, Enschede libraries in the Netherlands from 2007-2015. The bi-directional exchange resulted in a distinct strengthening of the UB libraries, specifically in the domains of library repositories and library informatics. Through this partnership, the UB libraries have a formal exchange with the University of Twente, in which each institution shares its publications with the other, broadening the accessibility of information to users of both systems. Currently, UB's libraries are automated through D-space software. Additionally, students' theses are included in the automated system to allow easy access to the UB community.

#### A.4. Hospital

The UB Hospital serves as both a regional referral hospital for the Southwest Province and as a teaching hospital for UB under the Faculty of Health Sciences. The Hospital provides approximately 30,000 consultations annually, has a 120-bed capacity, and is staffed by 120 individuals. In 2013, the Government of Cameroon funded an additional Laboratory Building for teaching and research to strengthen the UB Hospital's capacity to train health workers for Cameroon. This hospital is used as a teaching facility for UB's Doctor of Medicine terminal degree program, one of the six accredited medical schools in Cameroon.

### B. University of California, Los Angeles

#### B.1. Campus

The University of California, Los Angeles (UCLA) is one of the ten campuses of the University of California (UC) system. UCLA is the second-oldest campus of the UC system. It offers over 125 undergraduate majors and nearly 150 graduate degree programs in a wide range of disciplines. With an enrollment of 31,568 undergraduate and 12,960 graduate students, UCLA has the largest enrollment in the UC system, with more than 220,000 freshman applications for fall 2018. The university is organized into six undergraduate colleges,

eight professional schools, and four professional health science schools. The UCLA campus, comprised of 419 acres located in residential area of Westwood, Los Angeles, is informally divided into a North Campus and South Campus, which are both on the eastern half of the university's land. The South Campus is home to the physical sciences, life sciences, engineering, mathematical sciences, health-related fields, and the UCLA Medical Center.

## **B.2. Scientific Environment**

Fourteen Nobel laureates (seven professors and seven alumni) have been affiliated with the university as faculty, researchers, or alumni. Among the current faculty, 52 are members of the National Academy of Science; 33 are members of the National Academy of Engineering; 37, the Institute of Medicine; and 134, the American Academy of Arts and Sciences. Three professors have won Pulitzer Prizes for general non-fiction or history. UCLA's total research awards exceed more than \$1 billion annually since 2009-10. In 2018, UCLA ranked 13th in U.S. News & World Report Global Ranking and 9th in the Times Higher Education World Reputation Rankings (2018). In U.S. rankings (2018-2019), U.S. News & World Report ranked UCLA 1st among public universities and tied for 19th overall among national universities. UCLA ranked 12th among all universities for re-search spending in the sciences and engineering during the FY17 according to a report by the National Science Foundation. In FY18, UCLA ranked 14th in NIH funding, with 842 awards totaling nearly \$410M. In the 2018 edition of the U.S. News & World Report, UCLA Medical Center was placed on its honor roll for the 29th consecutive year while its hospitals in Westwood and Santa Monica were ranked No. 1 in Los Angeles, No. 2 in California, and No. 7 nationally. It was also ranked 7th in the Nation in "Best Hospitals" report based on 16 different disciplines that vary from patient care to "quality, safety, efficiency and reputation." UCLA Medical Center was also in the top 3% of institutions that were ranked as top in the nation in specialties, including top 10 rankings in 11 specialties: geriatrics (No. 4); nephrology (5); ophthalmology at the UCLA Stein and Doheny Eye Institutes (5); gastroenterology/gastrointestinal surgery (7); urology (7); psychiatry at the Resnick Neuropsychiatric Hospital at UCLA (8); rheumatology (8); diabetes and endocrinology (9); ear, nose and throat (9); pulmonology (9) and neurology and neurosurgery (10).

## **B.3. UCLA Health System**

For more than 60 years, UCLA Health has provided the best in health care and the latest in medical technology to the people of Los Angeles and throughout the world. UCLA Health includes four hospitals on two campuses and more than 170 community clinics throughout Southern California. The system is comprised of: Ronald Reagan UCLA Medical Center, UCLA Medical Center, Santa Monica, UCLA Mattel Children's Hospital, Stewart and Lynda Resnick Neuropsychiatric Hospital at UCLA, UCLA Health Clinics, UCLA Faculty Group, and the David Geffen School of Medicine at UCLA. The UCLA Health System is among the most comprehensive and advanced healthcare systems in the world. UCLA physicians are world leaders in the diagnosis and treatment of complex illnesses, and our hospitals are consistently ranked among the best in the nation by U.S. News & World Report. UCLA Health is at the cutting edge of biomedical research, and our doctors and scientists are pioneering work across an astounding range of disciplines, from organ transplantation and cardiac surgery to neurosurgery and cancer treatment, and bringing the latest discoveries to virtually every field of medicine.

## **B.4. David Geffen School of Medicine**

The David Geffen School of Medicine (DGSOM) is one of the top ten medical schools in the country. DGSOM engages the efforts of more than 6,000 clinical faculty, 2,000 full-time faculty and 1,000 active investigators, many recognized with the highest national and international awards and honors. UCLA constitutes a critical mass of outstanding research in all areas of basic, clinical, translational, and population-based research. The School of Medicine education and training currently encompasses 1,800 residents, 700 medical students, and 500 graduate students working toward PhD degrees in health-related sciences, with 240 active D-, F-, K-, R-, and T-series training and career development programs and single awardee fellowship projects. There are now nearly 150 endowed chairs. The mission of DGSOM-UCLA is to foster excellence through the promotion of learning, transmission of knowledge through teaching, and the creation of new knowledge through research. DGSOM-UCLA maintains an exceedingly high standard of system security in clinical, administrative and information systems that support all clinical care, research operations and clinical trials

### **B.4.1 DGSOM Global Health Program**

The UCLA DGSOM Global Health Program catalyzes opportunities to improve health globally. To achieve this vision, it engages in multi-disciplinary and innovative education programs, research initiatives, and bilateral partnerships that provide opportunities for trainees, faculty, and staff to contribute to sustainable health initiatives and to address health inequities facing the world today. These opportunities include the following programs mentoring MD students, engaging residents and fellows, and supporting faculty and staff across the globe.

### Programs For Medical students

#### *Global Health Selective*

The Global Health Selective (offered during the fall for first- and second-year medical students) features UCLA faculty from diverse disciplines who speak to students on a variety of global health topics, such as maternal and child health, reproductive health, global surgery, food security, infectious and non-communicable diseases in resource-limited settings, and policy strategies to help address global health challenges. During this course, students have an opportunity to meet and form meaningful relationships with global health faculty at UCLA, who often serve as future mentors.

#### *Global Short-Term Training Program*

The Global Short-Term Training Program provides funded opportunities for students to participate in mentored research projects over the summer, after completion of their first year of medical school. GSTTP is an eight-week program, during which students typically spend four to six weeks at a global site contributing to a research project.

#### *Global Health Clinical Electives*

There are opportunities for fourth-year students to experience how medicine is practiced in a range of countries, largely under-resourced low- and middle-income countries. The Global Health Program offer opportunities to work in high-resource settings outside of the U.S. During these experiences, students learn about differences in health care and medical education systems, disease epidemiology, and treatment approaches.

#### *Global Health Pathway*

This Pathway is a longitudinal commitment to pursuing global health activities throughout medical school, during which students receive mentorship and support for research or other types of global health projects, career planning, networking, and the development of leadership skills.

### Programs for Residents, Fellows, and UCLA Faculty

#### *Global Health Seed Grant Program*

The primary goal of this Program is to support residents and faculty involved in global health research in low- and middle-income settings, to establish or further build long-term global research partnerships that address pressing health questions relevant to the local setting, and to build the capacity of young researchers at UCLA and global partner sites.

### **B.5. UCLA Department of Surgery**

The UCLA Department of Surgery is housed on the campus of a comprehensive research university consistently ranked among the top 20 globally and with a \$1 billion research portfolio. The presence of all disciplines on a single compact campus - medicine, engineering, life sciences, physical sciences, public health, business and law - provides an unlimited environment for leading edge surgical research. The surgical training programs offer a unique combination of active faculty involvement, world class research, advanced technology, and a steadfast commitment to exceptional patient care. These programs offer unparalleled opportunities to learn and grow as a surgeon. The UCLA Department of Surgery is committed to measuring and improving the care of patients through rigorous health services, clinical outcomes, and policy-related investigation. Leading work in partnership with national and internationally-recognized experts will continue to contribute meaningfully to the improvement of surgical quality of care, patient experience, and end results here, and throughout the world. The UCLA Department of Surgery has 158 full time faculty participating in teaching, research and

clinical activities at UCLA and its major affiliated hospitals; 254 voluntary faculty; 16 fellows; and 147 residents. Their mission is to deliver leading-edge patient care, research, and education.

#### **B.5.1 UCLA Division of General Surgery**

The UCLA Division of General Surgery, led by Dr. Joe Hines, is staffed by 32 full-time, board-certified surgeons practicing in 7 distinct subspecialty areas: The Division of General Surgery provides comprehensive surgical consultation and care in many subspecialties including colon and rectal surgery, trauma, pediatric surgery, endocrine surgery, bariatric surgery, and multidisciplinary pancreas surgery. The Division's skilled surgeons are fellows trained in various specialties and many are renowned across the country and around the world, as leaders in their respective disciplines. The Division of General Surgery seeks to create world leaders in health and science by providing the highest quality education for our trainees through our renowned residency and fellowship programs. The Division of General Surgery, with its large and diverse research programs, is committed to developing and promoting cutting-edge discoveries in general surgery. The Division's faculty and research teams constantly strive to optimize the technologies we have and invent the technologies we need in order to bring to our patients the latest developments. The collaborative efforts of our clinical and research teams result in the offering of the best treatment options to help improve the quality of care and life for all of our patients.

**B.5.2 Office Space: Dr. Catherine Juillard, MD, MPH (PI)** is based at the Center for Health Sciences (CHS)–the former UCLA Medical Center Building for the UCLA Health Care system. Dr. Juillard has a private office within the division of General Surgery, with a dedicated desktop computer. CHS is located across the road from Ronald Reagan Medical Center, where Dr. Juillard maintains clinical practice. Dr. Juillard has complete informatics infrastructure available, including printers, wireless internet, photocopiers, scanners, etc. Multiple conference rooms of various sizes, with audiovisual and teleconferencing capabilities, are available across campus for program use.

#### **B.5.3 Program for the Advancement of Surgical Equity (PASE)**

The Program for the Advancement of Surgical Equity (PASE) is a program within the Division of General Surgery that aims to achieve surgical equity through rigorous research, education, and advocacy. It was established in 2019 with the mission to reduce surgical disparities both locally and globally. PASE supports academic collaborations and capacity-building initiatives with a goal to strengthen surgical systems in low- and middle-income countries (LMICs) and address social determinants of health in marginalized communities. PASE's partnerships with healthcare providers, community organizations, and public health agencies are central to the program's efforts to address the unmet surgical burden worldwide. PASE has dedicated office suites with complete infrastructure within UCLA's Center for the Health Sciences, where it is situated. PASE is staffed by two Global Surgery program managers, and Injury Prevention Coordinator, and an Administrative Analyst. It comprises 7 core faculty members that provide direct mentorship to PASE trainees and oversee its diverse projects across the world. PASE includes a number of collaborators from Cameroon, Uganda, Armenia, and other U.S Institutions.

#### **B.6 UCLA DGIT**

DGIT is an information and digital technology organization serving the UCLA Health schools of Dentistry, Medicine, Nursing, and Public Health. DGIT works hand-in-hand with the hospital's information technology team, Information Services & Solutions (ISS), to ensure delivery of high-quality services throughout UCLA Health Sciences. DGIT provides a dynamic portfolio of services and capabilities that support education, research, analytics, web development, and administrative functions for faculty, students, and staff. The technology solutions delivered fulfill DGIT's standards for security, reliability, scalability, accessibility, and innovation, and they are intended to accelerate the university's academic and research endeavors. They prioritize a commitment to stewarding information technology responsibly, and to fostering an environment defined by transparency, communication, and collaboration.

**B.7 UCLA Health Information Services and Solutions Department (ISS)** - Information Services & Solutions (ISS) develops and maintains the central technology infrastructure and provides services and applications to over 20,000 people comprising the UCLA Health System, Practice Group and School of Medicine. ISS is committed to delivering progressive technology solutions that effectively support the patient care, research, and teaching missions of the Health Sciences and offer an increasingly integrated set of computing and communication services. ISS serves more than a fixed collection of hospitals, clinics, classrooms, labs, and

offices, and strive to bring UCLA expertise to the community by participating in health exchanges and investing in technologies that shorten distances between people such as real-time access to information, telemedicine services, and web based access to resources.

## **B.8 UCLA Clinical and Translational Science Institute (CTSI)**

The UCLA Clinical and Translational Science Institute (CTSI) is a research partnership of UCLA, Cedars-Sinai Medical Center, Charles R. Drew University of Medicine and Science and the Lundquist Institute for Biomedical Innovation at Harbor-UCLA Medical Center. Its mission is to bring biomedical innovations to bear on the greatest health needs of Los Angeles—one of the most ethnically and economically diverse counties in the United States. Our vision is to catalyze research that translates discoveries into tangible improvements in health care, disease prevention and health in our community. The UCLA CTSI is one of more than 50 research hubs supported by the Clinical and Translational Sciences Award (CTSA) program of National Center for Advancing Translational Sciences (NCATS). NCATS—one of 27 Institutes and Centers at the National Institutes of Health (NIH)—was established to transform the translational process so that new treatments and cures for disease can be delivered to patients faster.

## **B.9 Libraries**

### **B.9.1 California Digital Library Research (CDL)**

California Digital Library Research (CDL) was founded by the University of California in 1997 to take advantage of emerging technologies that were transforming the way digital information was being published and accessed. Since then, in collaboration with the UC libraries and other partners, CDL assembled one of the world's largest digital research libraries and changed the ways that faculty, students, and researchers discover and access information.

### **B.9.2 Louise M. Darling Biomedical Library, the Regional Biomedical Library for the Southwest United States**

The Louise M. Darling Biomedical Library serves the Schools of Medicine, Dentistry, Nursing, Public Health, Life Sciences divisions of the College of Letters and Sciences, related institutes in biomedicine, and the UCLA Medical Center. The library is the Regional Medical Library and serves as the headquarters for the Pacific Southwest Region of the National Network of Libraries of Medicine. The collections are broad in scope and designed to support teaching, research, and patient-care related needs of its primary clientele. In addition, the collections are a resource for the health, life sciences, and psychology communities. The total collection includes more than 683,778 print volumes and provides access to thousands of electronic resources including journals, databases, and other materials. This facility provides access to MedLine and over 6,000 current biomedical journals and over 530,000 volumes of biomedical books. Extensive computing support for hardware (Office of Academic Computing and Microcomputer Information Center) and software also exists. Additional statistical support, apart from our biostatistician, is on a recharge basis from the Department of Biomathematics. Electronic and bioengineering support is provided by an engineer who is part of the UCLA Cardiac Arrhythmia Center. UCLA offers extensive graduate level classes in neuroscience, statistics, and radiologic principles.

**Information Resources** - The library subscribes to article databases such as BIOSOS Previews, CINAHL Plus, Global Health, OVID, PubMed, Web of Science, and PsycINFO, and to other electronic resources such as UpToDate, STAT!Ref-Nursing, Access Medicine, DynaMed, AIDSinfo, MedlinePlus, LexisNexis, Cochrane Library (evidence-based practice library), and Essential Evidence Plus to support nursing research needs. These resources are all available on campus and also available to current UCLA faculty, staff and students from home. In addition, the library allows internet access to the digital versions of books, journals, and database content via NetLibrary 24 hours a day, seven days a week.

**Data Archive - Institute for Social Science Research** -The ISSR Data Archives was established in December 1977 as a service unit supporting quantitative research, primarily secondary analysis, within the Institute for Social Science Research and the greater social science community at UCLA. The Archive maintains a collection of machine-readable data files and their documentation, coordinates the acquisition of additional data from a variety of sources, and provides access to publicly available data. The Archive is part of a network of national and international organizations, and maintains contact with researchers and data suppliers in order to be aware of new data collections, information management techniques, and new computing technology.

**Consultations** - Librarians are available for individual appointments with current UCLA faculty, staff and students to discuss information resources and search strategies.

**Interlibrary Loan** - Current UCLA faculty, staff, and students may request free interlibrary loans for materials not available at UCLA.

**Document Delivery** - Current UCLA faculty, staff, and students may register for document delivery, a fee-based service, in order to have copies of journal articles and book chapters owned by the UCLA libraries sent directly to them.

**Biomedical Library Website** - The Biomedical Library maintains a website ([www.library.ucla.edu/biomed](http://www.library.ucla.edu/biomed)) to provide easy access to the UCLA Library Catalog, article databases such as CINAHL and PubMed, and other information resources.

**Library Catalog** - Items available at the Biomedical Library are listed in the UCLA Library Catalog, which is available online.

**Computers** - Computers at the Louise M. Darling Biomedical Library, accessible to all UCLA faculty, students, and staff, have several statistical software programs, including SAS, SPSS, Stata, and R. Library computers also have TreeAge, specialized software for cost-effectiveness analysis.

**Instructional Microcomputing Facility (IMF)** - Located in the UCLA Biomedical Library, the Instructional Micro-computing Facility (IMF) provides free computer services (80 desktop computers, slidemakers, scanners, color and laser printers) and UCLA intranet and internet access for health sciences students (e.g., nursing, medicine, dentistry). In addition, it maintains a Health Sciences Graduate Student Lounge which allows 24-hour student access to over 100 laptop network ports and 19 computer workstations. In addition, the IMF holds free classes throughout the year on such topics as statistical software (e.g., SPSS, SAS), reference software (e.g., ProCite, Reference Manager, and Papyrus), MedLine, Internet, and Netscape Communicator.

## B.10 Data Management and Cloud-based Resources

**B.10.1 Research Electronic Data Capture (REDCap)** - REDCap is a free and secure, HIPAA compliant web-based application for quickly building and managing online surveys, data collection forms and databases. The CTSI supports REDCap at UCLA. The electronic capture system (EDC) is a modified version of Research EDC (REDCap) system [version 7.4.23]. REDCap is powered by the Vanderbilt University Medical Center and was created to address common challenges facing academic biomedical researchers using electronic database systems. REDCap provides audit trails for tracking data manipulation and user activity, as well as automated export procedures for seamless data downloads to Excel, PDF, and common statistical packages (SPSS, SAS, Stata, R/S-Plus). REDCap is flexible enough to be used for a variety of types of research and provides an intuitive user interface for database design and data entry. Databases can be quickly developed and customized for studies, usually by the researcher without any assistance. REDCap is specifically well suited to collect and track Clinical Report Form (CRF) data, scheduling study events (e.g., patient visits) and conduct surveys. REDCap has a rich access and authentication model which makes support for multi-institutional studies easy to manage. Another important feature is the ability to easily build real-time reports that can monitor completeness and quality of data. REDCap generates a study-specific data dictionary defined in an iterative self-documenting process by all members of the research team. This iterative development and testing process results in a well-planned data collection strategy for individual studies. UCLA's CTSI IP staff people at each site provide user support and training on creating and administering REDCap surveys. IP has also created an online video that provides basic training on using the CTSI instances of REDCap. IP and the Biostatistics program collaborate in promoting the use of REDCap as a minimum standard for data collection and data management, replacing excel spreadsheets, access databases, and other ad hoc data collection methods. IP also promotes investigators' use of the REDCap Forms Library. Based on extensive expertise and experience, REDCap has been modified to ensure that it performs at a higher and more secure level as required by clinical trials standards for EDC systems. These standards include Health Insurance Portability and Accountability act (HIPAA), 21 Code of Federal Regulations (CFR) chapter 11, and the Good Clinical Data Management Practices (GCDMP) guidelines published by the Society for Clinical Data Management (SCDM). All DOMstat statisticians and data managers are extensively trained in database building and management through REDCap, and are expected to build at least one database on their own as part of their

training. DOMStat has additionally built and maintained sample tracking databases through REDCap for multiple projects at UCLA (e.g. projects in lung transplant, kidney transplant, ophthalmology, genetics, lung cancer). Because all faculty and staff are experts in database management and keep diligent project records, any DOMStat member can take over a project or assist with a project when the person assigned to a project is unavailable. DOMStat additionally has expertise in using all tools available through REDCap, including external modules made available through Vanderbilt University and the REDCap community.

### **B.10.2 Amazon Web Services (AWS)**

Over the past four years, the UCLA David Geffen School of Medicine (DGSOM) has developed policies, procedures, and the requisite infrastructure for secured, HIPAA-compliant computing within AWS. DGSOM investigators are now able to spin up, through a self-service portal, on-demand VMs (per their specifications) with common software packages for (e.g., R, python libraries, etc.). Authentication and connections to the VMs are linked directly to UCLA's credentialing system and behind firewalls, ensuring compliance with all UCLA security policies and with routine auditing in place. Methods for per user charges have been established to support researchers, with active engagement by the DGSOM information technology group (DGIT) to expand and enrich offerings.

### **B.10.3 Microsoft Azure Cloud**

The UCLA Health System has established security protocols around VMs for protected health information within the Azure cloud. As UCLA's preferred cloud environment, in 2019 the CTSI bioinformatics team started to provision requested data sets into this environment. BIP is moving all of its internal systems (e.g., i2b2, REDCap) into the same Azure environment to ensure the most secure environment possible for protected data. In addition to establishing research VMs for UCLA-specific analyses, OHIA has also established a third-party framework for data analysis in Azure, creating a system wherein data cannot leave the electronic boundaries of the UCLA system—thereby ensuring data does not move beyond our control and creating a sandbox wherein external collaborators can access (but not replicate or remove) data from UCLA. The UCLA Health System has established security protocols around virtual machines for protected health information within the Azure cloud. All projects associated with the Precision Health program will use this cloud-based environment for storage, access, and analysis of de-identified clinical and genetic data. UCLA currently runs a multi-thousand CPUslurm-based cloud on this platform, with multi-site backup and Grafana-based management linked to two-factor authentication. UCLA Health is partnering closely with Microsoft to expand this system, serving as a key pilot site for new technologies.

## **B.11 Congo Basin Institute**

UCLA operates multiple tropical research facilities in Central Africa through its Congo Basin Institute (CBI), a partnership with the International Institute of Tropical Agriculture (IITA). The CBI's mission is to find integrative breakthrough solutions that conserve the environment and meet the vital needs of the developing world. With an emphasis on in-country capacity building, the CBI serves as a regional hub for international scholars working in the Congo Basin region by providing world-class research, education, training and technology development focused on critical issues facing the Congo Basin with implications for both the developing and developed world: climate change, poverty alleviation, water and food security, biodiversity, and human and animal health. Its goal is to create a network of permanent, multi-disciplinary enterprises focused on innovative, evidence-based solutions to critical development challenges.

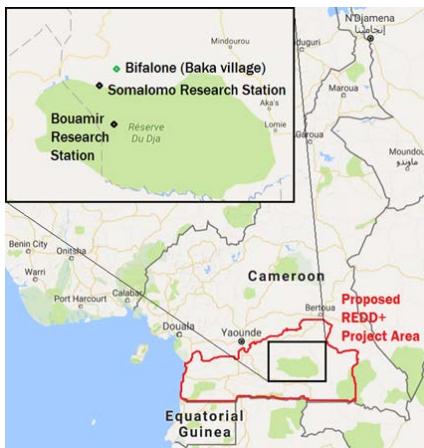
CBI's approach is novel and effective as it brings together leading universities, NGOs, government ministries, and corporate and local stakeholders. CBI draws on the University of California as well as other universities and NGO partners in the United States, Europe, Asia, and Cameroon.

In the near future, CBI will expand the existing campus of its partner, IITA, in Yaoundé to include a Research and Education Park that will provide a variety of buildings and resources. This innovative CBI structure will enable rapid scaling up of programs and partners to address emerging development issues, as well as advance project replication in other regions within Congo Basin nations. Facilities and research assistance, which are available on a fee for use basis to local and international researchers (with priority for CBI partners) include Field stations, laboratories, and accommodations :

### **B.11.1 Field Stations:**

In partnership with the Cameroon Ministry of Forestry and Wildlife, CBI recently opened two field stations in south-central Cameroon. These facilities are available on a fee-for-use basis to the broader community of local and international researchers, with priority for CBI partners. Facilities are located in and near the Dja Faunal Reserve, a 526,000 ha UNESCO World Heritage site in southern Cameroon. Biosphere reserves are 'Science for Sustainability support sites' – special places for testing interdisciplinary approaches to understand and manage changes and interactions between social and ecological systems, including conflict prevention and management of biodiversity. More than 100 mammal species (including five threatened species), 350 bird species, and 1,500 plant species are known to inhabit the reserve, including the endangered African forest elephant (*Loxodonta cyclotis*), western lowland gorilla (*Gorilla gorilla*), chimpanzee (*Pan troglodytes*), and multiple vulnerable species including the mandrill (*Mandrillus sphinx*), three pangolin species, black colobus (*Colobus satanas*), Bates's Weaver (*Ploceus batesi*), the largest known breeding colony of the Grey-necked rockfowl (*Picathartes oreas*), and many other rare or threatened species.

Situated in a diverse and understudied ecosystem, the facilities are a valuable resource for researchers and students from evolutionary biology, ecology, and anthropology, among other disciplines. CBI has trained and worked with local experts and guides in the Dja area including people from the local Baka and Badjoué communities. There is a range of expertise relating to biodiversity research which is available to visiting research teams on request.



### Bouamir Research Station

The Bouamir Research Station is located in mature forest on a 25km<sup>2</sup> study area (30 km from Somalomo) at the center of the Dja Faunal Reserve. It is reached by foot via a 7 hour hike. The field camp is available to host researchers and educational groups. Bouamir has screened and electrified platforms for research, dining, and cooking, platforms for sleeping, a ceramic water purification system, 1000W solar system, and showers. The camp is staffed by an eco-guard and camp manager, and supported by a manager in Somalomo who can organize porters, logistics, and re-supply runs. Guides and porters are available on request from Somalomo. Bouamir is available to host short, medium, and long term researchers, and can accommodate groups or classes of up to 25 people.

### Somalomo Research Station

The Somalomo Research Station is located on the edge of the Dja Faunal Reserve, just across the Dja River, and a 4-5 hour drive from Yaoundé. Somalomo is a staging ground for operations at the Boaumir Field Camp, and is available as a site to host additional research in secondary forest and agricultural areas surrounding the Dja, providing an important comparative site. This site has three bedrooms and a shared bathroom. The facility has electricity but currently no running water. It is recommended to plan to spend a night in Somalomo before undertaking the hike to Bouamir. CBI can accommodate larger students groups up to 25 with instructors.

### **B.11.2 Laboratory Facilities:** Genetic, analytic, and GIS facilities in Yaoundé, Cameroon

CBI supports researchers through existing research facilities and accommodations. CBI's existing research facilities are available for rent, with preference given to CBI Participants. Existing facilities include:

- Remote GIS /sensing research and training facility
- Plant tissue culture laboratory
- Plant, soil and water analytical lab.
- Molecular genetics laboratory
- Entomology and pathology laboratories with insectaries, isolation room, climate control incubators, and screenhouses

### **B.11.3 Accommodations:** Lodging for researchers and students in Yaoundé, Cameroon

Accommodations for researchers and students visiting Cameroon are available at CBI Bastos in Yaoundé, Cameroon.

### **CBI Bastos**

The accommodation is located in a gated complex with 24-hour security guards in the Bastos neighborhood of Yaoundé. It includes furnished individual and bunk rooms, kitchen, bathrooms, workspaces and WIFI internet access. Over 2,000 researchers from 15 countries have stayed at the facility since it opened. CBI Bastos is becoming a hub for collaborations between African and international researchers.

#### **B.11.4 Research Permits and Logistical Support:**

CBI staff can also assist with securing visas and permits to conduct research in Cameroon.

All researchers and scholars intending to conduct research in Cameroon must obtain a research permit from the Ministry of Scientific Research and Innovation (MINRESI). The application can be submitted directly to MINRESI in Cameroon, through a partner at a Cameroonian university or research institution, or with assistance from the Congo Basin Institute. Depending on proposed research topics, techniques and localities, various permits may be required in addition to the MINRESI permit:

- *Wildlife researchers and researchers working in protected areas* need to obtain a research permit from the Ministry of Forestry and Wildlife (MINFOF).
- *Researchers wanting to undertake research involving human subjects* will require an ethical clearance from the National Ethics Committee and if the work touches on medical issues will require an administrative clearance from the Ministry of Public Health. Additional information is available on request.
- *Researchers wanting to work in the Bouamir Research Station* will need approval from the Bouamir Research Station management committee. Additional information is available on request.
- *Researchers wanting to export specimens from Cameroon* will need an export permit from the Ministry of Forestry and Wildlife. Additional customs requirements may be needed depending on what is to be exported. Additional information is available on request. As part of CBI's mission to promote high-quality research in Central Africa, CBI can assist researchers in applying for MINRESI and MINFOF research permits.

### **C. The University of California, Berkeley (UC Berkeley)**

#### **C.1. Campus**

The University of California's flagship campus at Berkeley is one of the preeminent universities in the world with a distinguished faculty, a stellar research library, and more than 350 academic programs. UC Berkeley is a catalyst of economic growth and social innovation — the place where vitamin E was discovered, a lost Scarlatti opera found, the flu virus identified, and the nation's first no-fault divorce law drafted. UC Berkeley has 1,525 full-time and 500 part-time faculty members dispersed among more than 184 academic departments and programs and 80 interdisciplinary research units.

#### **C.2. Scientific Environment**

Berkeley's faculty includes 23 Nobel laureates, 31 MacArthur Fellows, 4 Pulitzer Prize winners, and 15 National Medal of Science winners. Nationally, Berkeley ranks first in the number of graduate programs in the top 10 in their fields, according to the most recent National Research Council study. In the study, 35 of Berkeley's 36 graduate programs ranked in the top 10 in their fields based on faculty competence and achievement. The national and international awards held by faculty underscore the University's preeminence. The American Council on Education ranked UC Berkeley as the number one graduate institution: "The best balanced distinguished university in the nation." UC Berkeley was also ranked as the nation's top university by The Washington Monthly, and the Times (UK) ranked Berkeley as the world's second best university. In U.S. News & World Report's latest global rankings, UC Berkeley retains the title of the world's No.1 public university and fourth-best university overall.

#### **C.3. School of Public Health (SPH)**

The School of Public Health was founded in 1943 and recently celebrated its 75th anniversary. SPH is located on the UC Berkeley campus and has 530 students, 45 full time faculty, and more than 70 adjunct faculty, active emeriti, and lecturers. SPH's faculty, consistently noted as among the leading scholars in their respective fields, includes 9 Institute of Medicine Members, 8 American Association for the Advancement of Science Fellows, 3 Fulbright Fellows, and 1 National Academy of Sciences Member. The School's mission is to conduct

world-class research, apply it to improve human health, develop diverse leaders, and enhance the health workforce through continuing education and assistance. SPH is also distinguished by a broad-based ecological perspective on health, which focuses on the interaction of biological, behavioral, and environmental determinants of human health over one's lifespan. SPH has 11 areas of concentration, including epidemiology, biostatistics, maternal and child health, health and social behavior, infectious diseases, and health services and policy. It is consistently ranked in the top 10 of Public Health programs.

### **C.3.1 Faculty**

The University offers exceptional resources for the UC Berkeley team to complete the proposed research. The team is led by **Drs. Alan Hubbard and Sandra McCoy**, highly regarded researchers and faculty members with full-time positions at UC Berkeley. Dr. Hubbard is a Professor of Biostatistics in the Division of Biostatistics and co-Director of the Center for Targeted Learning. Dr. McCoy is an Associate Professor in Residence in the Division of Epidemiology, Program Lead of the Berkeley Online MPH program in Epidemiology and Biostatistics, and she manages a complex research portfolio and teaches core methodology curriculum in the School of Public Health.

**C.3.2 Biostatistics Program:** Many issues in the health, medical and biological sciences are addressed by collecting and exploring relevant data. We offer training in the theory of statistics and biostatistics, computer implementation of analytic methods, and opportunities to use this knowledge in areas of biological and medical research.

**C.3.3 Epidemiology Program:** The purposes of epidemiological research are to discover the causes of disease, to advance and evaluate methods of disease prevention, and to aid in planning and evaluating the effectiveness of public health programs. Epidemiologists are interested in the study of infectious and noninfectious diseases. In recent years they have turned their attention increasingly toward the study of conditions affected by forces in the social and physical environment

**C.3.4 Berkeley Way West Healthy Futures Building:** The School of Public Health recently moved into a newly constructed building on campus shared with the Psychology Department and the Graduate School of Education. The eight-story building has 320,000 square feet. The School of Public Health has dedicated space for faculty, researchers, and students on the 5th floor. The building is equipped with state-of-the-art facilities for meetings, video conferencing, printing, copying, and scanning. There are two large colloquium rooms that can accommodate up to 75 people each, six large meeting rooms, and many huddle rooms and focus rooms for small group meetings and video conference calls. Each meeting space is equipped with a large monitor for video conferencing and high-speed wireless connectivity.

**C.3.5 Office Space:** Office space is provided to all faculty and their students in the new Berkeley Way West building which is located near downtown Berkeley and close to campus. **Dr. McCoy's** office (and **Drs. Packel, Dow, and Wang**) is located in the new 5th floor home of the Division of Epidemiology and Biostatistics in the Berkeley Way West building. Her office has all the necessary equipment, including computers, internet, telephones, and printers. She also has administrative support staff within SPH, including a contracts and grants specialist associated with Campus Shared Services, who will manage the financial aspects of this award. Doctoral students and full-time staff have dedicated work space and access to meeting rooms, resources for statistical computing, high volume copying machines and printers, scanners, fax machines, and other business facilities and services.

**C.3.6 Computers & Secure Server:** The School of Public Health at UC Berkeley includes approximately 1,000 current networked computers. All of the key personnel at UC Berkeley have a personal computer with word processing (Microsoft Office, Excel, etc.) and statistical software (R, STATA, SAS). Computers have full laser printing capabilities and high-speed Internet connections. A secure server system is managed by Information Services and Technology (IS&T) at UC Berkeley that meets HIPAA security requirements and the security requirements of the State of California. The server is a host-based computer that includes intrusion detection and firewalls.

Faculty have access to the campus's secure, scalable, distributed computing core (Savio) for computationally demanding work that is accessible through a secure shell interface.

**C.4. Library:** UC Berkeley's 25 libraries tie together to make the fourth largest academic library in the United States. In 2003, the Association of Research Libraries ranked it as the top public and third overall university library in North America based on various statistical measures of quality. As of 2016, Berkeley's library system contains over 11 million volumes and maintains over 70,000 serial titles.

The UC Berkeley Library uses UC-eLinks, an initiative of the California Digital Library. For database and literature searching, PubMed@UCB is publicly available, but access to full text articles is limited to computers on the UCB network or to approved offsite computers. It provides access to the MEDLINE database as well as other NLM databases. References published between 1958 and 1965 can be viewed through OLDMEDLINE. The MELVYL Catalog is used to locate books at all UC libraries, and California Periodicals to find journals/titles at other UC, CSU and California libraries. Many other important databases are available, including Current Contents, BIOSIS, and PsycINFO. Topics covered by electronic journals to which UCB subscribes include all categories of biological and medical sciences. Academic and instructional computing courses are also offered by the Library.

The Bioscience, Natural Resources & Public Health Library is centrally located on campus in the Valley Life Sciences building and is open to the public with materials available for on-site use. UC Berkeley faculty, staff, or students with current ID, and anyone with a current UC Berkeley library borrowing card may check materials out from the library. The Public Health Library's collection includes more than 108,000 print volumes and 410 current print serial titles. In addition to print material, library users have access to a robust electronic collection including more than 830,000 electronic books and 72,000 electronic journals. The collection includes materials in bioinformatics, botany, biostatistics, communicable diseases, community health, ecology, environmental science, environmental health, entomology, epidemiology, forestry, health administration, maternal and child health, molecular and cell biology, nutrition and food science, nutrition in health and disease, occupational health, physiology, plant pathology, public health, soil science, toxicology, zoology and international health. Reference librarians are available during designated hours.

#### **C.5. Center for Global Public Health (CGPH)**

CGPH provides transdisciplinary, experiential research, training, and learning opportunities for students and faculty to improve human health worldwide. CGPH focuses on the most vulnerable populations and communities with the greatest health inequities. Their goal is to be a platform to translate global health research into solutions for public health action at Berkeley and beyond. CGPH was launched at UC Berkeley in 2008 by a core group of faculty at the School of Public Health as a nexus to connect and engage diverse departments and research units towards translating global health research into public health action. Many CGPH faculty, including **Dr. McCoy**, have dedicated their lives towards teaching and researching global public health issues. Funded by the Vice Chancellor's office and with additional support from various grants and individual donors, CGPH partners with the Centers for Emerging and Neglected Diseases (CEND) under the Berkeley Alliance for Global Health to bring together more than 80 faculty members from 12 schools and colleges across UC Berkeley.

#### **C.6. Center for Effective Global Action (CEGA)**

CEGA is a multi-disciplinary research center at UC Berkeley advancing global health and development through impact evaluation and economic analysis. The Center is premised on the principle that the knowledge gained from randomized trials, and other rigorous forms of evaluation, is a valuable public good that can improve policy and outcomes around the world. CEGA also seeks to bridge the gap between scientific research and social action by equipping policymakers and donors with the knowledge needed to improve development

practice. Like their sister centers, the Jameel Poverty Action Lab (J-PAL) at MIT and Innovations for Poverty Action (IPA) at Yale, CEGA works to identify and disseminate the most effective strategies for poverty alleviation. CEGA researchers have led some of the most influential studies of development in recent years and have provided training in rigorous evaluation for hundreds of researchers and professionals in the developing world. **Dr. McCoy** is a CEGA faculty affiliate. As a result, the UC Berkeley team has access to the

rich interdisciplinary activities that are regularly sponsored by CEGA and can utilize these channels to disseminate the results of this study.

### C.7.The Bixby Center for Population, Health, and Sustainability

The Bixby Center at UC Berkeley is a collaboration of students, faculty, and researchers, working to improve sexual and reproductive health and address the impact of population on global public health and the environment. **Dr. McCoy** is Bixby Center affiliate. As its core research, the Bixby center aims to improve the quality of evidence for population policy including barriers to fertility regulation, access to contraception, safe motherhood, and the management and financing of family planning and reproductive health in low-income countries. It assists in the implementation of family planning and maternal health programs and seeks to improve the health outcomes of the world's poorest and most vulnerable women and their families. The Bixby Center works closely with leaders of U.S. and international-based organizations, as well as government officials throughout Africa and Asia. It is committed to developing innovations to improve reproductive health in resource-poor settings, including reliable health information systems, local access to essential technologies and guidelines for prioritizing interventions to maximize health impact.

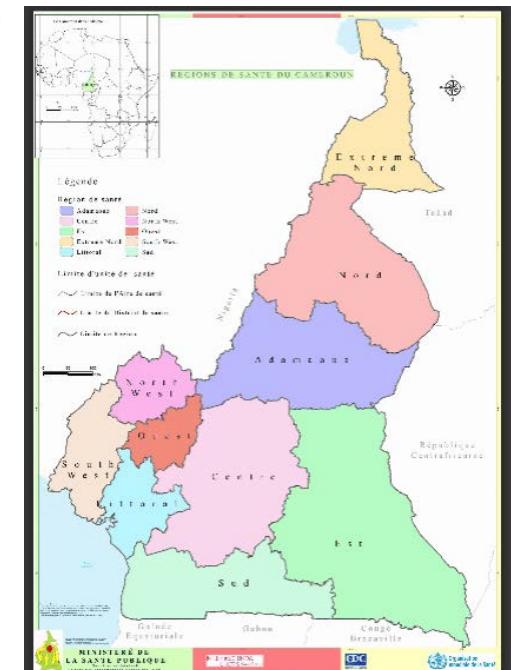
### C.8.Innovations for Youth (i4Y)

i4Y works to catalyze innovative interventions, practices and policies to improve equity and well-being for adolescents and youth (ages 15-24) locally and worldwide. As part of its mission, i4Y builds partnerships between faculty from diverse fields, students and trainees at UC Berkeley with adolescents and community collaborators, develops, evaluates and diffuses innovative interventions, practices, and policies. **Dr. McCoy** is an i4Y affiliate and serves on the Faculty Steering Committee.

## D. Cameroonian Ministry of Public Health

The Cameroonian Ministry of Public Health (MOPH) is in charge of elaborating and implementing policies and strategies for the improvement of maternal, newborn, and global health. The MOPH oversees the organization, management and development of public health facilities in Cameroon., as well as the technical supervision of private health facilities in the country. The MOPH is additionally responsible for ensuring the quality of care and improvement of the technical platforms at these facilities.

Cameroon's health map includes 10 regions, 189 health districts, 1,800 health areas and approximately 5,166 health facilities across the country which include general, central, regional, and district hospitals as well as district, integrated health and ambulatory health centers. The Ministry covers the country's 24M+ population across 475K square miles .



### D.1. Ministry of Public Health Structure

The MOPH's Central Administration is compromised of the following departments and divisions:

- The General Secretariat
- The Operational Research Division
- The Directorate of Organization of Health Care and Technology;
- The Department for the Control of Disease, Epidemics and Pandemics
- The Department of Family Health
- The Directorate of Health Promotion; the Directorate of Pharmacy, Medicines and Laboratories
- The Studies and Projects Division
- The Cooperation Division
- Human Resources Management
- The Department of Financial Resources and Heritage

### D.2. Department for the Control of Disease, Epidemics and Pandemics

For this project, we will be liaising with the MOPH's Department for the Control of Disease, Epidemics and Pandemics (DLMEP). The DLMEP is responsible for ensuring the following:

- The development of programs for the control of communicable and non-communicable diseases and monitoring their implementation in coordination with key partners and organizations
- the development of programs to combat HIV / AIDS and sexually transmitted infections, in conjunction with specialized technical services
- developing prevention strategies against epidemics and pandemics, in conjunction with key administrations
- the development of strategies to combat epidemics and pandemics, and the monitoring of their implementation
- coordination of epidemiological surveillance
- cross-border health surveillance
- monitoring of disease control programs
- monitoring the activities of specialized technical committees and bodies in their fields
- monitoring the inclusion of preventive health measures in socio-economic development programs and communities projects

The DLMEP includes the following subdivisions :

- 1) the Sub-Directorate for the Fight against HIV/AIDS, Sexually Transmitted Infections and Tuberculosis
- 2) the Sub-Directorate for the Control of Malaria and Neglected Tropical Diseases
- 3) the Sub-Directorate for the Control of Chronic Non-Communicable Diseases
- 4) the Sub-Directorate for the Control of Epidemics and Pandemics.

**Research and Training Support:** The DLMEP supports numerous research and training initiatives conducted across the Cameroonian territory. The DLMEP acts as a platform for the workforce development of the MOPH and other government agencies involved in the U.S. Agency for International Development (USAID) funded One Health Workforce project in Cameroon. The project promotes global health security by empowering Networks in Africa to build the human resources and bolster the workforce for more effective disease surveillance and control.

The project's capacity-building activities mainly concern field epidemiology, incident management systems, rapid response team, Integrated Disease Surveillance and Response (includes indicators and events based surveillance), supply chain management, risk assessment, preparedness and response plan for outbreak. Trainings are also involve simulation exercises.

Since 2010, the Cameroon Field Epidemiology Training Program (CAFETP) has been implemented by the Ministry of Public Health and the Ministry of Higher Education through the University of Buea with technical support from the United States Centers for Disease Control and Prevention (CDC). CAFETP is a national FETP program with regional reach. From 2010 to 2015, the program was part of the Strengthening Surveillance and Response in Central Africa (SURVAC) program, which was funded by the Bill and Melinda Gates Foundation and focused on strengthening surveillance in Central Africa. Over a period of five years, CAFETP trained 52 medical doctors, veterinarians, and laboratory technicians from Cameroon, DRC, and CAR. This program is funded by the United States government through the CDC and the Defense Threat Reduction Agency (DTRA). The two main trainings that CAFETP has organized consists of the 2-year 'Advanced FETP' program with a Msc. in field epidemiology and the 3-month 'Basic FETP' program. CAFETP is one of the 5 programs accredited by TEPHINET in the world. The DLMEP supports the project team by providing a deep understanding of Cameroon's health system within the country and facilitating all administrative aspects related to the MOPH's central, regional and operational levels. It also coordinates with other technical departments of Ministry when necessary.

**Office:** DLMEP has buildings adapted for training programs at the CAFETP and Public Health Emergency Operations Center (PHEOC) buildings in Yaoundé. There is a dedicated staff for workforce development. There are available spaces for meetings at PHEOC with a capacity of up to 50 people. DLMEP has experience in logistical support and is currently collaborating with Yale University, who provides logistics support and training, on a leadership training program. The DLMEP also has access to field vehicles to assist with travels.

## **E. African Institute for Mathematical Sciences (AIMS) - Cameroon**

AIMS-Cameroon is one of six centers of the African Institute for Mathematical Sciences (AIMS) which is a pan-African network of centers of excellence for postgraduate education, research, and outreach in mathematical sciences. The other centers are based in South Africa, Senegal, Ghana, Tanzania and Rwanda. AIMS mission is to enable Africa's brightest students to flourish as independent thinkers, problem solvers and innovators capable of propelling Africa's future scientific, educational and economic self-sufficiency.

### **E.1. Structure and Mission**

Established in 2003, the African Institute for Mathematical Sciences (AIMS) is Africa's first network of centers of excellence for postgraduate education, research, and outreach in mathematical sciences. We enable the continent's youth to shape the continent's future through Science, Technology, Engineering, and Maths (STEM) education and research. We have five centers of excellence across Africa – in South Africa, Senegal, Ghana, Cameroon, Tanzania, and Rwanda. AIMS is working to operate fifteen centers of excellence across Africa by 2023.

AIMS-Cameroon is the fourth center of excellence (out of 6 centers) of the AIMS network to be created under the framework of the Next Einstein Initiative in 2013. Our mission is to enable Africa's brightest students to flourish as independent thinkers, problem solvers, and innovators capable of propelling Africa's future scientific, educational, and economic self-sufficiency.

### **E.2. Campus Setting**

AIMS is situated in the seaside touristic town of Limbe. The town is an hour drive away from the city of Douala, the ever-buzzing economic capital of Cameroon and a half hour drive away from Buea home to Cameroon's only Volcanic Mountain, Mount Cameroon, which is the highest point in the sub-Saharan western and central Africa rising to 4,040 meters. AIMS-Cameroon is thus in close proximity to the University of Buea and the University of Douala, two large State Universities with whom joint activities (Seminars by visiting scholars, Conferences) are frequently organized.

In Limbe, AIMS-Cameroon is located in Crystal Gardens, near the Botanical Garden. This garden which is a significant center of attraction has a vast array of fascinating plants and runs alongside the Limbe river; and the Zoological Garden hosting rain forest animals mainly apes (gorillas and chimpanzees), crocodiles, snakes, antelopes and lots of weaver birds.

### **E.4. Campus Facilities**

The AIMS-Cameroon facility in Limbe is primarily a teaching institution, with two large classrooms, a library, computing facilities, on-board student accommodation, cafeteria and common spaces.

All personnel and visiting staff at AIMS are provided office space of varying square footage but never less than 15 m<sup>2</sup> (160 square feet). However teaching assistant and doctoral students share offices.

All personnel and students at AIMS-Cameroon are equipped with laptops, Wifi (as well as intranet) is available everywhere on campus. The campus is also equipped with a heavy-duty generator, as a back-up against power outages.

### **E.5. Educational Programs**

AIMS-Cameroon is host to four (4) programs in Cameroon, including:

- A 1 year Structured Master's degree in Mathematical Sciences, offered at the center in Limbe to selected African science graduates each year.

- A Teacher Training Program (TTP) designed to train in-service and pre-service teachers of mathematics in a bid to ameliorate their pedagogy and increase secondary school students' interest in the discipline.
- A Research Program in mathematics hosted at the center in Limbe where research is conducted in collaboration with visiting, Postdoc, and Ph.D. researchers.
- A Co-op Master's Program in Industrial Mathematics where students, after their taught master's program, go on to gain hands-on work experience in a professional work environment enabling them to develop valuable work skills and successfully transition from school to progressive careers.

So far, AIMS-Cameroon has trained 295 students, with 103 of them being women. 274 under the Structured Master's Program, and 21 under the Co-operative Master's Program. Through its graduate programmes and public outreach activities, AIMS influences choices at school and university level, drawing bright young Africans into mathematical and scientific careers.

## **E.6. Research Infrastructure**

Research is an integral part of the AIMS program. The bulk of research activities are conducted by students during the Research Phase of their training, with supervisors affiliated to the worldwide network of partners. Support is provided by Teaching Assistants, who are doctoral students or post-doctoral fellows conducting their own research. On campus we have the AIMS Research Centre, funded by the DAAD (or German Academic Exchange Service) and the Humboldt Foundation. The Research Chair is currently vacant, a new Chair is due to be appointed in 2021. It currently hosts one post-doctoral student and 3 PhD students (co-supervised by the former Chair, Prof. Gisèle Mophou).

The main features of the AIMS Research Centre are

- A strong focus on cutting-edge topics which are most relevant to African development, especially in fields where scientists in Africa have a competitive advantage and can do world-leading research
- Close involvement with local universities and other research institutions thus widening the pool of available expertise and serving to initiate long-term research programs in the local academic community
- Collaboration with institutions all over Africa to ensure strong pan-African participation in all the Research Centre's programs, stimulating the growth of pan-African research networks and partnerships
- Participation of top international researchers and institutions keen to work with African academics and students on cutting edge projects
- Close ties with industry by running programs associated with particular industrial needs, assisting in capacity building and collaboration on innovative projects
- The careful selection of cost-effective, high impact, interdisciplinary research programs in which a small fast-moving Centre can break new ground more effectively than is possible in larger, less flexible institutions

## **E.7. Strategic Partnerships**

AIMS has a culture of collaboration which enhances scientific discovery, knowledge sharing and learning, achieved through strategic partnerships with academic institutions in Africa and across the globe. Partnerships can take the form of faculty exchange programs, research exchange programs, post AIMS scholarships, as well as conferences, workshops and summer/winter schools. AIMS has been able to thrive through strategic partnerships with like-minded institutions in Africa and across the globe, who support our vision for the continent. Our Centre of Excellence was established, thanks to the commitment of the following partners:

*Government partners:* Republic of Cameroon

*Funding Partners:* International Development Research Centre; Alexander von Humboldt Foundation; Mastercard Foundation Scholars Program; German Federation of Education and Research, Canadian Government

*Local Academic Partners:* The University of Buea; the University of Dschang; the University of Maroua; the University of Douala; the African Institute of Informatics; the University of Bamenda;

*International Academic partners:* Imperial College London; Royal Statistical Society; University of Padova; Hochschule Mittweida University of Applied Sciences; Brandenburg University of Technology Cottbus-Senftenberg; University of Kassel

The AIMS Industry Initiative is leveraging the mathematical sciences towards the economic promotion of AIMS host countries, through the provision of quality human capital, knowledge transfer, and research applied to development. AIMS industry partners are real laboratories in which AIMS students test innovative solutions to boost company performance. The AIMS Industry Initiative aims to expand and diversify the organization's partner base to propel greater direct industry involvement in our training model. Our Industry partners include: Zuoix; Group 1 Holding Company; The Limbe Council; The Ministry of Public Health regional headquarters in Limbe; Cameroon Development Corporation; The Economic Community of Central African States.

## F. The University of Cape Town, South Africa

The University of Cape Town is the oldest university in South Africa and the leading research university on the African continent. UCT is rated amongst the top 100 universities in the world. Its consistent performance in world ranking systems speaks to the university's commitment to quality research as well as first rate higher education. UCT has over 25 000 students, of whom 30% are postgraduate students. It offers degrees in six faculties: Commerce, Engineering & the Built Environment, Health Sciences, Humanities, Law, and Science. UCT has established systems to ensure high quality research that are locally relevant and internationally competent. It is also the top recipient of NIH funding outside the US institutions.

### F.1. Faculty Health Sciences

UCT's Faculty of Health Sciences is committed to improving the health of the people of South Africa and beyond. Ranked the #1 health sciences faculty in Africa in 2018, its prestige today is rooted in over 100 years of excellence. The Faculty is home of the oldest medical school in southern Africa, and the site of famous advances in healthcare – including the world's first successful heart transplant in 1967 and research that led to the development of the CT scan.

The Faculty has 14 academic departments, over twenty multi-disciplinary research groupings, and more than 4000 students. The departments range from Medicine, to Surgery, to Psychiatry. In addition, there are large research institutes, units and groups in areas such as infectious disease and molecular medicine; liver disease; sports science; cardiology; child health; women's health; occupational and environmental health; brain and behavior; cancer; genetics; health economics, among others. The program of study at the Faculty are embedded in four main themes, namely undergraduate and postgraduate teaching, clinical services and research. Postgraduate registrations now exceed undergraduate, highlighting the attraction of our research environment.

The Faculty plays a vital role in responding to South African problems in the context of African and global health challenges through supporting training and research. The Faculty prepares students with the appropriate skills for health service, and its clinical exchange programs, education and extensive research collaborations span Africa and the world.

The Faculty of Health Sciences research enterprise aims to advance and encourage excellence in research. The Faculty leads high-quality research programs, trains future research leaders, and provides advice and counsel to health organizations around the world. Exceptional academics drive research in cross-disciplinary and international collaborations - amongst us are 12 of UCT's 33 A-rated scientists and 8 of the 29 UCT SARChI Research chairs. Our growing numbers of postgraduate students, many from Africa and beyond, reflect the Faculty's commitment to building research capacity and growing the next generation of academics.

Most recently, the Faculty joined the leadership of the Sub-Saharan African Medical School Study, which incorporates all of the medical schools in Africa. This network holds promise for development of a more systematic approach to inform the Faculty's role in Africa.

### **F.1.2. The Faculty of Health Sciences African Footprint**

The Faculty of Health Sciences at the UCT is one of several health science institutions across the African continent charged with the responsibility of training health professionals and health scientists. The faculty recognizes its historical context and location in Africa, and strives to play an active developmental role in the cultural, economic, political, scientific and social environment of South Africa and the African continent.

Each of the Faculty's departments and research groups has contacts within other institutions in Africa - through collaborative research, teaching and training programs or support for clinical practice in specific fields. The latter point takes the form of direct provision of clinical service on referral, provision of training in specialist and sub-specialist areas, and subsequent follow-up and onsite support for "alumni" of these programs. Some of the countries with which the Faculty has links through individuals, institutions, and universities are: Lesotho, Swaziland, Botswana, Namibia, Mauritius, Uganda, Tanzania, Malawi, Zimbabwe, Kenya, Cameroon, Sudan, Ethiopia, Ghana, Nigeria, Egypt and Gambia. In addition, several staff members of the Faculty serve on the many African committees and networks arranged around specific disciplines.

In 2006, a study was undertaken by UCT's International Academic Programs Office, which revealed that there were 127 linkages between the Faculty of Health Sciences and institutions and individuals across Africa. In the years since this study, this figure has significantly increased as the reputation of UCT's African footprint has extended.

### **F.1.3. Information Technology (HSF IT)**

HSF IT is the information technology support department for the Faculty of Health Sciences of the University of Cape Town. Its mission is to enable and assist the Health Sciences Faculty to adopt and take advantage of information technology to enhance their work and achieve their objectives using appropriate technologies deployed by suitably skilled people who have a synergistic relationship with the Faculty.

The HSF IT Section for Health Sciences offers the following services for UCT staff and students:

- IT Support on the use of Information and Communication Technology Services in the Faculty to enable the widespread use technology in order for Faculty to perform its functions of Teaching and Research.
- IT Support and Networking services to all off site hospitals and clinics.
- Define and enforce IT Policy specifically pertaining to the Faculty
- Management of all Faculty Computer Labs (Undergrad and Postgrad) in conjunction with EDU IT.
- IT advice and recommendations.
- Facilitate acquisitions services of any IT related hardware or software.
- Video Conferencing and VC support and advise.

### **F.1.4. Health Sciences Computer Labs**

Staff and students at UCT's Faculty of Health Sciences have access to two computing labs, namely the Health lab and Wolfson Computer Labs. The Health lab Computer Labs includes 121 PCs in its open area and 130 PCs in its five Teaching labs. The Wolfson Computer Labs includes 122 PCs in the Wolfson labs and 18 individual tutorial rooms with 1 PC per room. A number of software is also available at the Health Sciences Labs, such as RStudio and the WHO Reproductive Health Library 10.

### **F.1.5. Department of Surgery**

The Department of Surgery at the University of Cape Town forms part of the School of Adult Clinical Medicine in the University's Faculty of Health Sciences. The Department of Surgery prides itself on providing an outstanding clinical service, excellent teaching to both undergraduate and postgraduate students, and world-class research. The Department of Surgery is made up of the following divisions: General Surgery, Cardiothoracic Surgery, Emergency Medicine, Neurosurgery, Ophthalmology, Pediatric Surgery, Orthopedic Surgery, Otorhinolaryngology, Plastic and Reconstructive Surgery, and Urology

## Research

The Department of Surgery is committed to surgical research. Each division boasts its own research programs, mostly involving clinical research. However, both Cardiothoracic Surgery and General Surgery have active laboratory-based research programs.

### **F.1.6. Global Surgery Consortium**

The Global Surgery Consortium (GSC) is a multidisciplinary division within the Department of Surgery, Faculty of Health Sciences. Global Surgery is an area of study, research, practice, and advocacy that seeks to improve health outcomes and achieve health equity for all people who need surgical, obstetric and anesthesia care, with a special emphasis on underserved populations and populations in crisis.

The GSC's objectives is to:

- To provide an academic program to build surgical leadership in Africa and internationally.
- To become an internationally recognized, transdisciplinary Global Surgery research hub
- To promote social justice through advocacy and interventions to improve surgical outcomes.
- To promote comprehensive and cost-effective surgical care which prioritizes quality of life of the service-user.

The GSC's Executive Committee includes Dr. Salome Maswime as the Head of the Division of Global Surgery. The GSC also comprises a seven-member Steering Committee, four staff members, and seven doctoral and master's level fellows

## **F.2. Libraries**

UCT Libraries offer state-of-the-art technology, vast collections of reading and research material, and the specialized services of friendly, efficient and helpful staff.

The Chancellor Oppenheimer Library lies at the heart of Upper Campus. Its 8 branch libraries can be found close to the relevant faculties. The libraries house more than 1.2 million print volumes.

The libraries website provides essential information about library hours and services, and acts as a portal to research material, including:

- online reference works
- bibliographic and full-text databases
- 87 350 electronic journals
- articles
- eBooks
- a growing institutional digital repository
- Primo – a discovery and delivery tool for books.

### Chancellor Oppenheimer Library

The Chancellor Oppenheimer Library meets the specific needs of UCT's undergraduate and research-oriented communities. The southern wing of the library complex – the Research Wing – is reserved for postgraduate students and academic staff, and provides a quiet, comfortable haven for study, research, and writing.

The Research Commons, on Level 6 of the Research Wing, caters for the information and workspace needs of academics as well as doctoral and masters students. The Undergraduate Wing provides a variety of workspace options, including: study desks, computer workstations, power and network points for laptops, group project areas, and audio-visual viewing facilities.

### Branch libraries

The branch libraries are situated on the various UCT campuses, close to the academic departments they serve. They include:

- the Health Sciences Library, opposite Groote Schuur Hospital
- the Brand van Zyl Law Library, on Middle Campus
- the WH Bell Music Library, adjacent to the South African College of Music
- the Hidding Hall Library, near the Michaelis School of Fine Art.

### Digital Library Services

The Libraries' dedicated Digital Library Services (DLS) unit offers Digital scholarship, Geographic Information Systems (GIS) and data stewardship services to the research, teaching and learning communities at UCT. Platforms and services provided include:

- Hosting the UCT community of Data Stewards and Champions (e.g. UCT Research Data Services project on OSF, RDM at UCT Slack workspace)
- Digitisation for Preservation and Access
- Data Management Planning
- Data Sharing & Publishing
- Online Showcasing - Digital Collections at UCT
- Geographic Information Systems (GIS)
- Digital Scholarship

### **F.3. Hospitals**

Groote Schuur Hospital (Observatory, Cape Town): Groote Schuur is the main teaching hospital of the University of Cape Town's medical school, providing tertiary care and instruction in all the major branches of medicine. The hospital is an internationally acclaimed research institution and is world-renowned for its trauma unit, anesthesiology and internal medicine departments. Groote Schuur attracts many visiting medical students, residents and specialists each year who come to gain experience in various fields. As at December 2006 the hospital employed over 500 doctors, 1300 nurses and 250 allied health professionals

Red Cross Children's Hospital (Rondebosch, Cape Town): Red Cross War Memorial Children's Hospital is a tertiary pediatric hospital based in Cape Town, South Africa. The hospital was originally built as a memorial to soldiers lost in the Second World War. Since it first opened its doors in 1956, it has provided specialist care for children from all over South Africa, and continues to receive referrals for tertiary pediatric services from other African countries. It is South Africa's only dedicated child health institution and offers a comprehensive range of specialist pediatric services to children. It is a center of excellence for the training of all categories of child health professionals.

It is the largest children's hospital in Sub-Saharan Africa. It provides all levels of multidisciplinary care at an international level whilst taking into account the limitations of being located in a resource poor country.

Departments in which placements are offered: General Pediatric Medicine, Pediatric Surgery, Pediatric Trauma, Pediatric Neurology, Pediatric Orthopedic Surgery, and Pediatric Cardiology

New Somerset Hospital (Green Point, Cape Town): New Somerset Hospital is South Africa's oldest hospital and the first to provide training to medical doctors. New Somerset was the original academic hospital of the University of Cape Town before Groote Schuur Hospital opened its doors in 1937. The hospital provides comprehensive health care services which includes HIV, Aids and TB- related treatment, care, support services, HIV counselling and testing. It became the prime referral center for the treatment of AIDS and established the first antiretroviral distribution center in 2005.

Specialist services offered at the Hospital include: Anti-retroviral treatment, Casualty, Level 2 Neonatology, Maternity, Pediatrics and Psychiatric services.

Victoria Hospital (Plumstead, Cape Town): Victoria Hospital is a teaching institution that's well known for its excellence. As a district hospital it offers students and interns a perfect balance of expert supervision and hands on clinical training.

George Hospital (George, Western Cape): George Hospital is the only regional hospital (266 beds) in the Garden Route and Central-Karoo. It provides district (Family Medicine), regional (Surgery, Internal Medicine, Pediatrics, Obs & Gynecology, Psychiatry and Orthopedics) as well as tertiary services, including Maxillo-facial, Urology, ENT, Ophthalmology, Oncology and Neonatology.

It also has the only CT scanner in the area and therefore accepts patients from all the nearby district hospitals who require a CT scan. There is a 6-bed High Care Unit, 4 operating theatres and 2 day theatres. Each clinical unit consist of 3-4 specialists, a registrar, a few medical officers and interns.

The hospital includes the following departments: Internal Medicine, Pediatrics & Neonatology, Surgery, Family Medicine & Emergency Unit, Orthopedics, Anesthetics, Obstetrics & Gynecology, Psychiatry, and Ophthalmology. The Emergency Centre at George Hospital manages 40 000 to 45 000 patients per year and is staffed by Family and Emergency Medicine Physicians. There are 10 permanent senior doctors working in the unit on a shift-type system, a strong permanent nursing team. Many procedures are done, including ultrasonography, intercostal drains, suturing, closed reductions of fractures and dislocations, and of course all the ALS procedures, managing airways, breathing, and circulation. We regularly ventilate patients, including the use of non-invasive ventilation.

Knysna Provincial Hospital (Knysna, Western Cape): The Knysna Provincial Hospital is a district level hospital situated in the beautiful town of Knysna in the Garden Route of South Africa. It is the only provincial hospital in the Knysna and Bitou (Plettenberg Bay) sub districts which together with its 13 primary health clinics serves a population of around 150 000 people.

Knysna Hospital (90 beds) have 2 full time family physicians, 2 family medicine registrars, 5 medical officers and 6 community service doctors employed full time. The hospital is divided in a Male, Female, Pediatrics and Maternity ward, as well as an Out-Patient department and Emergency Centre. We have 2 theatres which provide elective (General Surgery, Orthopedics, ENT, Urology, Obstetrics, Gynecology, Plastic surgery) as well as emergency surgeries that fall within our scope of practice. It is driven by the Family Medicine team, but also welcomes specialists from the private and government sector on weekly outreaches.

We are managing an ever-growing burden of chronic illnesses, including diseases of lifestyle such as Diabetes and Hypertension, but our biggest challenges still remain within the realm of infectious diseases, more specifically HIV and TB.

The Emergency Centre manages around 2500 patients per month. Many procedures are done, including ultrasonography, intercostal drains, suturing, closed reductions of fractures and dislocations, and of course all the ALS procedures, managing airways, breathing, and circulation. We regularly ventilate patients, including the use of non-invasive ventilation.

Mitchells Plain Hospital ( Mitchells Plain, Cape Town): Mitchells Plain Hospital is a large district hospital serving a community of approximately 700 000 people with some of the highest disease burden in the Western Cape. It is aligned to the University of Cape Town's medical school, and is a training site for under-graduate and post-graduate students. The hospital is arguably one of the busiest in the Cape Metropole, and sees up to 4500 patients a month in its Emergency Unit. The Mitchells Plain sub-district has a huge disease burden of the four major health problems facing South Africa today.

These are:

- HIV/AIDS, with up to 70% of medical inpatients presenting a whole range HIV related problems such as disseminated TB, pericardial disease, renal failure, Kaposi sarcoma, cryptococcal disease etc.
- Non-communicable disease, which is a reflection of the massive obesity epidemic facing the country. Patients present with premature coronary artery disease, strokes, heart failure, diabetes related issues etc.
- Infectious diseases such as TB are rife in the community and, apart from TB, admits patients with bacterial meningitis, pneumonia, leptospirosis, malaria (occasionally) on a daily basis.
- Trauma – the trauma burden is enormous and surgeons deal with an enormous load of stab and gunshot related injuries.

Mitchells Plain Hospital comprises the following distinct specialties: Emergency Unit, Medicine, Surgery, Orthopedic surgery, Obstetrics and Gynecology, Pediatrics, Psychiatry, Radiology, and Anesthetics.

## **G. The Soroti Regional Referral Hospital, Soroti, Uganda**

Soroti Regional Referral Hospital, commonly known as Soroti Hospital is a hospital in the town of Soroti, in Soroti District, in Eastern Uganda. It is the referral hospital for the districts of Amuria, Bukedea, Kaberamaido, Katakwi, Kumi, Ngora, Serere and Soroti. The hospital is located in the central business district of the town of Soroti, approximately 291 kilometres northeast of Kampala, Uganda's capital, and largest city. Soroti Hospital is a public hospital, funded by the Uganda Ministry of Health and general care in the hospital is free. It is the main government referral facility for the mid-eastern region of Uganda.

SRRH represents the second-highest level of care within the Ugandan health system and is one of 13 public regional referral hospitals in Uganda. The 250-bed facility serves a predominantly rural catchment population and eight district level hospitals throughout the region with approximately 1400 trauma patients yearly. The hospital offers specialist curative (medicine, pediatrics, surgery, maternal health) promotive, preventative, rehabilitative and research services to a population of approximately 2 million people.

## **Equipment**

The main item of equipment to be used for this project is the UC Berkeley BRC High Performance Computing service through the Savio computing cluster. This is a 470-node, 11,620 processor-core computing cluster with over 300GB of memory and 8TB of storage that is available for fast processing of computationally intensive algorithms on large datasets. Using the BRC cluster will minimize the time necessary for data analysis.

## Foreign Justification

The overall objective of this application is to leverage data science to decrease the impact of trauma, surgical disease, and disparities on the population of Cameroon and sub-Saharan Africa by promoting collaborative research, networking, and capacity building. This is in line with funding opportunity announcement whose goal is to advance data science health research and innovation in Africa and support new African and global partnerships that enhance the impact of data science health research. This necessarily requires the study to be conducted in Africa.

# D-SINE Africa Hub

## Internal Advisory Board

### Senior Advisors

Halle Ekane (Buea)  
Shoptaw (UCLA)  
Stein (UCT)

Monono (WHO)  
Etoundi (MOPH)  
Njock (MOPH)  
Lebreton (CBI)  
Nkumbe (MEI)  
Ndip (Buea)  
Hoffman (UCLA)  
Saatchi (NASA)  
Minang (CAROSAF)  
Njoyong (Trauma Pt)  
Nkongho (Bonesetter)

## CORE A: Administrative Core

### Leadership Team

Director: Chichom (Buea)

Deputy Directors: Juillard (UCLA) Maswime (UCT)  
Hub Administrator: Dissak-Delon (MOPH)

### Core Officers

Seed Grant Program Officer: Ndip (Buea)  
Partnership Officer: Bilounga (MOPH)

### Admin Staff

Eta (Coordinator) · Nnoko (Finance) · Ncho (Analyst)

## Scientific Advisory Board

Trauma Expert  
Data Science  
Biostatistics  
NGO  
Tech  
Private Sector

## CORE B: DMAC

### Leads

Hubbard (UCB)  
Nguefack (Buea, AIMS)

### Other Faculty

Garuti (AIMS)  
Fouppouagnigni (AIMS)  
Machekano (Stellenbosch)  
Njouendou (Buea)

### Support

Victor Teghen (Buea)

## CORE C: Capacity Building

### Leads

Fouppouagnigni(AIMS)  
McCoy (UCB)

### Other Faculty

Maqungo (UCT)  
Garuti (AIMS)  
Nsagha (Buea)  
Nguefack (Buea)  
Halle Ekane (Buea)  
Hubbard (UCB)  
Njabo (CBI)  
Livingston (UCLA)  
Williams (UCLA)

## Project 1

### EQUITY SURVEILLANCE

#### MPIs

Nguefack (Buea, AIMS)  
Hubbard (UCB)

#### Co-Investigators

Maswime (UCT)  
Juillard (UCLA)  
Dissak-Delon (MOPH)

## Project 2

### TRAUMA OUTCOMES PREDICTION

#### MPIs

Juillard (UCLA)  
Chichom (Buea)

#### Co-Investigators

Tendongfor (Buea)  
McCoy (UCB)  
Hubbard (UCB)  
Maqungo (UCT)  
Dissak-Delon (MOPH)

## Future Projects

### SEED GRANT PROJECTS

### CENTER PROJECTS

### DS-I CONSORTIUM PROJECTS

#### Seed Grant Admin

PO: Lucy Ndip (Buea)  
Sandra McCoy (UCB)  
Alain Chichom (U Buea)  
Esoh Nnoko (U Buea)

## RESEARCH &amp; RELATED Senior/Key Person Profile (Expanded)

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County:				
State*:				
Province:				
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	Other Project Role Category:			
Degree Type:	Degree Year:			
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Attach Current & Pending Support:	File Name:			

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E-Mail*: cjuillard@mednet.ucla.edu				
Credential, e.g., agency login: JUILLARDDC				
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Degree Type: FAC	Degree Year:			
Attach Biographical Sketch*:	File Name:	Juillard_Biosketch_final.pdf		
Attach Current & Pending Support:	File Name:			

PROFILE - Senior/Key Person				
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County:				
State*:	CA: California			
Province:				
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Zip / Postal Code*:	94720-1650			
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Project Role*: PD/PI	Other Project Role Category:			
Degree Type:	Degree Year:			
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Attach Current & Pending Support:	File Name:			

PROFILE - Senior/Key Person				
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Department:	Department of Public Health			
Division:				
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Street2:				
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County:				
State*:				
Province:				
Country*:	CMR: CAMEROON			
Zip / Postal Code*:				
Phone Number*:	+23777673665			
	Fax Number:			
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Project Role*:	PD/PI			
Other Project Role Category:				
Degree Type:	Degree Year:			
Attach Biographical Sketch*:	File Name:	Nguefack_Tsague_Biosketch_final.pdf		
Attach Current & Pending Support:	File Name:			

## PHS 398 Cover Page Supplement

OMB Number: 0925-0001

Expiration Date: 02/28/2023

### 1. Vertebrate Animals Section

Are vertebrate animals euthanized?  Yes  No

If "Yes" to euthanasia

Is the method consistent with American Veterinary Medical Association (AVMA) guidelines?

Yes  No

If "No" to AVMA guidelines, describe method and provide scientific justification

.....

### 2. \*Program Income Section

\*Is program income anticipated during the periods for which the grant support is requested?

Yes  No

## PHS 398 Cover Page Supplement

### 3. Human Embryonic Stem Cells Section

\*Does the proposed project involve human embryonic stem cells?  Yes  No

### 4. Human Fetal Tissue Section

\*Does the proposed project involve human fetal tissue obtained from elective abortions?  Yes  No

If "yes" then provide the HFT Compliance Assurance

If "yes" then provide the HFT Sample IRB Consent Form

### 5. Inventions and Patents Section (Renewal applications)

\*Inventions and Patents:  Yes  No

If the answer is "Yes" then please answer the following:

\*Previously Reported:  Yes  No

### 6. Change of Investigator/Change of Institution Section

Change of Project Director/Principal Investigator

Name of former Project Director/Principal Investigator

Prefix:

\*First Name:

Middle Name:

\*Last Name:

Suffix:

Change of Grantee Institution

\*Name of former institution:

## PHS 398 Research Plan

OMB Number: 0925-0001

Expiration Date: 02/28/2023

### Introduction

1. Introduction to Application  
(for Resubmission and Revision applications)

### Research Plan Section

2. Specific Aims Overall\_SPECIFIC\_AIMS\_FINAL.pdf
3. Research Strategy\* Overall\_D-SINE\_RESEARCH\_STRATEGY\_FINAL.pdf
4. Progress Report Publication List

### Other Research Plan Section

5. Vertebrate Animals
6. Select Agent Research
7. Multiple PD/PI Leadership Plan Multiple\_PI\_Leadership\_Plan.pdf
8. Consortium/Contractual Arrangements Consortium\_Contractual\_Arrangements\_DSI.pdf
9. Letters of Support Overall\_LoS.pdf
10. Resource Sharing Plan(s) Resource\_Sharing\_Plan.pdf
11. Authentication of Key Biological and/or Chemical Resources

### Appendix

12. Appendix

## 1.0 D-SINE AFRICA OVERVIEW AND RESEARCH PLAN

### SPECIFIC AIMS

The Data Science Center for the Study of **Surgery, Injury, and Equity** in Africa (D-SINE-Africa) is a strategic partnership between the University of Buea (Buea), the University of California (Los Angeles (UCLA) and Berkeley), the Cameroonian Ministry of Public Health, the African Institute for Mathematical Sciences in Cameroon, and the University of Cape Town in South Africa. We have partners from the Congo-Basin Institute in Cameroon, researchers from Soroti Regional Referral Hospital in Uganda, and the UCLA Center for HIV Identification, Prevention, and Treatment Services. This coalition is built upon a long-standing collaboration between Buea and UCLA focused on decreasing the burden of surgical diseases in Cameroon and other sub-Saharan African (SSA) countries. Injuries and other surgically treated diseases comprise a significant burden of disease in SSA, but opportunities for research and funding are lacking. Our work on injury and other surgical emergencies has identified deep inequities that are particularly unmasked in acute care settings. The intersection between injury and equity is our priority area of study, as the inequities revealed by trauma are often symptomatic of larger, systemic, cross-cutting issues. Our mission is to leverage data science to decrease the impact of trauma, surgical disease, and disparities on the population of Cameroon and SSA by promoting collaborative research, networking, and capacity building.

The advent of data science has opened new horizons in opportunities to improve health in SSA. Although more abundant than ever, data is still a limited resource in low- and middle-income countries. Our approach views "big data" available in SSA as an opportunity to develop sustainable data-constrained approaches appropriate for resource-constrained settings. Data science can be harnessed to address our Center's two main goals: 1) to decrease the burden of injuries and surgical diseases through improved surveillance, prevention, and treatment; and 2) to improve access to quality surgical care in Cameroon and other SSA countries.

#### D-SINE Africa has three **Specific Aims:**

**1. Research:** To promote novel, high impact, and transformational research applying data science to reduce the burden of injury and surgical diseases through epidemiological studies, prevention strategies, disease surveillance, and clinical care optimization. With support from its Cores, D-SINE will conduct two 5-year Research Projects using data science strategies to identify, track, and support key populations: those at high risk of becoming afflicted, having poor access to care, and suffering attrition to continued care. We will also support new pilot projects aimed at improving equity and access to surgical care through data science.

**2. Networking:** D-SINE Africa will create and enhance connections between scientists, institutions, and stakeholders within its Cores, Projects, and the DS-I Africa Consortium. These novel partnerships will create new ways of looking at injury and surgical disease, speed uptake of findings on high impact, evidence-based interventions, and promote innovative, multidisciplinary science on injury, equity, and surgical disease.

**3. Capacity Building:** To mentor and train researchers, policy makers, providers, community leaders, and staff members in advanced analytic methods and public health approaches to address critical issues in injury and equity. Our Seed Grants Program will support pilot projects using pre-existing data sets or new data collection methods through our own Center and across the DS-Africa network.

Our Specific Aims will be implemented across three Cores and two Research Projects:

**Administrative Core** leads the D-SINE Africa interdisciplinary team, convenes meetings, and coordinates science, networking and capacity building agendas. It leads strategic planning initiatives, manages existing and new partnerships, and manages administrative, financial and dissemination functions.

**Data Management and Analysis Core** guides innovation and impact in data quality, statistical methods, and implementation science. It manages the secure housing of data, oversees quality, and supports effective data management and analysis across D-SINE Africa's Cores, Projects, and partners.

**Capacity Building Core** will support development of a diverse cadre of SSA researchers, mentor D-SINE Africa Research Fellows, implement and support the Seed Grant Program, and leverage D-SINE partners' resources to strengthen administrative capacity towards research training and administration.

**Two Research Projects** on **Health Equity Surveillance** and **Trauma Follow-Up Prediction** will use data science to address urgent priorities at the intersection of surgery, injury, and equity over the next 5 years.

D-SINE Africa efforts will drive innovation and impact in data science, injury, and equity research to improve access to surgical disease prevention and care, including those whose socioeconomic status conspires to increase their vulnerability to injury and surgical conditions while reducing consistent surgical care access.

## 1.0 D-SINE OVERVIEW AND RESEARCH PLAN

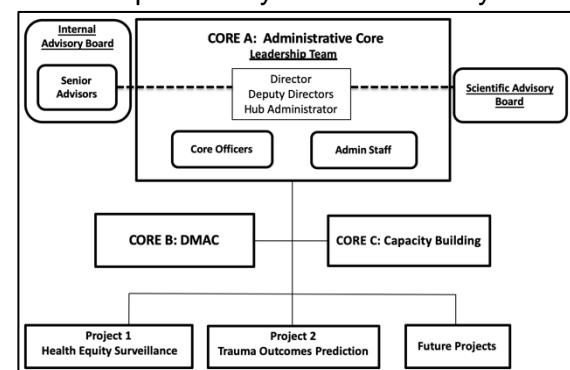
## RESEARCH STRATEGY

## A. SIGNIFICANCE AND RELEVANCE TO THE DS-I AFRICA PROGRAM

**A.1 The D-SINE Africa strategic plan for the five-year funding cycle focuses its scientific resources, methods expertise, and capacity building experience on addressing the intersection of health disparities with the risk factors and outcomes associated with injury and surgical disease in SSA.** Our mission is to decrease the impact of trauma, surgical disease, and disparities on the population of Cameroon and sub-Saharan Africa (SSA) by promoting collaborative research, fostering networking, and supporting capacity building, with an emphasis on equity and data science. Our goal is to create a hub to support and sustain data science-driven research to promote the study of injury, surgery, and equity in SSA. Our center will feature three cores (Administrative (Admin), Data Management and Analysis (DMAC), and Capacity Building Core (CBC)) that will work together to support D-SINE's mission, including the successful execution of two five-year Research Projects and additional, new projects that are developed through our hub's work, Seed Grant Program for SSA investigators, and the greater DS-I Africa Consortium (**Figure 1**). Through this five-year period, we aim to make impactful contributions to the field of data science that improve equitable access to surgical care in SSA and reduce disparities in susceptibility to surgical disease, while simultaneously building the capacity in SSA for data science research to address the continent's most urgent public health needs.

**A.2 The scientific premise for this plan is based on findings showing that trauma and other surgically treated conditions are a crippling, unaddressed burden of disease that disproportionately impacts SSA globally.** The disparity *among* countries is compounded by that *within* individual SSA countries, where there exists another layer of disparity, further marginalizing those of lower socioeconomic status (SES). Failing to identify those who are most vulnerable to surgical disease and poor outcomes associated with lack of surgical care further compounds this inequity. A long-term goal for D-SINE Africa is to develop and disseminate context-relevant methodology and interventions aimed at identifying, tracking, and ultimately reducing these disparities in SSA. Traditionally, considered the “neglected stepchild of public health”,<sup>1</sup> a growing body of evidence suggests that surgical care is a critical part of health systems development expected to become increasingly necessary as countries industrialize<sup>2,3</sup>. As appreciation of the importance of surgical care grows, the magnitude of the problem is reflected in dire statistics: 2 billion people lack access to surgical care globally; access to essential surgery could prevent 6-7% of avertable deaths in low- and middle-income countries (LMICs); and, contrary to popular misconception, strengthening surgical care appears to be cost-effective<sup>2-4</sup>. Poorer countries not only have significantly worse access to surgical care, but also have worse surgical outcomes<sup>4,5</sup>. Within LMICs, lower SES individuals are less likely to receive surgery when they need it<sup>6-8</sup>. This intersection between surgery and equity represents a *discrete but critical gap in the larger context of two complex issues*: 1) overall strengthening of surgical care systems in LMICs; and 2) the ubiquitous problem of health inequities that are particularly stark in many SSA countries. Failing to address this essential intersection between surgery and equity will exacerbate current inequities, further magnifying health outcome disparities.

**A.3 The confluence of an increasing quantity of data with the rapid development of advances in data science methods is an unprecedented opportunity to tackle surgical disparities in SSA.** Another scientific premise for the D-SINE Africa approach is the promising application of machine learning, GIS mapping, and other data science techniques to acute surgical conditions. Given the challenges of conducting randomized trials in acute care settings and the many factors that contribute to injury outcomes, data science approaches inherently lend themselves to applications in this context. In complicated systems with many relevant variables, traditional statistical methods can lack the flexibility to address questions in previously data-poor settings. The use of data science methodology, particularly machine learning and causal inference, can be leveraged to understand how a complex set of factors, both biological and social, can impact injury health outcomes. Advantages of these methods include: the ability to adapt to available data elements; the incorporation and evaluation of multiple complex and nonlinear models<sup>9-14</sup>; and improved treatment of time dependent analyses and missing variables in complex data sets<sup>10,15</sup>. These techniques have shown initial promise in select applications in SSA settings,<sup>14,16,17</sup> but have been underused in surgical contexts<sup>18</sup>.



**Figure 1:** D-SINE Africa Organizational Outline (see *Hub Organizational Structure* section for further detail).

**A.4 Our short-term goal targets D-SINE Africa's public health and data science expertise towards identifying solutions to produce measurable reductions of barriers in access and adherence to surgical disease prevention and care, with emphasis on those who are currently marginalized due to their SES.** Our multidisciplinary team has a track record of data science application to trauma and acute care challenges in HIC and LMIC<sup>9,10,19,20</sup>. We also have a demonstrated commitment to using data science approaches to address surgical inequity in the US and in SSA<sup>21-24</sup>. We propose to build on this strong foundation to complete two projects supported by the D-SINE Africa Cores that aim to improve surgical outcomes at points in patient trajectories most likely to be impactful (see **Research Project Strategies**).

**Research Project 1 – Health Equity Surveillance** addresses the urgent gap in rapid SES estimation necessary to track health equity in acute care settings by applying a clustering algorithm to existing publicly available Demographic and Health Surveys (DHS) data sets for SSA. The project's targeted dimension reduction will yield an SES metric that can be assessed by collecting only four variables at the individual level and making this validated methodology free for researchers interested in health equity to implement in their own studies in SSA. The platform for this methodology will be tested using trauma registry data in three SSA countries to ensure feasibility. **Research Project 2 – Trauma Follow Up Prediction** aims to improve trauma outcomes by using machine learning to optimize a mobile phone-based screening survey that will identify which trauma patients would benefit from further care after they are discharged from the hospital, again using a data reduction “big data to small data” approach in line with D-SINE Africa's commitment to sustainable data use practices (see **C.2**). These projects utilize common data sources (Cameroon Trauma Registry), have harmonizing themes (injury, equity, and data reduction), and will yield findings that can be used together (e.g., identification of SES groups vulnerable to poor follow up care). These projects and the pilot projects implemented by D-SINE Africa's Seed Grant Program (see **Admin Core** and **CBC Core Strategies**) will be supported by three cores. The Admin Core will ensure financial and administrative oversight, communication and integration within D-SINE and the DS-I Africa Consortium, and dissemination of findings. The DMAC will oversee data collection, security, and quality while providing data science methods expertise. The CBC will provide close mentorship and curated professional development curricula to each D-SINE Africa Research Project Fellows and Seed Grant trainees. The expected outputs from D-SINE Africa's short-term goals include: identification of population-specific inequities in trauma and surgical care access and outcomes in SSA; cross-cutting methodology to facilitate monitoring of disparities in acute settings across SSA; and improved adherence to follow up care in Cameroon to improve trauma outcomes. These outcomes feed directly into our long-term goal of reducing the impact of surgical diseases and injury and disparity on population health in SSA.

**A.5 D-SINE Africa is poised to increase data science capacity in SSA at the institutional and individual levels to accelerate innovation and impact on population health.** We will capitalize on our partner institutions' strengths, collective years of experience mentoring trainees, existing training tools and programs, and access to large datasets to foster the next generation of African researchers leveraging data science methodology to benefit the health of their communities. D-SINE Africa features a Capacity Building Core (CBC), that is built around recognized hurdles to investigator development and success in SSA. To support the DS-I Africa Consortium UR2 training grant recipients' formal degree-granting program development, D-SINE Africa will provide several complementary career enhancement opportunities (see **CBC Strategy Approach**

**Aim 1 D.1.2.1 and Aim 2 Seed Grant Program**). The CBC will oversee implementation of D-SINE Africa's Seed Grant Program, designed to support investigators interested in data science applications to trauma, surgical, and health equity issues (see **CBC Strategy Approach D.2 Aim 2**). For investigators or trainees throughout the DS-I Africa Consortium who wish to selectively strengthen their understanding of data science approaches, the D-SINE Africa CBC will offer several stand-alone data science courses and certificates, ranging from 3-course series suitable for learners of all backgrounds to in-depth coursework featuring rigorous, hands-on experience with modern data analysis methods. Each of D-SINE Africa's Research Projects will incorporate an SSA Research Fellow who will be integrated into study activities. D-SINE Africa's two main Research Projects will have several opportunities for smaller, pilot projects and secondary analyses in years 3-5 of the funding cycle that can serve as mentored research projects for young SSA investigators. Our strategic partnership with the Congo-Basin Institute (CBI) provides access to additional large data sets (roadway infrastructure, geospatial data, satellite data) that have potential for novel application to trauma and surgical care and advanced training facilities (see **Letters of Support**). Young investigators from SSA who work on D-SINE Africa sponsored pilot projects, Seed Grants, or other mentored opportunities will have access to these data to spur innovative application and analysis.

## A.7 D-SINE Africa draws upon a strong history of multidisciplinary, multi-institutional, multi-country collaboration to foster synergy among the Center's sectors and enhance strategic collaboration through D-SI Africa Consortium Participation.

D-SINE Africa is founded on a long-term partnership between the University of California (Los Angeles (UCLA) and Berkeley (UC Berkeley campuses), the University of Buea (Buea), and the Ministry of Public Health in Cameroon (MOPH). To enhance the opportunity and impact of D-SINE Africa's work, we have brought in additional strategic partners: the African Institute for Mathematical Sciences, Cameroon (AIMS-Cameroon), which brings advanced mathematical, data science, and capacity building expertise; and the University of Cape Town (UCT), which features clinician scientists with documented excellence in global surgery research and the added experience of a premiere research institution skilled at managing and executing research in SSA (**Figure 2**). D-SINE Africa's model is collaborative, integrating investigators and stakeholders from all partners institutions throughout every component of the Center (three Cores, two Research Projects, Internal Advisory Board, and Seed Grant Program). This design is intentional, both because it leverages strengths brought by each individual and institution, and because our team knows that the most innovative, successful projects are almost always born of cross-sectoral collaboration. Partnerships and collaborations are the foundational architecture of D-SINE Africa's structure with additional roles integrated into the Research Hub cores to spur development of new, innovative partnerships. This approach will dovetail with D-SINE Africa's integration into the broader D-SI Africa Consortium, including working groups, cross-consortium initiatives and projects, and MPI participation in the DS-I Africa Steering Committee and associated meetings. Our team thrives on team-based work and has a sustained history of achievement through collaboration. D-SINE Africa's research hub is based in bi-lingual Cameroon, featuring investigators that speak both French and English (Chichom, Juillard, Nguefack-Tsague, Dissak-Delon, Mama) at each leadership level. This unique profile optimally positions D-SINE Africa to serve as a network facilitator to the majority of the SSA linguistic diaspora, nearly half of which is Francophone. D-SINE Africa believes in amplifying collected data impact through open data sharing with researchers, public health practitioners, and other stakeholders for secondary analyses. As detailed in the **Resource Sharing Plan**, data collected through D-SINE Africa's two projects and Seed Grants will be made available to researchers through NIH-supported FAIR (Findable, Accessible, Interoperable, and Reusable) data sharing practices through partner agreed-upon mechanisms to protect human subjects, including contributing these data to the D-SI Africa Coordinating Center and the Open Data Science Platform.

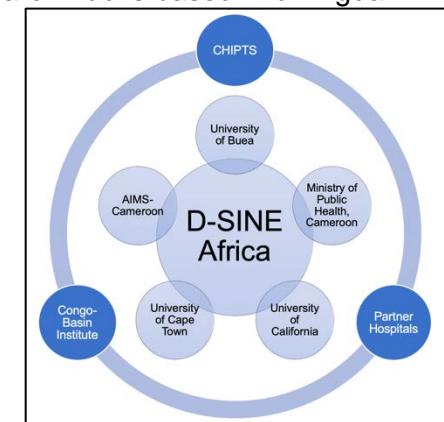


Figure 2: D-SINE Africa Partners

**A.8 D-SINE Africa has built community engagement vehicles into the Internal Advisory Board (IAB) and Administrative Core to promote a multi-faceted approach to building trust with research participants and end-users.** D-SINE Africa's mission is to leverage data science to decrease the impact of trauma, surgical disease, and disparities on the population of Cameroon and SSA. As disparities inherently impact disenfranchised, vulnerable populations, interventions aimed at mitigating these disparities cannot succeed without strong community engagement. We have included several key stakeholder representatives on D-SINE Africa's IAB: Anne Njoyong is a Cameroonian trauma patient who brings first-hand experience of health systems navigation from the patient perspective; Agbor Augustine Nkongho (known in the community as "Dr. Bone") is a traditional bonesetter, representing an important provider group often utilized by West African trauma patients, yet marginalized from formal health care settings<sup>25,26</sup>; and Edwin Minang is the coordinator for the Cameroon Road Safety Foundation (CAROSAF), a non-profit organization dedicated to road traffic injury prevention and advocacy (see **Letters of Support**). We have also included a "Partnership Officer" (Chanceline Bilounga (MOPH), see **Admin Core Strategy**). While the MPIS will interface regularly with the DS-I Africa Consortium, Collaborating Center, and other awardees, Dr. Bilounga's position will provide an additional layer of partnership development focused on engaging community partners, advocacy groups, clinicians, and end-users of research findings or successful interventions. Our goal is for D-SINE to hold a unique and vital place for brokering information from academia to the community—and from the community to academia.

## B. RESEARCH TEAM AND ENVIRONMENT

**B.1 Strategic Partners.** D-SINE Africa is designed to leverage resources from a network of institutions with research expertise in public health, biomedical sciences, data science, and clinical medicine to accomplish our Specific Aims. The Senior Leadership Team, Leads, and co-Is for D-SINE Africa's Cores and Projects are drawn from five partner institutions: Buea; MOPH; AIMS-Cameroon; the University of California; and UCT. This

collaboration weaves together clinician researchers, public health experts, data scientists, capacity building resources, and governmental administrative experience to create D-SINE Africa's Executive Committee. In addition to these core partners, D-SINE Africa is also supported by CBI, partner hospitals in Cameroon and Uganda, and CHIPTS-UCLA. Each partner has been brought on to bring a strategic component to the team, creating a tightly designed portfolio of expertise, resources, infrastructure, and excellence.

**B.1.1 University of Buea.** D-SINE Africa will sit at the Buea, an Anglophone university with 300 full-time and 200 part-time faculty who instruct 12,000 students through seven main faculties: Arts; Education; Veterinary Medicine and Agriculture; Engineering and Technology; Health Sciences; Science; and Social and Management Sciences. **Dr. Alain Chichom** is the Chief of Surgery at Buea, and has a long track record of successful research and mentorship there. Buea has been the seat for the majority of research and education activities conducted by its ongoing collaboration with the University of California's Program for the Advancement of Surgical Equity (PASE, see **B.1.2**) and the MOPH. Buea has a strong foundation upon which to build D-SINE and support our specific aims of fostering injury, surgery, and equity research, networking, and capacity building in Cameroon and elsewhere in SSA. To enhance Buea's existing capacity to support D-SINE's mission, several strategic partners have been engaged.

**B.1.2 University of California.** Buea has a formal agreement and long-term partnership with **PASE**, a UCLA Department of Surgery initiative, consisting of multidisciplinary core faculty from UCLA and UC Berkeley who work together to promote research and education aimed at reducing surgical disparity both globally and locally. **Dr. Catherine Juillard**, who will serve as a D-SINE Africa Deputy Director, is PASE's founding co-Director and has had a long-term collaboration with PASE's Director of Research in Cameroon, **Dr. Alain Chichom**. The strong history of research, mentorship, and previous NIH funding (*R21TW010956, R21TW010453*) awarded this partnership serves as the foundation for the current proposed scope of work. This partnership has also had a successful track record of mentorship in both the US and Cameroon, supporting Cameroonian trainees in first-author publications<sup>27-29</sup>. **Dr. Alan Hubbard** (UC Berkeley) is the PASE core biostatistics faculty lead and has worked with Juillard and Chichom on projects related to machine learning prediction in trauma<sup>9</sup> and development of novel algorithms for rapid SES assessment in resource-limited settings<sup>22,23</sup>. Recently, PASE has recruited Associate Professor of Epidemiology **Dr. Sandra McCoy** (UC Berkeley) to join the core faculty group, who will serve as the D-SINE Africa Capacity Building Core Co-lead. She brings an exceptional quantitative background in epidemiology and strong leadership in public health curriculum development, as the current program lead and curriculum coordinator for the UC Berkeley MPH epidemiology and biostatistics program. McCoy is an NIH-funded researcher who has been conducting research and designing interventions in SSA<sup>30-34</sup> for over 10 years. The robust network and resources of the two premiere University of California campuses at Los Angeles and Berkeley can be leveraged to buttress Buea's technical research expertise and capacity building activities with extensive scientific, infrastructure, and administrative support.

**B.1.3 Ministry of Public Health, Cameroon.** The MOPH has been a Buea/PASE team partner since 2008<sup>35-39</sup>. A priority program that has come from this collaboration is the multi-institutional Cameroon Trauma Registry (CTR), which provides an ongoing data source for work on trauma outcome prediction,<sup>9,40,41</sup> mHealth intervention development,<sup>42</sup> and injury surveillance<sup>43,44</sup>. The CTR will serve as a backbone data source for both of D-SINE Africa's proposed Research Projects. Integration of the MOPH into the D-SINE Africa structure will occur at several levels: 1) The current Director of Disease Control at the MOPH, **Dr. Georges Alain Etoundi-Mballa**, will serve on D-SINE Africa's IAB; 2) **Dr. Fanny Nadia Dissak-Delon**, a Regional Controller in the MOPH, will take a leave of absence to serve full-time as D-SINE Africa's Hub Administrator; 3) **Dr. Chanceline Bilounga** will serve on D-SINE Africa's Administrative Core Staff as our Partnership Officer to ensure ongoing communication between D-SINE Africa leadership, the MOPH, and other partners. As the MOPH governs health systems organization in Cameroon, it is considered an end-user of any research findings or successful interventions that may be developed. By creating a close-knit partnership between the MOPH and D-SINE Africa's other partner organizations, MOPH priorities will drive project development from the ground up and facilitate uptake and dissemination of findings.

**B.1.4 African Institute of Mathematical Sciences (AIMS-Cameroon).** To complement existing data science and capacity building resources at Buea, D-SINE Africa has formed a strategic partnership with AIMS-Cameroon. AIMS is a pan-African network of centers of excellence and scientists dedicated to postgraduate education, research, and outreach in mathematical sciences. AIMS-Cameroon's partnership brings deep experience in mathematical sciences capacity building in SSA, with expertise in curriculum development and delivery, and faculty with diverse mathematical sciences backgrounds. **Drs. Mama Fouopouagnigni** and **Marco Garuti** currently serve as co-Directors for AIMS-Cameroon. Fouopouagnigni will serve as Co-Lead with McCoy

for the D-SINE Africa CBC, which will be greatly enhanced by his extensive teaching experience and intimate knowledge of the existing data science resources through the AIMS faculty network. **Georges Nguefack-Tsague** holds dual Buea and AIMS faculty appointments, with expertise in advanced statistics and DHS data analysis (the primary data source for the ***Health Equity Surveillance Research Project***), and teaches the CDC field epidemiology program at Buea, optimally positioning him for MPI on this collaborative project.

**B.1.5 University of Cape Town (UCT).** In order to support the University of Buea's existing research and administrative capacity, our collaboration has formed a strategic partnership with the University of Cape Town in a unique North-South-South model. UCT's current Head of their Division of Global Surgery, ***Dr. Salome Maswime***, will serve as a D-SINE Africa Deputy Director with Juillard. She brings added expertise in global surgery research and leadership with a clinical background in obstetrics and gynecology,<sup>45–47</sup> another high priority surgical discipline in SSA, to complement Chichom's and Juillard's backgrounds in trauma. ***Sithombo Maqungo*** is an orthopedic surgeon with a focus in trauma and gunshot wound epidemiology,<sup>48,49</sup> adding another surgical niche to the D-SINE Africa portfolio. As an SSA university with a well-established, rich, research portfolio and extensive track record of managing large U.S. federal grants, UCT will serve as an institutional administrative mentor to Buea, bringing a valuable perspective and ability to translate complex research resources towards application and implementation in SSA settings (see ***Letters of Support***).

**B.2. Senior Leadership Team.** D-SINE Africa's Senior Leadership Team will consist of a Director and two Deputy Directors from diverse partner institutions who will work together to provide Hub leadership. Each of these Directors will have a Senior Advisor at their home institution who has expertise in research design and implementation, a significant funding track record, and strong administrative experience. A Hub Administrator (Dissak-Delon) will be responsible for daily management, execution, and oversight Hub activities (**Table 1**).

**Table 1:** D-SINE Africa Senior Leadership Team's associated roles and expertise.

Name	Institution	U54 Role	Center Role	Project Role	Expertise
Alain Chichom-Mefire	Buea	MPI	Director	Lead	Surgery, Trauma, Public Health
Catherine Juillard	UCLA	MPI	Deputy Director	Lead, Co-I	Surgery, Trauma, Public Health
Salome Maswime	UCT		Deputy Director	Co-I	Surgery, Obstetrics/Gynecology, Public Health
Alan Hubbard	UC Berkeley	MPI	DMAC Co-Lead	Lead	Biostatistics, Data Science, Public Health
Georges Nguefack-Tsague	Buea / AIMS	MPI	DMAC Co-Lead	Lead	Statistics, Public Health
Mama Fouppouagnigni	AIMS		CBC Co-Lead		Mathematics, Statistics
Sandra McCoy	UC Berkeley		CBC Co-Lead	Co-I	Epidemiology, mHealth, Implementation Science
Fanny Dissak-Delon	MOH		Hub Administrator	Co-I	Public Health, Medicine, Qualitative Methods
Gregory Halle-Ekane	Buea		Senior Advisor		Obstetrics/Gynecology, mHealth, Leadership
Steve Shoptaw	UCLA		Senior Advisor		Behavioral Health, Health Equity, Leadership
Dan Stein	UCT		Senior Advisor		Behavioral Health, Trauma, Leadership

**B.2.1 Directors.** ***Alain Chichom (Buea)*** will serve as **U54 MPI** and **D-SINE Center Director**. Chichom's administrative leadership experience and long track-record of productive research, funding, and mentoring trainees in Cameroon and the U.S., coupled with guidance and input from the Cores, the Advisory Boards, and Halle-Ekane's guidance, assure successful administration of D-SINE Africa for the next five years. ***Catherine Juillard (UCLA)*** will serve as **U54 MPI** and **D-SINE Center Deputy Director**. She has 13 years of experience leading studies in Cameroon<sup>35,36,40–42,50,51</sup> and SSA<sup>19,20,52–56</sup> focused on improving surgical care access and quality, and applying data science approaches to injury, surgery and equity research<sup>9,22,23</sup>. Juillard and Chichom have collaborated since 2008, with a successful track record of project execution, trainee mentoring (both US and SSA), funding, and publication<sup>27–29,41–57</sup>. ***Salome Maswime (UCT)*** will serve as **D-SINE Center Deputy Director**. Maswime has received several honors, including being awarded the World Economic Forum Young Scientist and Next Einstein Fellow,<sup>58</sup> for her work on access to surgical and maternal health care in SSA<sup>45,47,59</sup>. Maswime's UCT team will provide expertise in global surgery research, capacity building, health equity advocacy, and high-level administration, creating unique North-South-South translational mentorship support for Buea's infrastructure to execute D-SINE Africa's administrative and research goals. ***Fanny Dissak-Delon (MOPH)*** will serve as **D-SINE Africa's Hub Administrator**, working closely with Dr. Chichom to oversee daily activities. Dissak-Delon has worked with PASE/Buea since 2014 as the CTR study supervisor. She brings deep experience in research and program administration, working with various MOPH departments, divisions, and offices, as well as with CTR participating hospital leadership. ***Dr. Dissak-Delon will take a leave of absence*** from the MOPH to serve full time as the D-SINE Hub Administrator for the length of the proposed projects.

**B.2.2 Senior Advisors.** Our leadership team has a demonstrated funding track record consisting of Patient-Centered Outcomes Research Institute (PCORI) funding, USAID contracts, Melinda and Bill Gates Foundation funding, World Bank contracts and grants, academic society grants, and several NIH grants (R21s—PIs; P42, R01, and R56—Co-Is). In addition to our track record of successfully leading research projects funded across

the federal and non-federal level, we are proposing a Senior Advisory panel to advise and guide the D-SINE Africa leadership team. The Senior Advisors are individuals from within our partner institutions with a demonstrated excellence in leadership, scientific productivity, and administration of large funding resources through complex systems who will provide input on the strategic management, structure, and execution of the award through regular meetings. Serving as Senior Advisor to the Center Director (Chichom), **Dr. Gregory Halle Ekane** (Buea) is the current Dean for the School of Medicine and former Vice Dean for Research and Cooperation at Buea. He is also an accomplished investigator and mentor, serving as an Afya Bora Fellowship in Global Health Leadership mentor. Professor of Psychiatry **Dan Stein** (UCT), who has extensive experience mentoring junior colleagues in areas of particular relevance to SSA, will serve as Senior Advisor to Maswime (Deputy Director). He has served as the Director of Extramural Research for the South African Medical Research Council since 1997 and was awarded the Lifetime Achievement Award by the World Federation of Societies of Biological Psychiatry in 2019. His robust track record in NIH funding, publication (over 1200 PubMed indexed publications), and mentorship will provide Maswime with rich support at her home institution. **Steve Shoptaw** (UCLA) will serve as Senior Advisor to Juillard (Deputy Director). He has served as PI or Co-PI on over 45 NIH-funded projects and currently directs the NIH-funded (*P30MH058107*) CHIPTS-UCLA, which includes both U.S. and international work. In addition to his Professor faculty position at UCLA, Shoptaw is Professor (Hon) at UCT, where he collaborates with Stein (Senior Advisor to Maswime). The Senior Advisors' combined administrative, scientific, and operational expertise will contribute seasoned guidance to the D-SINE Africa Directors. Please see **Biosketches** and **Letters of Support** for further information.

### **B.2.3 Administrative Core Organization**

The Admin Core will be led by D-SINE Africa Chichom, with engaged support from Juillard and Maswime, and operational support from the Hub Administrator, Dissak-Delon. The Senior Leadership team is designed to include representation from Buea, UCLA, UCT, and MOPH to facilitate close collaboration and shared decision-making between these key partner institutions. The Team will meet weekly to review progress on Center activities, to respond to emerging issues, and make decisions about staff and resource allocation. The Admin Core will also be bolstered by staff to facilitate administrative duties and officers and advisors to provide targeted support (see **Admin Core Strategy** for detailed description of organization and operations). D-SINE Africa will also have a DMAC (see **B.2.3.1**) that will ensure data control/data quality, manage data resources, and support and develop data science methodology across D-SINE Africa's Cores and Research Projects (see **DMAC Strategy**). In addition to the Admin Core and the DMAC, D-SINE Africa will feature a CBC that will house D-SINE Africa's internal and external capacity building activities. As capacity building is D-SINE Africa's third Specific Aim, the incorporation of the CBC will centrally organize D-SINE Africa's administrative, educational, mentorship, and technical capacity building resources to ensure that D-SINE Africa's capacity building activities are well-developed and optimally implemented (see **B.2.3.2** below and **CBC Strategy**).

### **B.2.3 Associate Directors (Core Leads)**

**B.2.3.1 DMAC Co-Leads.** **Nguefack-Tsague** (Buea, AIMS) will serve as **U54 MPI, DMAC Co-Lead (D-SINE Associate Director)**, and Project Lead on Research Project 1 – Health Equity Surveillance, bringing advanced statistical expertise, with particular knowledge of DHS data analysis, combined with a robust experience of conducting fieldwork in Cameroon. Nguefack-Tsague's work in Cameroon has focused on access to care, including trauma care, and universal health coverage<sup>60–63</sup>; he has made important contributions to data adaptive estimation including work on Bayesian model selection<sup>64</sup> and post-estimation inference<sup>65</sup>. **Hubbard** (UC Berkeley), will serve as **U54 MPI, DMAC Co-Lead (D-SINE Associate Director)** and Project Lead for Project 1 – Health Equity Surveillance. He is director of the Biomedical Big Data pre-doctoral (T32) training program, Co-Director for the Center of Targeted Learning, and head of the computational biology Core E of the SuperFund Center at UC Berkeley (NIH/EPA). His work has focused on semi-parametric estimation in high-dimensional data and estimation of complex causal parameters and prediction algorithms using machine learning, with an emphasis on applications in epidemiology,<sup>66,67</sup> environmental exposures, and trauma<sup>10,68,69</sup>. The DMAC's three Specific Aims are designed to support D-SINE Africa's Cores and Projects through: quality control and assurance (Aim 1); data systems management and coordination (Aim 2); and data science methods development and support (Aim 3). Further details on the DMAC's Aims, faculty, structure, operations, and Hub integration can be found in **Biosketches** and the **DMAC Strategy**.

**B.2.3.2 CBC Co-Leads.** **Fouopouagnigni** (AIMS-Cameroon) will serve as **CBC Co-Lead and D-SINE Africa Associate Director**. As Professor of Mathematics and AIMS-Cameroon Center President, he has been instrumental in the expansion of the core training capacity at AIMS, specifically in the mathematical modelling of infectious diseases, data science, and mathematics for climate science. His leadership skills in combination

with his knowledge of curriculum development and training implementation in Cameroon uniquely qualify him to lead the CBC. The CBC will be co-led by **McCoy** (UC Berkeley), Associate Professor of Epidemiology and Program Lead and Curriculum Coordinator of the UC Berkeley Epidemiology and Biostatistics Online MPH program. McCoy has mentored trainees at the undergraduate, graduate, and postdoctoral levels for the past 10 years, including postdoctoral fellows in sub-Saharan Africa, and leads a portfolio of NIH-funded research focusing on impact evaluation, implementation science, and intervention design and evaluation in SSA<sup>30-34</sup>. The creation of a dedicated CBC will harmonize and develop D-SINE Africa's rich resources and expertise to infuse capacity building opportunities throughout D-SINE Africa's activities. The CBC will support D-SINE Africa's Cores and Research Projects through Specific Aims focused on: mentoring emerging SSA scientists towards independence (Aim 1); post-award implementation of D-SINE Africa's Seed Grant Program (Aim 2); and capacity building support for grant and research administration (Aim 3). The CBC will serve as a central coordinating center for D-SINE Africa's capacity building, mentoring, and career enhancement opportunities available to Seed Grant Program awardees, multi-year Research Fellows (assigned to each of D-SINE's two Research Projects), and investigators in the D-SINE Africa and DS-I Consortium networks. For further details regarding the CBC faculty, resources, and curricula, please see **Biosketches** and **CBC Strategy**.

**B.3 Internal Advisory Board (IAB).** All **Senior Advisors (Halle Ekane, Shoptaw, and Stein)** will serve on the IAB. Additionally, **Richard Njock** and **Georges Alain Etoundi Mballa** will provide senior representation from the *MOPH* to ensure that D-SINE Africa's projects incorporate stakeholder factors influencing uptake and dissemination of findings at an early stage of design. **Risa Hoffman**, Director of the *Global Health Program at the UCLA School of Medicine* and PI of an NIH- and USAID-funded partnership in Malawi, will provide expert scientific and administrative guidance. **Tom Smith** (Director) and **Matthew Lebreton** (General Manager) of the *Congo-Basin Institute (CBI)* in Cameroon, and **Henry Nkumbe**, CEO and Medical Director of *Magrabi Eye Institute (MEI)*, bring established expertise in successful on-the-ground management and implementation of complex partnerships in Cameroon<sup>70</sup>. CBI is a consortium led by UCLA and the International Institute of Tropical Agriculture (IITA) dedicated to addressing the interconnected issues of environment, disease, and poverty. Their model centers on research and capacity building to support SSA trainees and supports a network of training facilities, field stations, lab facilities, and accommodations in Cameroon. Both programs are well-funded, sustainable models of successful collaborative initiatives in Cameroon whose organizational leadership experience will provide important guidance to D-SINE Africa's establishment as a sustainable collaborative center in Cameroon. NASA-funded researcher **Sassan Saatchi** brings deep expertise in advanced data science applications, including satellite-facilitated remote sensing and spatial analysis. **Lucy Ndip** is the *Buea's Deputy Vice-Chancellor in charge of Research, Cooperation and Relations*, bringing critical understanding of the administrative and research funding landscape at Buea, both as a funded investigator and as a high-level administrator. To ensure community involvement in D-SINE Africa's research priorities and implementation, we will include stakeholders from community groups affected by the burden of trauma and other surgical diseases in Cameroon. **Edwin Minang**, National Coordinator for the Cameroon Road Safety Foundation (CAROSAF), an advocacy group dedicated to reducing road traffic deaths, will also bring essential insight from the non-profit and community-based perspectives. **Anne Njoyong**, a former trauma patient, will represent the ultimate end-users of D-SINE Africa's work to help inform how we empower research participants and increase successful uptake of interventions. A traditional tone setter,<sup>25,26</sup> **Agbor Augustine Nkongho's** perspective will help D-SINE Africa's leadership better understand how and why people seek certain types of health care, consider the practical application of injury research in Cameroon, and explore how to better integrate non-formal medical sectors into our work. Further information can be found in **Letters of Support**.

## C. INNOVATION

**C.1 To break down the silos between data and health sciences, D-SINE Africa has a multi-disciplinary leadership structure through every level of its hierarchy.** There are several barriers to the realization of data science's potential to impact public and biomedical health in SSA, including limitations in data collection and storage formats and a lack of awareness; a global survey of 7,280 neurosurgeons' knowledge of machine learning received only two responses from Africa<sup>18</sup>. Training programs and academic structures tend to silo professionals with data science backgrounds, rather than engaging with biomedical, clinical, and public health professionals. D-SINE Africa features an MPI structure that includes a Cameroonian surgeon, a Cameroonian data scientist, a U.S. surgeon, and a U.S. data scientist; the Hub's Senior Leadership Team features data scientists, clinicians, and public health experts. This blended leadership structure with shared decision-making builds collaboration into D-SINE Africa's framework. The CBC's shared leadership between a Cameroonian mathematician and a U.S. epidemiologist will provide emerging SSA investigators with an integrated training

experience that merges these traditionally distinct fields, preparing them to embrace multidisciplinary models to tackle SSA's most pressing health issues. D-SINE Africa has embraced a philosophy of "agnostic inclusivity," which fosters innovation through dialogue between scientists of seemingly unrelated fields, for example, including a traditional bone setter and a NASA scientist on the same IAB (see **B.3**). This innovative structure can serve as a model for other SSA academic entities to break down historical silos.

**C.2 D-SINE Africa research projects feature integration of equity into data science methods to simultaneously solve critical health issues with approaches that can also address broad challenges in public health research.** Advances in data science are an opportunity to improve health equity, but biased training data, lack of transparency, and poor regulation can unintentionally exacerbate disparities<sup>71-73</sup>. As equity is a central theme to the D-SINE Africa work, we will examine approaches and projects from an equity lens, ensuring that products developed through D-SINE Africa and the DS-I Consortium do not inadvertently amplify existing inequity through algorithmic or other bias. Limitations of private sector work, including proprietary algorithms or lack of access to training cohorts, can be potentially mitigated by a Consortium approach, where open sharing of data, methods, and findings can facilitate rapid identification and mitigation of bias. Another potential equity pitfall in data science applications to pressing health issues in SSA is leveraging present advantages of large available data sets without anticipating future resource limitations. D-SINE Africa's embedded equity lens forces the questions of sustainability and shareability to be addressed upfront, so that products from our work result in innovative ways to promote efficient data practices in the future. Our two Research Projects embody this "big data to small data approach", which utilize data restriction and leverage existing data sets to refine data collection for optimal future resource-utilization efficiency (see **Research Project Strategies**). This novel approach can be adapted to other areas of public health research to optimize sustainability of ongoing data collection in SSA necessary to address critical research questions.

**C.3 D-SINE Africa has an innovative structure to overcome common barriers to transformational funding opportunities faced by SSA institutions.** Many SSA institutions are limited in NIH grant application competitiveness due to infrastructure, track record, or administrative resources limitations. These common barriers conspire to create additional disparity in research resources that threaten to further amplify existing health inequity in SSA. By forming a strategic partnership with UCT, an institution with SSA-specific expertise and resources, we have created a unique North-South-South model to provide institutional mentorship to Buea and enhance the resources available to develop and administer our Research Hub. We have also created a team of Senior Advisors consisting of an experienced senior investigator from each D-SINE Africa Director's institution that has extensive expertise in successful scientific investigation, management of large U.S. Federal funding, and administration of complex research organizations. The Senior Advisors and Directors will have open, bi-directional communication, ensuring ongoing, real-time input to guide D-SINE's administration, strategy, and research. While utilizing existing infrastructure in Cameroon for data management would be ideal, current infrastructure is plagued by issues that threaten data security in this context. We believe that the existing human resources have incredible potential for accelerated data science application to health issues in Cameroon. Limiting the human potential in Cameroon to wait for infrastructure development before investing in data science programs would further existing disparities in the public's health. In recognition of the common infrastructure challenges inhibiting data science potentiation in SSA, our DMAC has developed a plan to utilize partner institutions' data management resources while simultaneously developing low-cost infrastructure at Buea for long-term, sustainable data management (see **Letters of Support** and **DMAC Strategy**). Finally, the Seed Grant Program will include curricula in data science methods, leadership, and scientific writing, to help emerging SSA investigators compete for independent awards (see **CBC Strategy**).

## D. APPROACH

### D.1 D-SINE Africa Organizational Structure

**D.1.1 Senior Leadership Team.** The Senior Leadership Team will consist of the Center Directors and Hub Administrator. The Center Director and will have primary responsibility for all aspects of D-SINE Africa's functioning, have final authority over the structure and function of administrative personnel, and will make final decisions on priority setting with input from the co-Directors, Associate Directors, Scientific Advisory Board, and IAB. This structure also recognizes the long-standing, successful, and productive collaboration in Cameroon between Chichom and Juillard, the important field supervision and administration that Dissak-Delon has contributed throughout this collaboration (see **Research Team and Environment B.2.1**), and Maswime's research and administrative expertise.

**D.1.2 The D-SINE Africa Executive Committee** is made up of the Director, Co-Directors, and Associate Directors (Core Leads). This body will meet semimonthly to review D-SINE Africa's scientific agenda and

policies and to advise the Senior Leadership Team. The Executive Committee is central to D-SINE Africa's strategic planning process and provides input on agenda setting. They also weigh in on decisions regarding daily operations, scientific implementation of D-SINE Africa's agenda, and the dissemination of core materials with the Administrative Core and partner institutions.

*D.1.3 Internal Advisory Board (IAB)* provides guidance to the Senior Leadership Team regarding the implementation of D-SINE Africa's scientific agenda, and integrates the voices of diverse stakeholders in the agenda-setting process. Recognizing the sensitivities of conducting collaborative research in SSA communities on equity, our IAB is involved at every step in advising the "whether" and "how" to implement cutting edge science and to develop key policy impact strategies. In addition to frequent, regular meetings between the Directors and Senior Advisors, the IAB will meet semi-annually to provide input towards the agenda-setting process and advise D-SINE Africa in regards to network and capacity building activities. Sub-committees may be assembled on an ad hoc basis to inform targeted activities relevant to the subcommittee's expertise. See list of IAB members in the ***Hub Organizational Structure***.

*D.1.4 The Scientific Advisory Board (SAB)* provides guidance to the Senior Leadership Team regarding the direction of D-SINE Africa scientific agenda and will review and comment on the scientific effectiveness of the overall Center program, as well as comment on the progress in promoting science, networking, and capacity building across the Cores. In accordance with the NIH Funding Opportunity Announcement Requirements and to prevent a conflict of interest in the review process, we have not named SAB members. SAB expertise will include trauma or other acute care surgical disciplines; data science; biostatistics; health policy in SSA. The SAB should also reflect multi-sectoral perspectives, with representation from academia, tech/private sector, non-profits, and governmental organizations. The SAB will meet annually and provide input about new D-SINE Africa members and expertise, new community partners, and upcoming funding opportunities.

## **D.2 D-SINE Africa Cores**

*D.2.1 The Admin Core*, consisting of D-SINE Africa's Director, Co-Directors, Executive Director, and staff, will lead strategic planning, coordinate the research agenda across Cores and Projects, and assist D-SINE Africa Cores and Projects in meeting their deliverables. The Admin Core will provide oversight of fiscal management, personnel, and logistical support, and monitoring productivity of Cores. It will be actively involved in coordinating events across collaborating institutions and support the CBC to provide training opportunities for researchers across career levels throughout the DS-I Africa Consortium. It will support the DMACs data quality assurance and support services across D-SINE Africa's Cores and Projects. It will govern and approve the DMAC's data sharing practices and interface with the DS-I Africa Consortium. The Administrative Core will work in tandem with the CBC to govern the fiscal and administrative aspects of D-SINE Africa's Seed Grant Program, while the CBC will implement the Seed Grant Programs, including assembling mentorship teams to support trainee projects and curating training opportunities tailored to individual trainees' professional goals. To support the Administrative Core leadership in facilitating these activities, administrative staff will include a full-time administrative analyst, a full-time research coordinator, and a financial analyst (see ***Admin Strategy***).

*D.2.2 The DMAC* will lead D-SINE's data science methodology development, analysis support, data storage and management, and data quality assurance processes. The DMAC will provide services and support across the other D-SINE Africa Cores and Projects. The DMAC leadership and supporting faculty feature a breadth of data science methods expertise, with an exceptional strength in machine learning methodology for prediction and causal inferences. The DMAC also features a dedicated data manager to perform ongoing maintenance and quality assessments of all D-SINE Africa project data. DMAC scientists will provide guidance for development, collection, and management of new data sets through D-SINE Africa's future activities and compile and house previously acquired data sets provided by D-SINE Africa participating institutions. The DMAC will also provide ad hoc statistical data analysis methodology support for investigators associated with the DS-I Africa Consortium, which include applications of machine learning and causal inference methodology and the computational implementation of such algorithms. Details on the servers, storage, computational processes, and conflict resolution plan can be found in the ***DMAC Strategy***.

*D.2.3 The CBC* is designed to define and address common barriers to sustainable capacity building. As the DS-I Africa Consortium model is intended to partially mitigate certain obstacles, the CBC will focus on separate, but complementary, activities designed to dovetail with the training grant programs and other components of the DS-I Africa Consortium. The CBC will curate and assemble tailored mentorship and didactic curricula to support emerging SSA investigators in data science applications to trauma and surgical disease; implement the D-SINE Africa Seed Grant Program to foster and ultimately launch the careers of junior African

scientists working at the intersection of injury, surgery, and equity; and support the Buea in grants administration through mentorship and supplemental resources. See **CBC Strategy** for further information.

### D.3 Financial Stewardship and Conflict Resolution

Our U54 Research Hub funding application features an MPI structure. Two Cameroon MPIs are from Buea (prime institution): Chichom-Mefire (corresponding PI) and Nguefack-Tsague. The U.S. MPIs work together through PASE: Juillard (UCLA) and Hubbard (UC Berkeley). **To ensure careful administration and stewardship of funds, funding disbursements will be made on a quarterly basis and require all four MPIs signatures.** To harmonize with Buea's existing resources for grants administration, our IAB includes the Deputy Vice-Chancellor for Research, Cooperation and Relations (Ndip). Additionally, we have hired an independent consultant, Iris Kouo Ngamby, who is the current PEPFAR/Global Fund Liaison for the U.S. Embassy in Cameroon, to provide regular administrative support to Ndip's office. Finally, multiple members of the Buea Grants and Publications Office have attended the NIH 2020 Virtual Seminar of Program Funding and Grants Administration to deepen their understanding of NIH grants management. Please see **Multiple PI Plan** for details on MPI structure and conflict resolution plans for MPIs, Core Leads, and Project Leads. Additional information on anticipated challenges can be found in individual **Core and Project Strategies**.

### D.4 Specific Aims:

#### D.4.1 Aim 1. Research

Over the next five years, D-SINE Africa will promote achievements in research, methods, and promising interventions designed to reduce the burden of trauma and surgical diseases in SSA, with particular focus on improving within-population health equity. Markers of D-SINE Africa's impact in this sector will include: timely and successful achievement of project milestones (see **G. Timeline**); selection, award, and implementation of pilot seed grants; contribution to the development, implementation, and completion of DS-I Africa Consortium projects; and investigator-initiated prevention, methods, and implementation science research on injury, surgery and equity. Research impact also will continue to be measured by number and quality of peer-reviewed manuscripts accepted for publication. Project-specific population outputs will be measured by increased trauma patient adherence to follow up care and integration of health equity surveillance on a broad, cross-cutting thematic basis in SSA. The expected impact of these measures will be the increase in access to trauma and surgical care, particularly in those most vulnerable, in Cameroon and SSA.

#### D.4.2 Aim 2. Networking

**D-SINE Africa's networking goals for the next five years are focused in three areas: within partner institutions; across the DS-I Africa Consortium and extended continuum; and beyond these existing networks of resources.** D-SINE Africa's Research Hub includes architecture designed to interlock at key points with the other DS-I Africa Consortium partners and their extended networks. The Senior Leadership Team and Partnership Officer will identify partners to synergize with existing or new projects, investigators whose collaboration could yield new, innovative ways of studying D-SINE Africa's priority areas, and emerging investigators in the D-SINE Consortium (including training grantees, RFA-RM-20-016). The strategic creation of a CBC concentrates capacity building resources from each D-SINE Africa partner institution into a single clearinghouse, enabling curated, seamless incorporation into the greater DS-I Africa network to support Consortium participants and trainees. D-SINE's IAB features a blend of backgrounds with potential to facilitate new partnerships in tech, non-profit, communications, and governmental sectors and identify partners in our priority areas who may want to collaborate on projects throughout the Consortium. We will also use our unique resources at the partner CBI campus in Cameroon to convene virtual and physical meetings for training and collaboration among scientists, providers, policy makers and stakeholders. In addition to these networking priorities, D-SINE Africa will have a cross-cutting approach to optimizing data transparency and sharing across the DS-I Africa Consortium and beyond. We will work closely with the Open Data Science Platform team to facilitate alignment of activities and enhance data sharing according to the NIH principles of FAIR (findable, accessible, interoperable, and reusable) data while safeguarding study subjects.

#### D.4.3 Aim 3. Capacity Building

Mentored learning activities over the next five years will continue through the formal short course and certificate didactic programs led by D-SINE Africa scientists and experienced mentorship teams providing close guidance to emerging SSA investigators focusing on developing data science approaches in health research and innovation. D-SINE Africa will provide a variety of career enhancement and training opportunities to SSA students, post-doctoral researchers, and young investigators through our two main research projects

(each will include an SSA Research Fellow), pilot projects, the Seed Grant Program, and additional mentored secondary analyses of D-SINE Africa data sets (see **CBC Strategy** for further detail).

## E. SUSTAINABILITY

Our goal is to create a dedicated center at the University of Buea in which to invest and expand over time. We anticipate that the DS-I Africa Research Hub U54 funding opportunity will result in an exponential accumulation of publications, digital assets, and other evidence of productivity that will enhance opportunities for future funding as well as substantial and sustainable capacity building. To this end, several of the D-SINE Africa partner institutions have demonstrated an ongoing investment in this collaboration (see **Letters of Support**):

- *MOPH* has provided support personnel (Bilounga, Dissak-Delon) for our group's past and future work;
- *UCLA* has invested in PASE's infrastructure and ongoing projects in Cameroon:
  - Support of the CTR research personnel at four institutions in Cameroon
  - Awarding Juillard the Marjorie Fine, MD, Endowed Chair for Clinical General Surgery, held in perpetuity, to support academic activity dedicated improving health equity;
  - Supporting a program manager to support PASE global projects
- *Buea* has invested in:
  - administrative support and clinical duty requirement reduction for Chichom to protect his time;
  - *Senior leadership* (Halle Ekane, Ndip, Chichom) has been structured into D-SINE Africa's administration to cement investment into the Center's future.

We plan to leverage the NIH investment in our Hub by applying for complementary federal grant mechanisms (D43, R01, R21), exploring other sources of federal funding (USAID, DOD), and pursuing foundation and non-profit funding sources. D-SINE Africa's path to independence beyond the U54 mechanism will be paved through CBC-led mentorship of new investigators who will compete for extramural awards and development of infrastructure that can be leveraged for future funding applications and administration. The DMAC will implement a graduated plan to transition data storage, management, and quality procedures to Buea over the life of the award that can be used for future data science research. Our IAB strategically incorporates senior leadership from successfully funded complex centers (CHIPTS-UCLA, CBI, and MEI) to provide specific guidance towards funding and sustainability. We will also explore potential commercialization of products that may be amenable to tech and other private partnership and investment. Finally, we have built into D-SINE Africa CBC activities that address two critical, under-addressed bottlenecks to sustainable independent research capacity growth in SSA: grants administration and scientific writing (see **CBC Strategy**).

## F. RESEARCH HUB INTEGRATION

**F.1 Multisectoral, multidisciplinary, and interdisciplinary integration are D-SINE Africa foundational principles.** The Hub's structure intentionally builds multi-institutional leadership into all cores and projects. This shared leadership approach is critical to the thematic basis of D-SINE Africa, the multisectoral intersection of surgery, injury, data science, and equity. Each Core interacts with each Research Project to provide integrated services and opportunities. For example, the DMAC will oversee and support data management and analysis for each Research Project, while the CBC will provide oversight for each Research Project's Research Fellow and coordinate pilot projects for DS-I Africa trainees utilizing data collected from each Research Project.

**F.2 D-SINE Africa's leadership structure and Research Project design integrates its projects and Cores to ensure that the Overall Hub is greater than the sum of its parts.** Each of D-SINE Africa's Research Projects contributes to the Hub's theme. They also share common data sources (CTR) and they each leverage new and existing data to achieve their Aims. Findings from each will provide opportunities for future projects and analysis that integrate results from both. For example, the SES methodology that will be integrated into the CTR (**Research Project – Health Equity Surveillance**) can then be used as an input for the second project (**Research Project 2 – Trauma Follow Up Prediction**) to identify which SES clusters might benefit from early identification to optimize follow up adherence. Data and findings from both Research Projects will be available to the broader DS-I Africa Consortium to lay a foundation for future analysis and development of novel interventions. To ensure integration of all Cores into D-SINE Africa's projects, leads from each Core are integrated into the Research Project investigator teams. We have included partners (MEI, CBI) and IAB members (Saatchi) with access to relevant data sets to provide additional opportunities for D-SINE Africa and DS-I Africa Consortium investigators and trainees to conduct novel data science and public health research. Our Executive Committee will regularly discuss new ways to integrate research projects and work with our Advisory Boards to identify new opportunities to leverage existing data and digital infrastructure. Whenever possible, D-SINE Africa Research Projects' data will be shared through the DS-I Consortium to facilitate

maximal utility of data collected and spark innovative, novel uses of existing data (see **DMAC Strategy** and **Resource Sharing Plan**). The D-SINE Africa Executive Committee will collaborate with the DS-I Africa Consortium to create appropriate frameworks to ensure human subject protections throughout this process.

**F.3 D-SINE Africa builds stakeholder engagement and research dissemination into its structure to ensure that the intended communities benefit from our projects and activities.** D-SINE Africa's emphasis on community partnership is echoed throughout its various components. On the IAB, Cameroon's MOPH, the CAROSAF Road Safety Advocacy group, several trauma patients, and traditional bonesetters are all represented. Our strategic partnership with UCT brings D-SINE Co-Director Dr. Salome Maswime's expertise in advocacy to amplify D-SINE Africa research impact. Our Partnership Consultant (Dr. Chanceline Bilounga) will ensure bi-directional communication with existing community stakeholders and identification of new partners, which will be a standing agenda item for Executive Committee meetings. See **Specific Aim 2 Networking D.4.2** and the **Admin Core Strategy** for further information.

## G. TIMELINES AND MILESTONES

	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4																
<i>Data Science Center for the Study of Surgery, Injury, and Equity in Africa (D-SINE-Africa)</i>																				
<b>Key Meetings</b>																				
Internal Advisory Board	X		X		X		X		X		X		X		X		X		X	
Scientific Advisory Board		X			X				X				X			X			X	
Strategic Planning	X		X			X		X				X		X			X			X
DS-I Consortium		X	X		X	X		X		X	X		X		X		X	X		X
<b>Activities</b>																				
MPI fund disbursement approval	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fiscal and administrative reporting				X				X				X			X			X		X
<b>Administrative Core</b>																				
<b>Aim 1: Direct Research</b>																				
Milestone: Core Lead Meetings	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Milestone: Core and services evaluation, CQI		X		X		X		X		X		X		X		X		X		X
Milestone: MOPH Annual Report			X				X				X			X			X			X
Milestone: Select Research Project Fellows			X																	
<b>Aim 2: Promote Networking</b>																				
Milestone: Establish website, social media accounts	X	X																		
Milestone: Internal Advisory Board Meetings		X		X		X		X		X		X		X		X		X		X
Milestone: Dissemination of research findings													X			X				X
<b>Aim 3: Support Capacity Building</b>																				
Milestone: Create Seed Grant selection committee			X																	
Milestone: Promote funding opportunity	X	X	X																	
Milestone: Select Seed Grant recipients				X				X			X		X			X			X	
Milestone: Grant reporting					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>Data Management and Analysis Core</b>																				
Aim 1: Develop standardized, data quality protocols	X	X																		
Milestone: Develop quality control protocols		X																		
Milestone: Implement for data QA/QC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>Aim 2: Manage and coordinate data systems</b>																				
Milestone: expand REDcap system	X	X																		
Milestone: Create collection of accessible DHS files	X	X																		
Milestone: creation of analysis data and metadata	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Milestone: ensure appropriate data access	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>Aim 3: Support/develop data science methodology</b>																				
Milestone: Set-up OSF site, register analysis plans	X	X																		
Milestone: Statistical analysis support			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<b>Capacity Building Core</b>																				
Aim 1: Enable emerging African scientists	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Milestone: Training Coordinator creates "toolkit"			X																	
Milestone: Identification Research Project Fellows			X																	
Milestone: Annual D-SINE Fellow presentations						X										X				X
<b>Aim 2: Implement Seed Grant Program</b>																				
Milestone: Annual Seed Grant awards					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Milestone: Grant awardee mentorship, coursework					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Aim 3: Administrative and financial capacity building	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Milestone: Fully executed subawards	X	X																		
Milestone: Annual NIH RPPRs submitted on time			X				X				X			X			X			X

For research projects timelines, see **Overall - PHS Human Subjects and Clinical Trials Information- Study Record 1, 2.7 Study Timeline**.

## PHS Human Subjects and Clinical Trials Information

OMB Number: 0925-0001

Expiration Date: 02/28/2023

### Use of Human Specimens and/or Data

Does any of the proposed research in the application involve human specimens and/or data \*

Yes       No

Provide an explanation for any use of human specimens and/or data not considered to be human subjects research.

Are Human Subjects Involved

Yes       No

Is the Project Exempt from Federal regulations?

Yes       No

Exemption Number

1     2     3     4     5     6     7     8

Other Requested Information

**Human Subject Studies**

<b>Study#</b>	<b>Study Title</b>	<b>Clinical Trial?</b>
1	Improving health equity surveillance and assessment of need for post-discharge follow-up care using trauma registry data collection systems in Sub-Saharan Africa.	No

## Section 1 - Basic Information (Study 1)

OMB Number: 0925-0001

Expiration Date: 02/28/2023

### 1.1. Study Title \*

Improving health equity surveillance and assessment of need for post-discharge follow-up care using trauma registry data collection systems in Sub-Saharan Africa.

### 1.2. Is this study exempt from Federal Regulations \*

Yes       No

### 1.3. Exemption Number

1     2     3     4     5     6     7     8

### 1.4. Clinical Trial Questionnaire \*

1.4.a. Does the study involve human participants?       Yes       No

1.4.b. Are the participants prospectively assigned to an intervention?       Yes       No

1.4.c. Is the study designed to evaluate the effect of the intervention on the participants?       Yes       No

1.4.d. Is the effect that will be evaluated a health-related biomedical or behavioral outcome?       Yes       No

### 1.5. Provide the ClinicalTrials.gov Identifier (e.g. NCT87654321) for this trial, if applicable

## Section 2 - Study Population Characteristics (Study 1)

### 2.1. Conditions or Focus of Study

- Wounds and Injuries
- Trauma Care
- Health Equity
- Follow-up Care
- Africa South of the Sahara

### 2.2. Eligibility Criteria

(1) Demographic Health Survey Data includes people of all ages residing in 37 Sub-Saharan African countries.

(2) Trauma registry inclusion criteria will consist of all patients who present to participating hospital sites in Cameroon, Uganda, and South Africa with an injury, as defined by the World Health Organization, and are: 1) admitted, 2) leave against medical advice, 3) die in the emergency ward, or 4) are transferred to another hospital for a higher level of care. There are no exclusions based on age, sex/gender, race, socio-economic status, or occupation.

(3) In-depth interviews will be conducted with investigators and research staff using the EconomicClusters platform in Cameroon, Uganda, and South Africa who are 18 years or older.

(4) In-depth interviews will be conducted with trauma patients, Emergency Department staff, or trauma registry research assistants at one of the 10 study hospital sites in Cameroon adults who are 18 years or older.

2.3. Age Limits	Min Age: N/A (No limit)	Max Age: N/A (No limit)
2.3.a. Inclusion of Individuals Across the Lifespan	Inclusion_of_Individuals_Across_the_Lifespan_.pdf	
2.4. Inclusion of Women and Minorities	Inclusion_of_Women_and_Minorities.pdf	
2.5. Recruitment and Retention Plan	Recruitment_and_Retention_Plan.pdf	
2.6. Recruitment Status	Not yet recruiting	
2.7. Study Timeline	Study_Timeline_Overall_.pdf	
2.8. Enrollment of First Participant	09/01/2021	Anticipated

## Inclusion of Individuals Across the Lifespan

(1) The Demographic Health Survey (DHS) collects data on a representative sample of the population in countries that participate in The DHS Program. Nationally representative samples of children are thus included in each dataset.

(2) Trauma Registries in Cameroon, Uganda, and South Africa - Trauma affects persons of all ages and disproportionately affects young people. Consequently, recruitment and enrollment for the proposed research project will include all injured persons presenting to care at 10 hospitals sites in Cameroon, the Soroti Regional Referral Hospital (Soroti, Uganda), and the Groote Schuur Hospital (Cape Town, South Africa).

Children will be included in this study as trauma is a condition which affects persons of all ages. Moreover, the mechanisms, presentations, demographics, treatment, and outcomes associated with trauma in children may be widely different than those associated with trauma in adults. Factors such as inability to communicate in young children may make them more susceptible to post-discharge complications without routine follow-up. Consequently, recruitment and enrollment for this study will include injured subjects of all ages, including pediatric patients. Persons under 18 years will be eligible for participation only if permission is provided by an parent/adult guardian and the child provides oral assent. Patients under the age of 18 will be excluded if no adult is able or willing to provide consent after ten contact attempts.

Fifteen percent of the Cameroon Trauma Registry cohort who provided household cellular telephone numbers between October 2017 and December 2019 were under the age of 18. Of the 4,109 patients captured by the Soroti Regional Referral Hospital Registry between October 2016 and July 2019, nearly 40% were under the age of 18. Finally, nearly 8% of all injuries recorded by The Cape Town Trauma Registry between October 2010 and September 2011 were among patients under the age of 18. For the proposed research, a similar distributions of patients under the age of 18 are expected to be enrolled in each respective registry, constituting a considerable proportion of the overall study population.

(3) Persons under the age of 18 will not be included in in-depth Interviews with investigators and research staff using the EconomicClusters platform in Cameroon, Uganda, and South Africa

(4) Persons under the age of 18 will not be included in in-depth Interviews with trauma patients, Emergency Department staff, or trauma registry research assistants at one of the 10 participating hospital sites in the Cameroon Trauma Registry.

## Inclusion of Women and Minorities

(1) The Demographic Health Survey (DHS) collects data on a representative sample of the population in countries that participate in The DHS Program. Nationally representative samples of women are thus included in each dataset. Inclusion of minorities depends on the distribution of ethnicities within a specific country.

(2) Trauma Registries in Cameroon, Uganda, and South Africa - Trauma is a condition which affects individuals of all sex/gender(s), races, and ethnicities. Recruitment and enrollment for the proposed research project will therefore include all injured persons presenting to care at the Soroti Regional Referral Hospital (Soroti, Uganda), the Groote Schuur Hospital (Cape Town, South Africa), and ten hospitals sites in Cameroon, regardless of sex/gender, race, or ethnicity.

Between October 2017 and December 2019, patients captured by the Cameroon Trauma Registry (CTR) were predominantly male (70%), with a median age of 30 years old (IQR 22-40). Of the 4,008 patients enrolled in the Soroti Regional Referral Hospital (SRRH) Trauma Registry between October 2016 and July 2019, 63% were male and 37% female. Of the patients enrolled in the Cape Town Trauma Registry between October 2010 and September 2011, 71.3% were male, younger than 40 years of age. As trauma is a condition that disproportionately impacts young males, we expect the distribution of our study population to be 60-70% male in the proposed research.

Although specific data on ethnic origin is not collected as part of both the CTR and SRRH Trauma Registry, no ethnic group will be excluded from the study inclusion. Data from the Central Intelligence Agency's World Factbook (<https://www.cia.gov/library/publications/the-world-factbook/fields/400.html>) indicates that less than 1% of people in Cameroon are non-African; 99% of trauma patients enrolled in the study are therefore expected to be of African descent. In the case of Uganda, 32% of the population is foreign-born, as Uganda has been a host country for refugees fleeing conflict in neighboring nations. However, the Teso Sub-region of Uganda, where the Soroti Regional Referral Hospital is located, comprises a predominantly African population. We therefore expect 99% of trauma patients enrolled in the study to be of African descent. Lastly, according to the Central Intelligence Agency's World Factbook, ethnicities in South Africa are distributed as follows: 81% black, 9% colored (mixed race), 8% white, and 2% of Asian/Indian descent. A similar distribution of ethnicity is expected to be enrolled in the proposed research.

(3) Women will be included in in-depth Interviews with investigators and research staff using the EconomicClusters platform in Cameroon, Uganda, and South Africa. The distribution of minorities cannot be determined at this time, however we expect most study subjects to be of African descent.

(4) Women will be included in in-depth Interviews with trauma patients, Emergency Department staff, or trauma registry research assistants at one of the 10 participating hospital sites in the Cameroon Trauma Registry. As less than 1% of people in Cameroon are non-African, we expect 99% of study subjects to be of African descent.

## Recruitment and Retention Plan

(1) No recruitment will be conducted for existing Demographic Health Survey Data for 37 Sub-Saharan Africa countries.

(2) Trauma Registries -Recruitment of human subjects will occur at the following hospital sites:

- The Soroti Regional Referral Hospital in Eastern Uganda
- The Groote Schuur Hospital in Cape Town South Africa
- Ten regional, district, and mission-based hospitals in Cameroon:
  1. Laquintinie Hospital of Douala, (Littoral region)
  2. Limb   Regional Hospital, (Southwest region)
  3. Pouma Catholic Hospital,(Littoral region)
  4. Edea Regional Hospital, (Littoral region)
  5. The Emergency and Reanimation Center of Yaounde, (Centre Region)
  6. Bafoussam Regional Hospital (West region)
  7. Maroua Regional Hospital (Far north region)
  8. Bafia district hospital (Centre Region)
  9. Kribi District hospital (South Region)
  10. Bertoua Regional Hospital (East Region)

Recruitment Strategy: Regardless of sex, age, race, ethnicity, or socioeconomic status, all eligible patients who arrive at one of the study site hospitals in Cameroon, Uganda, or South Africa seeking care for a traumatic injury will be approached by either clinical staff or a trained research assistant for inclusion in the study.

Approaching a patient or his/her guardian will only be done once provision of medical care has been established and will not interfere with the provision of medical care in any way. Clinical staff assessing patients for an injury will be the primary individuals approaching the patient for recruitment in the study. In the event that immediate care must be provided for a patient arriving at the hospital, a trained research assistant will follow up with the subject at a more appropriate time for recruitment in the study.

A trained research assistant at each hospital site, will seek verbal consent from study subjects using a standardized informed consent or assent script. The purpose of the research, including risks and benefits of the study, will be explained to the patient. If the patient is unconscious or otherwise unable to give consent, provisional administrative authorization will be obtained to include them in the study. If possible, the research team will make an effort to reconsent patients who have recovered from unconsciousness and are able to then give consent. If a patient declines to be included in the study, no data will be recorded on any study instruments for that patient and he/she will not be included in the study. For patients under the age of 18 years, consent will be provided by an parent/guardian and oral assent will be sought from the child.

Additionally, patients included in the Cameroon Trauma Registry (CTR) who provide a contact phone number will also be recruited to participate in mobile-based follow-up of their physical disability and need for further medical care post-discharge. For this component of the study, study subjects will be contacted via phone at 0.5, 1, 3, and 6 months post hospital discharge. Dedicated research assistants will make up to 10 attempts to contact patients at each data collection round using all phone numbers provided at registration.

### Retention Strategy:

Patients included in all trauma registries will be followed throughout the course of their clinical care at each hospital site. No retention strategy will be necessary for this part of the study.

CTR Patients who provide a telephone number will be contacted at four time points post-discharge. As study participation involves multiple survey encounters, retention strategies will include financial reimbursement for time spent answering survey questions on the phone. Subjects will be fully reimbursed for each phone call with a transfer of talk time minutes directly to their mobile phones, a facility that is available and that we have experience with in Cameroon. At each phone encounter, patients will be informed that their study participation is entirely voluntary and made aware of the risks and benefits of participation. Study subjects will be explicitly

informed that non-participation will not be reported to hospital or government authorities and will have no bearing on future medical care services.

Monitoring Progress in Recruitment and Retention : The recruitment and retention of study subjects in all trauma registries and the mobile-based follow-up component of the CTR will be monitored by study PIs on a quarterly basis. As such, every quarter, a US and Cameroon-based program manager will prepare written reports presenting data —in aggregate and by hospital site— on: patient enrollment, study subjects' demographics and overall status, and the retention of subjects post-discharge. Additionally, the Cameroon-based program manager will provide information on any adverse events among study subjects or alert study investigators to subjects whose responses in follow-up assessments trigger concern. Following the review of these interim analysis reports, the PIs will recommend any modifications that are required to enhance recruitment and retention of study subjects.

(3) Investigators and research staff using the EconomicClusters platform in Cameroon, Uganda, and South Africa will be recruited for in-depth interviews either in-person or via email by a study investigator who will ask for their participation. Individuals will be informed that their participation is entirely voluntary and that non-participation will have no detrimental impact on their employment or research opportunities. During each interview, study subjects will be free to skip or decide not to answer a question. They will also be free to stop the interview at any time.

(4) Trauma patients, Emergency Department staff, and trauma registry research assistants at 10 study hospital sites in Cameroon will be recruited for in-depth interviews in-person by a study investigator who will ask for their participation. Individuals will be informed that their participation is entirely voluntary and that non-participation will have no detrimental impact on their on their medical care or employment. During each interview, study subjects will be free to skip or decide not to answer a question. They will also be free to stop the interview at any time.

## Study Timeline

### I. RESEARCH PROJECT 1 – HEALTH EQUITY SURVEILLANCE

A	Year 1				Year 2				Year 3				Year 4				Year 5				
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
<b>AIM1</b>																					
A.1.1	X	X	X	X	X	X															
A.1.2	X	X	X	X	X	X															
M1							<b>M1</b>														
<b>AIM2</b>																					
A.2.1		X	X	X	X	X	X														
A.2.2		X	X	X	X	X	X														
M2								<b>M2</b>													
<b>AIM3</b>																					
A.3.1									X												
A.3.2									X												
A.3.3									X												
M3										<b>M3</b>											
A.3.4									X	X	X	X									
M4													<b>M4</b>								
A.3.5										X	X	X	X	X	X						
A.3.6										X	X	X	X	X	X						
A.3.7																	X	X	X	X	
M5																				<b>M5</b>	
<b>AIM4</b>																					
A.4.1										X	X										
A.4.2												X	X								
A.4.3													X	X							
A.4.4																		X	X		
M6																				<b>M6</b>	

NOTE: A= ACTIVITY M=MILESTONE

#### Timeline of Activities:

##### Aim 1: Develop EconomicClusters models for 37 SSA countries

**A.1.1:** Apply EconomicClusters algorithm to 37 Sub-Saharan African countries with DHS data from 2010 or later

**A.1.2 :** Rank distinct economic groups for each country based on average values of variables known to be associated with socioeconomic status. Output: ordinally-ranked economic model for each country based on only four variables

**Milestone 1:** EconomicClusters model development completed

##### Aim 2: Validate the EconomicClusters models for each country using established DHS metrics

**A.2.1:** Validation of EconomicClusters models for each of the 37 SSA countries by comparing their effect size with that of the established DHS Wealth Index.

**A.2.2:** Optimization of EconomicClusters model for any given country that fails to meet validation criterion

**Milestone 2:** EconomicClusters model validation completed

##### Aim 3: Characterize inequity in trauma care access and outcomes in Cameroon, South Africa, and Uganda by implementing the EconomicClusters strategy in trauma registry data collection.

**A.3.1:** Incorporate EconomicClusters variables for Cameroon, Uganda, and South Africa into each hospital sites' respective trauma registry forms and RedCap databases

**A.3.2:** Organize three separate 1-day training with trauma registry research assistants in Cameroon, Uganda, and South Africa focusing on EconomicClusters variables for their country

**A.3.3:** Collect EconomicClusters data for a two-week pilot period at all hospital sites; organize midweek meetings with each hospital site to assess data quality (completeness, clarity, errors) and address any challenges

**Milestone 3:** EconomicClusters implementation and pilot testing completed**A.3.4:** Data collection for the 12-month *EconomicClusters* implementation phase**Milestone 4:** EconomicClusters data collection completed**A.3.5:** Evaluate the feasibility of EconomicClusters implementation for the trauma registry from each country using a harmonized data quality framework**A.3.6:** Test associations between SES and the following variables: undergoing surgery, in-hospital complications, and in-hospital mortality**A.3.7:** Preparation and publication of manuscripts**Milestone 5:** Completion of data analysis and dissemination of findings

*Aim 4: Develop a publicly available toolkit to support researchers in implementation of EconomicClusters models strategy in their own research.*

**A.4.1:** Develop EconomicClusters toolkit user-interface (*R shiny app* that will be hosted on an encrypted platform)**A.4.2:** Pilot test use of the web app and associated server in Cameroon, Uganda, and South Africa**A.4.3:** Evaluate user-experience of “toolkit” implementation through in-depth interviews with stakeholders using the platform**A.4.4:** Publish and disseminate toolkit**Milestone 6:** EconomicClusters toolkit made freely available to the public**II. RESEARCH PROJECT 2 – TRAUMA FOLLOW UP PREDICTION**

A	Year 1				Year 2				Year 3				Year 4				Year 5			
	Q1	Q2	Q3	Q4																
<b>AIM1</b>																				
A.1.1	X																			
A.1.2	X																			
A.1.3	X																			
A.1.4	X																			
A.1.5	X																			
A.1.6	X	X																		
M1			M1																	
M2			M2																	
M3			M3																	
A.1.7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
A.1.8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
M4					M4															
A.1.9	X	X	X	X																
A.1.10						X	X	X												
A.1.11	X	X	X	X	X	X	X	X												
<b>AIM3</b>						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
A.3.1																				
A.3.2																		X	X	X
M5																				M5

NOTE: A= ACTIVITY M=MILESTONE

**Timeline of Activities:**

*Aim 1. Scale-up an mHealth, phone-based screening tool to identify trauma patients in Cameroon who would benefit from further formal medical care*

**A.1.1:** Recruit six new trauma registry research assistants and six new research assistants to conduct phone-based follow-up surveys with discharged trauma patients in Cameroon**A.1.2:** Organize a 1-week training for newly hired trauma registry research assistants in Cameroon who will be briefed on the research protocol, trauma registry forms, data verification process, and data entry using RedCap. Research assistants will also be required to complete a CITI human subjects training online.**A.1.3:** Organize a 1-week training for newly hired mhealth research assistants in Cameroon who will be briefed on the research protocol, mhealth screening tool and GOSE survey, the interface system developed by Duck

Egg Digital, data verification process, and data entry using RedCap. Research assistants will also be required to complete a CITI human subjects training online.

**A.1.4:** Conduct 3-week pilot testing of trauma registry forms in newly added hospital sites in Cameroon

**A.1.5:** Conduct 3-week pilot testing of mhealth screening tool and GOSE survey for trauma registry patients discharged from newly added hospital sites in Cameroon

**A.1.6:** Organize midweek meetings during pilot phase with research personnel at each hospital site to assess data quality (completeness, clarity, errors) and address any challenges

**Milestone 1:** Duck Egg Digital interface ready to be launched

**Milestone 2:** Implementation of Cameroon Trauma Registry (CTR) in 10 collaborating hospitals completed

**Milestone 3:** Implementation of post-discharge follow up assessments with mHealth screening tool and GOSE survey for all trauma registry patients receiving care at 10 collaborating hospitals completed

**A.1.7:** Official start of enrollment of patients in CTR

**A.1.8:** Official start of enrollment of discharged trauma registry patients in follow-up study

**Milestone 4:** Enrollment of a cohort of 4,500 patients in Cameroon Trauma registry

**A.1.9:** Recruit and conduct In-depth interviews (IDs) with 15 trauma patients, 10 Emergency Department staff, and 5 trauma registry research assistants based on the domains of the Consolidated Framework for Implementation Research

**A.1.10:** Analysis of data from cohort of 4500( determine proportion of hospitalized trauma patients who are: 1) reached by mobile phone, and 2) identified as needing follow-up care)

**A.1.11:** Transcription and analysis of interview transcripts with 30 subjects

**Aim 2: (see *Research Project 2 - PHS Human Subjects and Clinical Trials Information- Study Record 1, 2.7 Study Timeline*).**

**Aim 3. Determine factors associated with compliance with recommendations for post-discharge follow-up care after injury.**

**A.3.1:** Assessment of characteristics of 450 trauma patients who comply with recommendations for post-discharge follow-up care

**A.3.1:** Data analysis and manuscript preparation

**Milestone 5:** Completion of data analysis and dissemination of findings

## 2.9. Inclusion Enrollment Reports

IER ID#	Enrollment Location Type	Enrollment Location
<u>Study 1, IER 1</u>	Foreign	Enrollment will occur at 10 regional, district, and mission-based hospitals in Cameroon.
<u>Study 1, IER 2</u>	Foreign	Enrollment will occur at the Soroti Regional Referral Hospital in Eastern Uganda
<u>Study 1, IER 3</u>	Foreign	Enrollment of patients will occur at the trauma unit of the Groote Schuur Hospital in Cape Town South Africa
<u>Study 1, IER 4</u>	Foreign	Enrollment will occur at 10 regional, district, and mission-based hospitals in Cameroon.
<u>Study 1, IER 5</u>	Foreign	Cameroon, South Africa, and Uganda

**Inclusion Enrollment Report 1**

1. Inclusion Enrollment Report Title\* : Cameroon Trauma Registry
2. Using an Existing Dataset or Resource\* :  Yes  No
3. Enrollment Location Type\* :  Domestic  Foreign
4. Enrollment Country(ies): CMR: CAMEROON
5. Enrollment Location(s): Enrollment will occur at 10 regional, district, and mission-based hospitals in Cameroon.
6. Comments: The numbers below represent our estimates for the patients we expect to enroll in the Cameroon Trauma Registry over the five-year period of this study. The enrollment for the proposed research project is to be conducted exclusively in Cameroon, a country in Sub-Saharan Africa. Based on the Central Intelligence Agency's World Factbook, less than 1 percent of people in Cameroon are non-African. We, therefore, anticipate enrolling mostly, if not all, individuals classified as Black.

**Planned**

Racial Categories	Ethnic Categories				Total	
	Not Hispanic or Latino		Hispanic or Latino			
	Female	Male	Female	Male		
American Indian/ Alaska Native	0	0	0	0	0	
Asian	0	0	0	0	0	
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	
Black or African American	23922	55818	0	0	79740	
White	0	0	0	0	0	
More than One Race	0	0	0	0	0	
<b>Total</b>	<b>23922</b>	<b>55818</b>	<b>0</b>	<b>0</b>	<b>79740</b>	

**Cumulative (Actual)**

Racial Categories	Ethnic Categories									Total	
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity				
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported		
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0	
Asian	0	0	0	0	0	0	0	0	0	0	
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0	
Black or African American	0	0	0	0	0	0	0	0	0	0	
White	0	0	0	0	0	0	0	0	0	0	
More than One Race	0	0	0	0	0	0	0	0	0	0	
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0	
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	

**Inclusion Enrollment Report 2**

1. Inclusion Enrollment Report Title\* : Soroti Regional Referral Hospital Trauma Registry
2. Using an Existing Dataset or Resource\* :  Yes  No
3. Enrollment Location Type\* :  Domestic  Foreign
4. Enrollment Country(ies): UGA: UGANDA
5. Enrollment Location(s): Enrollment will occur at the Soroti Regional Referral Hospital in Eastern Uganda
6. Comments: The numbers below represent our estimates for the patients we expect to enroll in the Soroti Regional Referral Hospital Trauma Registry over a 12-month period. Our estimates are based on current data from the registry. Based on the Central Intelligence Agency's World Factbook, the vast majority of the Ugandan population is of African descent. We anticipate enrolling mostly, if not all, individuals classified as Black.

**Planned**

Racial Categories	Ethnic Categories				Total	
	Not Hispanic or Latino		Hispanic or Latino			
	Female	Male	Female	Male		
American Indian/ Alaska Native	0	0	0	0	0	
Asian	0	0	0	0	0	
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	
Black or African American	518	882	0	0	1400	
White	0	0	0	0	0	
More than One Race	0	0	0	0	0	
<b>Total</b>	<b>518</b>	<b>882</b>	<b>0</b>	<b>0</b>	<b>1400</b>	

**Cumulative (Actual)**

Racial Categories	Ethnic Categories									Total	
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity				
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported		
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0	
Asian	0	0	0	0	0	0	0	0	0	0	
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0	
Black or African American	0	0	0	0	0	0	0	0	0	0	
White	0	0	0	0	0	0	0	0	0	0	
More than One Race	0	0	0	0	0	0	0	0	0	0	
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0	
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	

**Inclusion Enrollment Report 3**

1. Inclusion Enrollment Report Title\* : Cape Town Trauma Registry
2. Using an Existing Dataset or Resource\* :  Yes  No
3. Enrollment Location Type\* :  Domestic  Foreign
4. Enrollment Country(ies):
5. Enrollment Location(s): Enrollment of patients will occur at the trauma unit of the Groote Schuur Hospital in Cape Town South Africa
6. Comments: The numbers below represent our estimates for the patients we expect to enroll in the Ca Cape Town Trauma Registry over a 12-month period. Our estimates are based on current data from the registry. According to the Central Intelligence Agency's World Factbook, ethnicities in South Africa are distributed as follows: 81% black, 9% colored (mixed race), 8% white, and 2% of Asian/Indian descent. A similar distribution of ethnicity is expected to be enrolled in the proposed research.

**Planned**

Racial Categories	Ethnic Categories				Total	
	Not Hispanic or Latino		Hispanic or Latino			
	Female	Male	Female	Male		
American Indian/ Alaska Native	0	0	0	0	0	
Asian	46	114	0	0	160	
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	
Black or African American	1879	4601	0	0	6480	
White	186	454	0	0	640	
More than One Race	209	511	0	0	720	
<b>Total</b>	<b>2320</b>	<b>5680</b>	<b>0</b>	<b>0</b>	<b>8000</b>	

**Cumulative (Actual)**

Racial Categories	Ethnic Categories									Total	
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity				
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported		
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0	
Asian	0	0	0	0	0	0	0	0	0	0	
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0	
Black or African American	0	0	0	0	0	0	0	0	0	0	
White	0	0	0	0	0	0	0	0	0	0	
More than One Race	0	0	0	0	0	0	0	0	0	0	
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0	
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	

**Inclusion Enrollment Report 4**

1. Inclusion Enrollment Report Title\* : In-depth interviews to assess trauma registry implementation
2. Using an Existing Dataset or Resource\* :  Yes  No
3. Enrollment Location Type\* :  Domestic  Foreign
4. Enrollment Country(ies): CMR: CAMEROON
5. Enrollment Location(s): Enrollment will occur at 10 regional, district, and mission-based hospitals in Cameroon.
6. Comments: A total of 30 trauma patients, Emergency Department Staff, and Trauma registry research assistants will be enrolled to participate in In-depth interviews focusing on domains of the Consolidated Framework for Implementation Research as relates to the implementation of the Cameroon Trauma Registry at their site.

**Planned**

Racial Categories	Ethnic Categories				Total	
	Not Hispanic or Latino		Hispanic or Latino			
	Female	Male	Female	Male		
American Indian/ Alaska Native	0	0	0	0	0	
Asian	0	0	0	0	0	
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	
Black or African American	15	15	0	0	30	
White	0	0	0	0	0	
More than One Race	0	0	0	0	0	
<b>Total</b>	<b>15</b>	<b>15</b>	<b>0</b>	<b>0</b>	<b>30</b>	

**Cumulative (Actual)**

Racial Categories	Ethnic Categories									Total	
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity				
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported		
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0	
Asian	0	0	0	0	0	0	0	0	0	0	
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0	
Black or African American	0	0	0	0	0	0	0	0	0	0	
White	0	0	0	0	0	0	0	0	0	0	
More than One Race	0	0	0	0	0	0	0	0	0	0	
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0	
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	

## Inclusion Enrollment Report 5

1. Inclusion Enrollment Report Title\* : In-depth interviews with investigators and research staff using the EconomicClusters toolkit
2. Using an Existing Dataset or Resource\* :  Yes  No
3. Enrollment Location Type\* :  Domestic  Foreign
4. Enrollment Country(ies): CMR: CAMEROON, ZAF: SOUTH AFRICA, UGA: UGANDA
5. Enrollment Location(s): Cameroon, South Africa, and Uganda
6. Comments: The numbers listed below represent the maximum amount of African investigators and research staff using the EconomicClusters model toolkit that will be recruited for In-depth interviews assessing their experience with the platform using domains of the Consolidated Framework For Implementation Research. Since this study will be conducted in Africa, we expect most participants to be of African decent.

### Planned

Racial Categories	Ethnic Categories				Total	
	Not Hispanic or Latino		Hispanic or Latino			
	Female	Male	Female	Male		
American Indian/ Alaska Native	0	0	0	0	0	
Asian	0	0	0	0	0	
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	
Black or African American	25	25	0	0	50	
White	0	0	0	0	0	
More than One Race	0	0	0	0	0	
<b>Total</b>	25	25	0	0	50	

### Cumulative (Actual)

Racial Categories	Ethnic Categories									Total	
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity				
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported		
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0	
Asian	0	0	0	0	0	0	0	0	0	0	
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0	
Black or African American	0	0	0	0	0	0	0	0	0	0	
White	0	0	0	0	0	0	0	0	0	0	
More than One Race	0	0	0	0	0	0	0	0	0	0	
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0	
<b>Total</b>	0	0	0	0	0	0	0	0	0	0	

### Section 3 - Protection and Monitoring Plans (Study 1)

3.1. Protection of Human Subjects [Protection\\_of\\_Human\\_Subjects.pdf](#)

3.2. Is this a multi-site study that will use the same protocol to conduct non-exempt human subjects research at more than one domestic site?

If yes, describe the single IRB plan

3.3. Data and Safety Monitoring Plan [Data\\_and\\_Safety\\_Monitoring\\_Plan.pdf](#)

3.4. Will a Data and Safety Monitoring Board be appointed for this study?

3.5. Overall structure of the study team [Overall\\_Structure\\_of\\_the\\_Study\\_Team.pdf](#)

## **Protection of Human Subjects**

### **1. Risks to Human Subjects**

#### a. Human Subjects Involvement, Characteristics, and Design

##### ***Study Design***

This study will aim to evaluate the feasibility of EconomicClusters implementation in trauma registry data collection systems in Cameroon, South Africa, and Uganda to track socio-economic status (SES). A freely available “toolkit” will be developed to help researchers use EconomicClusters methodology to measure SES in their own studies. The study will also aim to scale up a mobile phone-based screening tool to identify trauma patients who would benefit from further care post-discharge by implementing the Cameroon Trauma Registry at 10 hospitals in Cameroon. Factors associated with compliance with recommendations for post-discharge follow-up care after injury will also be determined.

Through an implementation science approach, in-depth interviews (IDIs) will be conducted with investigators and research staff using the EconomicClusters toolkit to evaluate stakeholder experience with the platform. Additionally, 30 IDIs will be conducted with trauma patients, Emergency (ED) staff, and trauma registry research assistants to assess the trauma registry implementation process in Cameroon. All interviews will focus on domains of the *Consolidated Framework For Implementation Research* (CFIR).

##### ***Subject Populations***

(1) The Demographic Health Survey (DHS) data analyzed in this study includes nationally representative samples of the populations of 37 Sub-Saharan African countries

(2) Study subjects that will be enrolled in the trauma registries will consist of all patients who present to participating hospital sites in Cameroon, Uganda, and South Africa with an injury, as defined by the World Health Organization, and are: 1) admitted, 2) leave against medical advice, 3) die in the emergency ward, or 4) are transferred to another hospital for a higher level of care.

Subjects included in the post-discharge follow-up assessment with an mhealth screening tool will consist of trauma registry patients in Cameroon who provided a contact phone number.

(3) IDIs will be conducted with investigators and research staff using the EconomicClusters we app platform to assess stakeholder experience with the platform

(4) 15 trauma patients, 10 ED staff, and 5 trauma registry research assistants from a variety of facility types, job titles, and demographics will be purposefully selected to participate in IDIs.

##### ***Collaborating Sites***

Data collection will occur in Cameroon at the 10 aforementioned hospital sites:

1. Laquintinie Hospital of Douala, (Littoral region)
2. Limbé Regional Hospital, (Southwest region)
3. Pouma Catholic Hospital,(Littoral region)
4. Edea Regional Hospital, (Littoral region)
5. The Emergency and Reanimation Center of Yaounde, (Centre Region)
6. Bafoussam Regional Hospital (West region)
7. Maroua Regional Hospital (Far north region)
8. Bafia district hospital (Centre Region)
9. Kribi District hospital (South Region)
10. Bertoua Regional Hospital (East Region)

Data collection in Soroti, Eastern Uganda will occur at the Soroti Regional Referral Hospital.

Data collection in Cape town, South Africa will occur at the Groote Schuur Hospital.

**b. Study Procedures, Materials, and Potential Risks**

***Research Procedures Involving Human Subjects***

(1) A secondary analysis of existing DHS data will be conducted to develop specific Economicclusters models for 37 Sub-Saharan African countries. Models for Cameroon, Uganda, and South Africa will be incorporated in trauma registry data collection systems in these countries.

(2) Trauma registry data collection (Cameroon, Uganda, South Africa):

A trained research assistant at each collaborating site will obtain verbal consent from study subjects to be included in the study. If the subject declines to be in the study, clinical and research staff will not record the subject's information in the trauma registry. Clinical staff will verbally collect information on demographics, injury context, and mechanism from all traumatically injured subjects and/or an adult surrogate. They will record this information on a paper trauma registry data collection form. Clinical staff will also collect clinical data during patient care. EconomicClusters variables specific to Cameroon, Uganda, and South Africa will be incorporated into trauma registry data collection forms and data entry platforms for a 12-month period.

Each hospital's trained research assistants will then follow up with patients' progress to record complications, outcomes, and final disposition of patients during their time as an inpatient. They will collect trauma registry data collection forms daily and follow the hospital course of each patient that is admitted for further care. By participating in daily rounds, the research assistants will collect information on further treatment and outcomes, including complications and mortality. Research assistants will enter data into the encrypted, password-protected, online database hosted on REDCap ("Research Electronic Data Capture," which is a HIPAA-compliant, secure web application for building and managing online surveys and databases).

Post-Discharge Follow-up assessment (Cameroon only):

Dedicated research assistants at each collaborating site will contact study subjects by phone at 2 weeks, 1 month, 3 months, and 6 months post-hospital discharge. Patients and/or their surrogate who are successfully reached 2 weeks post-discharge and consent to participate will be administered a 7-item mhealth phone-based screening tool survey to identify their need for follow-up care. Additionally, at all follow-up time points, subjects will be administered a GOSE survey to assess their physical and economic disability following their traumatic injury. Research assistants will enter data into the encrypted, password-protected, online database hosted on REDCap

Local oversight of data collection will be led by Cameroonian principal investigator (George Nguefack-Tsague, PHD, Alain Chichom Mefire, MD) with the assistance of Cameroon-based project managers.

(3-4) A purposeful sampling technique will be used to select trauma patients, ED staff, trauma registry staff, and investigators who be asked to provide their thoughts on 1) the implementation of the Cameroon Trauma Registry or 2) their experience with the EconomicClusters app platform. All IDIs will be conducted by study investigators trained in qualitative research methods in a private room. IDIs will be audi-recorded and transcribed verbatim in the spoken language, then translated into English. Transcripts will be coded and analyzed.

***Potential Risks***

The proposed research project poses a minimal risk to subjects who choose to participate, using the NIH definition of "the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests."

The potential risks of this study include:

- (1) Unintentional disclosure of private health or identifying information. This risk is unlikely to occur. If an information breach were to occur the risk to the subject(s) would likely be minimal, although it is theoretically possible that physical or emotional harm could result from information disclosure.
- (2) Physical or psychological distress from participation. Asking patients to recall the context and discuss the consequences of their injury may cause them some psychological stress, but this risk should be minimal.
- (3) Time and financial loss while participating in follow-up surveys. Study involvement will require some time lost for survey completion, however the risk to the subject will be minimal as the surveys should not take more than 15 -20 mins to complete.

Private Health or Identifying Information:

Mobile phone numbers, names, and addresses will be collected as part of the trauma registry at the ten collaborating hospital sites in Cameroon. Data on patient symptoms and well-being will be collected from all subjects at 2 weeks post-discharge. Data on subject's physical and economic disability will also be collected during all follow-up timepoints ( 2 weeks, 1 month, 3 months, and 6 months). No additional individually identifiable private information will be specifically collected for the proposed research project.

In-depth interviews (IDIs):

No individually identifiable private information will be collected from study subjects participating in IDIs.

Telephone Follow-up assessments:

Research assistants conducting follow-up assessments will administer the mhealth screening tool and GOSE survey over the phone. To protect the confidentiality of study subjects, other than patient's name and phone number, the research assistants will not have access to demographic, clinical, or identifying information collected during the patient's initial hospital presentation. Research assistants will record post-discharge trauma patients' responses on paper survey forms and will then transfer this data into an encrypted, password-protected online database. Data collected through this process will be linked to registry data by study identification number only. Paper forms will be stored in secure lock boxes at each hospital site in Cameroon up to the end of the study period. Only the site research assistant and a Cameroon-based project manager will have access to the secure lockboxes.

## **2. Adequacy of Protection Against Risks**

### a. Informed Consent and Assent

A trauma registry research assistant at each hospital site will seek in-person verbal consent from study subjects using a standardized informed consent or assent script. Informed consent for telephone contact by study personnel is included in the Cameroon Trauma Registry consent process. The purpose of the research, including risks and benefits of the study, will be explained to the patient. If the patient is unconscious or otherwise unable to give consent, provisional administrative authorization will be obtained to include them in the study. If possible, the research team will make an effort to reconsent patients who have recovered from unconsciousness and are able to then give consent. If a patient declines to be included in the study, no data will be recorded on any study instruments for that patient and he/she will not be included in the study. If a given trauma patient happens to be under the age of 18 years, a parent or guardian's permission and child assent will be sought and appropriately documented by trained staff. When possible, requests for consent will be delivered in the subjects' primary language. Research assistants who will be selected for this project will be appropriately trained. After obtaining patients' oral consent, trained research assistants and clinical staff at each hospital site will collect all relevant information on paper trauma registry data collection forms, which has a check box to ensure oral consent was given by the patients.

During follow-up assessments, research assistants will one more obtain oral consent to participate over the phone prior to the administering of the mhealth screening tool and GOSE surveys. They will mark that consent was received on their paper survey forms.

Study subjects participating in IDIs will be explained the purpose of the research, including risks and benefits of participating. Study subjects will be informed that their participation is entirely voluntary and that non-participation will have no detrimental impact on their medical care, employment, or research opportunities. During each interview, study subjects will be free to skip or decide not to answer a question. They will also be free to stop the interview at any time.

### **b. Protections Against Risk**

To protect and minimize against the unintentional disclosure of private health or identifying information: Patient data will be recorded on paper forms which will be stored in secure lock boxes at each of the hospital site for up to five years prior to local destruction. Trauma registry research assistants will enter data into the encrypted, password-protected, online database hosted on REDCap. All personnel with the potential to handle patient data (i.e. the DMAC data manager, PASE-UCLA program manager) will undergo standard protection of human data training and certification. All data analyses conducted by research team members will be conducted on secure, encrypted computers. No fewer than 10% of trauma registry forms at each collaborating site will be quality-checked for accuracy by a Cameroon-based project manager and PASE-UCLA program manager). Likewise, data verification of 10% of follow-up assessment surveys will also be conducted by a Cameroon-based project manager. No identifying patient data will be revealed in the trauma QI procedures; that is, all data will be de-identified

While the risk for physical and psychological discomfort are low, subjects will be informed that they are free to skip any survey questions that make them feel uncomfortable. To offset any financial risks that research participation will cause, post-discharge trauma patients will be transferred mobile phone credits after any phone interviews conducted for the study. Subjects will be informed that their responses will be entered into an electronic database, which will be encrypted and password-protected. Subjects will also be informed that the data will be accessible only to research personnel.

It is highly unlikely that adverse effects will result directly from the study interventions. However, it is possible that during follow-up calls, patients may disclose information that suggests immediate need for medical or professional intervention. If subjects are suspected to have urgent medical or safety needs, research assistants will promptly report this information to the Cameroon-based Project Manager and Dr. Alain Chichom for adjudication. Where necessary, subjects will be re-contacted to urge them to seek medical care.

In-depth interviews (IDIs) with trauma patients, facility staff, trauma registry research staff, and investigators will be recorded on external recording devices and immediately uploaded on password-protected, encrypted computers prior to transcription. Once audio transfer has been confirmed, recording devices will be cleared of voice data. Voice recordings and transcriptions will be linked to other study data by study identification number only and will not contain any additional identifying information.

### **c. Vulnerable Subjects, if relevant to your study**

Trauma impacts all individuals, including members of vulnerable populations such as pregnant women, children, fetuses, and institutionalized individuals. As such, and because the proposed study poses minimal risk to subjects, these populations will be included in the study with the following exceptions:

1. For feasibility, fetuses will not be separately enrolled from their mothers. However, pregnant women will be eligible for participation and if consent is provided data regarding fetal outcomes will be recorded.
2. Despite minimal risk, prisoners will not be included in the study as it would be difficult to guarantee voluntary participation.

The proposed research project may involve pregnant women and/or children but excludes prisoners, as explained above. The proposed project does not specifically pose any risks to pregnant women and children. Pregnant women and children must be included in this study as trauma affects individuals regardless of their association with a certain subpopulation. The minimal physical, psychological, financial, and confidentiality risks associated with the proposed research project are the least possible for achieving the objectives of the research. The study poses no more than inconvenience to the subjects. All study subjects will be fully informed

regarding the reasonably foreseeable impact of the research on them, including the vulnerable subpopulations identified above. Amongst pregnant women, no inducements, monetary or otherwise, will be offered to terminate a pregnancy; individuals engaged in the research will have no part in any decisions in any decisions as to the timing, method, or procedures used to terminate the pregnancy; and, individuals engaged in the research will have no part in determining the viability of a neonate. If children are involved, research staff will solicit the assent of the children and the permission of their parents and/or guardians.

### **3. Potential Benefits of the Proposed Research to Research Participants and Others**

There is no direct benefit to patients enrolled in the trauma registries in Uganda, South Africa, and Cameroon. However, subjects enrolled in the follow-up component of this study in Cameroon have the potential to receive direct benefit from increased post-discharge surveillance, as well as an indirect benefit that may come from establishing a sustainable mobile-based follow-up program for patients after injury in the future.

Additionally, there are no direct benefits to study subjects participating in IDIs. Indirect benefits may include an improvement in the EconomicClusters app platform which could facilitate health equity research, leading to reforms in trauma care access in the Sub-Saharan African region.

The potential confidentiality, psychological, and financial risks as well as the potential risks to employment and reputation are unlikely. If a breech in confidentiality were to occur, it would be of minimal magnitude. We have built in mechanisms to minimize the psychological and financial risks as well as risks to employment and reputation for the trauma care providers and QI personnel. An indirect benefit to all patients, providers, and QI personnel is the improvement of trauma care. The QI personnel will directly benefit from the proposed project by obtaining a whole host of knowledge and skills regarding QI. All in all, we feel that the direct and indirect benefits of the project outweigh the potential, minimal risks of harm for the patients in the Cameroon Trauma Registry, the trauma care providers, and the QI personnel.

### **4. Importance of Knowledge to be Gained**

Trauma kills more people annually than HIV, malaria, and tuberculosis combined; 90% of these deaths occur in low- and middle-income countries. SSA is the world region most vulnerable to traumatic morbidity and mortality. The knowledge gained through the proposed project has the potential to improve health equity surveillance by providing researchers with an easy-to-use, efficient socio-economic status metric that can be incorporated into their work. The project also has the potential to lead to scalable mobile phone-based screening tool intervention that could improve outcomes and long-term health for patients after traumatic injury in a resource-poor environment.

The risks of the proposed project to study subjects are reasonable insofar as they are of low likelihood and in most cases are of minimal magnitude. We have designed protections against several of these risks into our protocol. The risks—which are unlikely and in most cases, minimal—are by far offset by the knowledge to be gained through the project.

## **DATA AND SAFETY MONITORING PLAN**

**a. Monitoring the Progress of the Study:** The recruitment and retention of study subjects will be monitored by the study PIs on a quarterly basis. Every quarter, the Cameroon-based project managers and PASE-UCLA program manager will prepare a written report presenting data —in aggregate and by hospital site—on: patient enrollment, comparison of target to actual enrollment, study subjects' demographics and overall status, and the retention of subjects in the study overtime. Additionally, the Cameroon-based project manager will provide information on any adverse events among study subjects or alert study investigators to subjects whose responses to the mhealth screening tool trigger concern. Following the review of these interim analysis reports, the PIs will (1) recommend any modifications that are required to enhance recruitment and retention of study participants and (2) determine whether it would be necessary to reconsider the study's design.

**b. Plans for Assuring Compliance with Requirements Regarding the Reporting of Adverse Events:**

Any adverse events identified by the trauma registry research assistants will occur in a hospital setting where the patients will have direct access to medical attention.

In Cameroon, the ten research assistants (based at each hospital site) conducting follow-up calls will be responsible for reporting serious adverse events to the Cameroon-based program manager within 24 hours of occurrence. The Cameroon-based project manager will then communicate this information directly to the study PIs who will be responsible for reporting the serious adverse event(s) to their respective institutions 'IRB Committees.

A serious adverse event is one that is fatal or life-threatening (i.e., results in an immediate risk of death); requires or prolongs hospitalization; results in persistent or significant disability; is a birth defect; or is an important medical event that when based upon appropriate medical judgment, may jeopardize the participants, and may require medical or surgical intervention to prevent one of the outcomes listed above. Serious adverse events are not expected to occur during this study.

**c. Plans for Assuring Data Accuracy and Protocol Compliance:** The quarterly reports described above will also include findings on data accuracy and protocol compliance audits. These audits will be conducted more frequently towards the start of the study and will include the Cameroon-based project manager and PASE-UCLA-based program manager reviewing scans of no fewer than 10% of trauma registry forms at each collaborating site. Additionally, in Cameroon, a field supervisor will travel to all sites on a quarterly basis to conduct site visits and cross-reference the Cameroon trauma Registry capture record with information from hospital admission log-books. For the follow-up component of the study, the Cameroon-based project manager will (1) review data entry during follow-up phone calls and (2) determine the accuracy and completeness of data entered into the project's secure, online database.

Under the PIs' direction, all data will be managed in a secure fashion. Individually identifiable private information about human subjects will be accessible only to research assistants, the Cameroon-based project manager and PASE-UCLA-based program manager, the DMAC data manager, as well as the PIs and co-investigators of the study. Any data sharing with hospital administrators, the Cameroon Ministry of Public Health, and other external parties will occur in a de-identified fashion. Identifiers that will be collected as part of the Cameroon Trauma Registry at all ten hospital sites, and will include: Names, Addresses, and Phone numbers. No additional individually-identifiable private information will be collected for the purposes of this study in follow-up calls with study subjects. All data will be stored electronically in an encrypted, password-protected online database (REDCap). Access to REDCap will be controlled by the DMAC data manager.

## Overall Structure of the Study Team

(1) Trauma registry research assistants at all collaborating hospital sites in Cameroon, Uganda, and South Africa will be responsible for ensuring data on all study subjects are accurately collected. They will transfer all data into the REDCap database, and will upload scanned copies of 10% of paper trauma registry forms onto a secure file sharing service for quality checks. These research assistants will also be responsible for following up with admitted trauma patients, documenting all received surgical and medical procedures these subjects receive until they are discharged or no longer obtaining care at the institution

(2) Given the large number of hospital sites in Cameroon, the study team will also include a field supervisor who will supervise data collection activities for all trauma registry research assistants in Cameroon. The field supervisor will conduct monthly site visits to collaborating hospitals to meet with key stakeholders (e.g. hospital administrators, hospital staff), provide trainings, and present findings from new analyses of the Cameroon Trauma Registry (CTR) data collected at the respective hospital site. During these visits, the field supervisor will perform quality assurance checks to ensure data quality and integrity at each site. Site visits occur at least once a quarter.

(3) In Cameroon, ten dedicated research assistants will be responsible for conducting follow-up phone assessments of discharged trauma registry patients who provide a contact phone number. They will call subjects at four time points post-discharge: 2 weeks, 1-month, 3-months, and 6-months to administer an mhealth screening tool and/or a GOSE survey. These research assistants will be responsible for transferring data collected during follow-up calls into a REDCap database. They will also upload scanned copies of 10% of completed survey forms onto a secure file sharing service for quality checks.

(4) Two Cameroon-based project managers will be responsible for conducting administrative duties and overseeing research activities in Cameroon that are associated with different components of the study. These individuals will prepare documents to obtain administrative authorizations and IRB approvals from local institutions and a national ethics committee. Project managers will coordinate training events and develop training materials for research personnel. Trainings on data collection of EconomicClusters variables for Cameroon and follow-up assessment of discharged trauma registry patients will be led by the project managers. The Cameroon-based project managers will also be responsible for data verification of 10% of trauma registry or follow-up assessment data (mhealth screening tool /GOSE survey) by cross-referencing paper forms to a RedCap database.

(5) The PASE-UCLA program manager will provide support to the Cameroon-based project managers, assisting them in managing research activities in Cameroon. She will help develop training materials and will conduct trainings on data collection of EconomicClusters variables for research personnel in Uganda and South Africa. The PASE-UCLA program manager will also perform data verification of 10% of the trauma registry data from the Soroti Regional Referral Hospital in Eastern Uganda and the Groote Schuur Hospital in Cape Town, South Africa.

(6) The DMAC Data Manager, with support from a data analyst, will perform periodic analyses on the trauma registry data, evaluating the feasibility of EconomicClusters implementation for trauma registry in Cameroon, Uganda, and South Africa using a harmonized data quality framework. The DMAC Data Manager will also apply quality assurance/control procedures. Lastly, the DMAC Data Manager will participate in research personnel training on data collection of EconomicClusters variables.

The Cameroon-based project manager, PASE-UCLA program manager, and DMAC Data Manager will report directly to the study PIs and Co-investigators.

## Section 4 - Protocol Synopsis (Study 1)

### 4.1. Study Design

#### 4.1.a. Detailed Description

#### 4.1.b. Primary Purpose

#### 4.1.c. Interventions

Type	Name	Description
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#### 4.1.d. Study Phase

Is this an NIH-defined Phase III Clinical Trial?  Yes  No

#### 4.1.e. Intervention Model

4.1.f. Masking  Yes  No

Participant  Care Provider  Investigator  Outcomes Assessor

#### 4.1.g. Allocation

### 4.2. Outcome Measures

Type	Name	Time Frame	Brief Description
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### 4.3. Statistical Design and Power

### 4.4. Subject Participation Duration

4.5. Will the study use an FDA-regulated intervention?  Yes  No

4.5.a. If yes, describe the availability of Investigational Product (IP) and Investigational New Drug (IND)/Investigational Device Exemption (IDE) status

4.6. Is this an applicable clinical trial under FDAAA?  Yes  No

### 4.7. Dissemination Plan

**Delayed Onset Studies**

Delayed Onset Study#	Study Title	Anticipated Clinical Trial?	Justification
The form does not have any delayed onset studies			

## Multiple PI Leadership Plan

### Rationale:

Dr. Alain Chichom, MD, Catherine Juillard, MD, MPH, Alan Hubbard PhD and George Nguefack-Tsague PhD will serve as M-PIs on the project. Drs. Chichom and Juillard have had a collaborative relationship involving injury research projects based in Cameroon since 2008. Dr. Chichom was a member of the Advisory Board for the University of California, San Francisco (UCSF) Center for Global Surgical Studies, a research center which Dr. Juillard co-founded and directed. He currently serves as the Director of Research in Cameroon for UCLA's Program for the Advancement of Surgical Equity (PASE), a research program for which Dr. Juillard is the founding Co-Director. Drs. Chichom and Juillard have worked together on multiple studies, including research funded by the NIH (R21TW010956, R21TW010453) with a productive publication and trainee co-mentoring track record of. Dr. Hubbard has also worked closely with Dr. Juillard and Dr. Chichom on projects related to machine learning prediction in trauma and development of novel algorithms for rapid socioeconomic assessment in resource-limited settings. Dr. Alan Hubbard is also a core faculty member at PASE and was a core faculty member of the Center for Global Surgical Studies at UCSF. Dr. Nguefack-Tsague currently holds dual Buea and AIMS-Cameroon faculty appointments, and is thus a colleague of Dr. Chichom. He has worked with Dr. Chichom co-teaching scientific writing workshops in Cameroon. These pre-existing informal and formal relationships between the PIs set a solid, rational structure for this leadership team.

Dr. Chichom and Dr. Juillard are clinically active surgeons, with expertise in trauma surgery. Each has particular skills in areas required for execution of the proposed project. Dr. Juillard has extensive experience in injury and trauma research in Cameroon and has lived in Cameroon in the past. Prior and ongoing projects with collaborators in Cameroon include surgical system capacity assessment, injury surveillance capacity building, and development of the multicenter Cameroon Trauma Registry. She has also co-authored World Health Organization publications on injury and trauma in low- and middle-income countries, including Guidelines on Trauma Quality Improvement Programs. Dr. Juillard has been a standing member of San Francisco General Hospital's and UCLA's Trauma Performance Improvement Committees and participated in trauma systems planning in San Francisco, including local injury prevention, prehospital care, and institutional trauma protocols and guidelines. She has mentored trainees in sub-Saharan Africa and the United States (US) who have successfully published and obtained intramural and extramural grant support.

As the Chief of Surgery at the University of Buea and a well-respected academic surgeon in Cameroon, Dr. Chichom is well-positioned to facilitate implementation of the proposed project. Dr. Chichom also has extensive experience in injury and surgical research in Cameroon, with a particular focus on health systems organization. He is an award-winning educator at the University of Buea and has had a track record of mentoring medical students and residents for over 10 years in Cameroon. Dr. Chichom-Mefire has published over 40 articles in peer-reviewed journals and is a member of numerous surgical societies such as the International Society of Surgery (ISS-SIC), the International Association of Trauma Surgery and Intensive Care (IATSIC), and the World Society of Emergency Surgery (WSES).

Dr. Hubbard and Dr. Nguefack-Tsague both offer advanced statistical expertise to the project. Dr. Nguefack-Tsague is an Associate Professor of Biostatistics at the University of Yaoundé I in Cameroon, with affiliate faculty positions at AIMS-Cameroon and at the University of Buea, where he has taught advanced statistics for the CDC Field Epidemiology Training Program since 2015. Dr. Nguefack-Tsague currently serves as the General Coordinator of the HELINA (Pan African Health Informatics Association)'s Working Group, "Data Mining and Big Data Analytics." His methodological work revolves around data-adaptive estimation and using Bayesian methods for ensembling. He has particular expertise in secondary data analysis of one of the main data sources for the Center's **Research Project – Health Equity Surveillance**, which he will Co-Lead with Dr. Hubbard.

Dr. Hubbard is a Professor of Biostatistics at the University of California, Berkeley. He is a co-Director of the Biomedical Big Data pre-doctoral (T32) training program and *Center of Targeted Learning*, and Director of the computational biology Core E of the SuperFund Center at University of California, Berkeley (NIH/EPA). He has also worked as a consulting statistician on several federally funded and foundation projects. His research

focuses on the application of statistics to population studies with particular expertise in semi-parametric models and the use of machine learning in causal inference, as well as applications in high dimensional biology.

All researchers will leverage their combined expertise and history of collaboration to lead the Data Science Center for Surgery, Injury, and Equity Africa (D-SINE Africa).

#### Governance & Organizational Structure:

All project management decisions will be reached by consensus between the four M-PIs. Although all aspects of the proposed project will be discussed and jointly agreed upon, each PI will take primary leadership of certain aspects of the project, with support from the other PIs.

Dr. Chichom will be responsible for the oversight and coordination of D-SINE Africa's Administrative Core, leading the strategic planning of the Center's research agenda and assisting D-SINE Africa Core members in meeting their deliverables. Dr. Chichom will also be the corresponding PI for the NIH and will assume lead responsibility for the submission of progress reports and all communication to the NIH, with assistance and support by Dr. Juillard, who is D-SINE Africa's Deputy Director. Dr. Chichom will additionally assume lead responsibility for budgetary oversight. Dr. Hubbard and Dr. Nguefack-Tsague will jointly provide oversight of Data Management and Analysis Core (DMAC) activities, including implementing all policies, procedures, and processes as it relates to data access, management and analysis. Drs. Juillard and Chichom will share joint lead responsibility for research operations and evaluation. All M-PIs will share responsibility for dissemination of findings.

M-PIs will communicate semimonthly, either by phone, e-mail, or Zoom videoconferencing to discuss the Center's administrative workflow, the status of ongoing research, and data management and analysis activities. The exact meeting times will be determined based on M-PIs schedules. M-PIs will also organize larger meetings with all other Co-Investigators and key personnel from the University of Buea, University of Cape Town (UCT), AIMS Cameroon, UCLA and the University of California (Berkeley and Los Angeles). M-PIs will also organize yearly in-person meetings in the US or Cameroon, that additional co-investigators can join in virtually, to discuss D-SINE Africa's research progress, the project's evaluation findings and recommendations, and trainee development.

#### Budget Allocation:

All resources will be allocated to the University of Buea which will subdivide the award. Funds for key personnel salary support, travel expenses, and supplies; as well as recurring and non-recurring research costs will be subcontracted to the UCLA, UCB, AIMS Cameroon, and UCT. To ensure careful administration and stewardship of funds, funding disbursements will be made on a quarterly basis and require all four MPIs signatures.

#### Data Sharing:

All M-PIs will have access to data collected through the project. All M-PIs will have to be consulted and approve the sharing of any data generated through D-SINE Africa. Drs. Nguefack and Hubbard, as DMAC Co-Leads, will serve as the direct liaison to the DMAC to harmonize data sharing activities.

#### Publication Policies:

A publication policy will be established based on the relative contribution of M-PIs, key personnel, and study staff. All publications resulting from D-SINE projects will have joint Sub-Saharan African and U.S. authorship represented.

#### Conflict Resolution:

Most of our MPI team has had long-term collaboration in Cameroon (Chichom, Juillard, Hubbard), and we have already established a strong working relationship with our newest partner (Nguefack-Tsague), who has deep experience working with teams at three different institutions (University of Yaoundé I, AIMS, and University of Buea). We do not expect conflict to arise, but if a potential conflict between the MPIs develops, we will first and foremost attempt to resolve the conflict ourselves. If this fails to resolve the conflict, we will invite Dr. Halle Ekane (University of Buea) to mediate a discussion among all M-PIs. If this is unsuccessful, we will then

involve D-SINE Africa Senior advisors, Dr. Steve Shoptaw (UCLA), Dr. Dan Stein (UCT), and Dr. Halle Ekene, who shall meet and attempt in good faith to settle any dispute, claim or controversy arising out of or relating to the interpretation, performance or breach of this disagreement. However, if the D-SINE Africa Senior Advisors fail to resolve the disagreement within thirty days, then such disagreement will be referred for resolution to Dr. George Etoundi from the Cameroonian Ministry of Public Health in Cameroon.

Change in PI location:

If one of the M-PIs or Core Leads moves to a new institution, attempts will be made to move that individual's portion of the grant to the new institution. If one of the M-PIs or Core Leads is unable to carry out his or her duties, a new, qualified investigator will be recruited by the remaining M-PIs, subject to approval by the D-SINE Executive Committee (Director, Deputy Directors, and Core Leads) on the grant.

Resolution of Conflict Among D-SINE Directors

If a conflict arises among D-SINE Director (Chichom) and Deputy Directors (Juillard and Maswime) will

1 First try to resolve it among themselves, involving Halle Ekane to mediate.

2) If this is not effective, we will follow the established policies of the University of Buea and the University of California<sup>1</sup>.

3) If this is unsuccessful, then we will involve Nguefack and Hubbard (program MPIs) to help resolve the conflict.

4) If the MPIs are unable to come to consensus agreement, we will then follow a similar procedure for MPI conflict resolution by involving D-SINE Africa Senior advisors, Dr. Steve Shoptaw (UCLA), Dr. Dan Stein (UCT), and Dr. Halle Ekene, who shall meet and attempt in good faith to settle any dispute, claim or controversy arising out of or relating to the interpretation, performance or breach of this disagreement.

5) if the D-SINE Africa Senior Advisors fail to resolve the disagreement within thirty days, then such disagreement will be referred for resolution to Dr. George Etoundi from the Cameroonian Ministry of Public Health in Cameroon.

Resolution of Conflict Among D-SINE Co-Leads

**Core Leads:** If conflict occurs between the DMAC (Nguefack, Hubbard) or CBC (Foupouagnigni, McCoy) Co-Leads, they will initially try to resolve it among themselves, inviting the D-SINE Director (Chichom) to mediate. If internal resolution proves impossible, we will follow the appropriate policies of Buea and the University of California<sup>1</sup>, which provides policy guidelines pertaining to conflict resolution. In the unlikely event that this is not successful, we will each nominate a senior D-SINE faculty member not associated with the Core to serve on a dispute resolution panel chaired by Chichom and Juillard. If this is unable to be resolved within the D-SINE Center hierarchy, then we will follow the same procedures as 4-5 under "Resolution of Conflict Among D-SINE Directors," above.

**Project Leads:** If conflict occurs between the Co-Leads for Project 1 (Nguefack, Hubbard) or Project 2 (Chichom, Juillard), they will initially try to resolve it among themselves. If this is unsuccessful, the other Project Co-Leads (ie, Co-Leads for Project 2 if conflict occurs between the Co-Leads for Project 1) will be involved to try and resolve the conflict (as all Project Co-Leads are U54 program M-PIs). If the conflict is not able to be resolved, we will then follow the appropriate policies of Buea and the University of California<sup>1</sup>, which provides policy guidelines pertaining to conflict resolution. In the unlikely event that this is not successful, then we will follow procedures consistent with U54 program M-PI conflict resolution previously described by inviting Dr. Halle Ekane (University of Buea) to mediate a discussion among all M-PIs. If this is unsuccessful, we will then involve D-SINE Africa Senior advisors, Dr. Steve Shoptaw (UCLA), Dr. Dan Stein (UCT), and Dr. Halle Ekene, who shall meet and attempt in good faith to settle any dispute, claim or controversy arising out of or relating to the interpretation, performance or breach of this disagreement. However, if the D-SINE Africa Senior Advisors fail to resolve the disagreement within thirty days, then such disagreement will be referred for resolution to Dr. George Etoundi from the Cameroonian Ministry of Public Health in Cameroon.

**Reference:**

<https://ethics.berkeley.edu/conflict-resolution>. UC Berkeley, 2020 <https://ethics.berkeley.edu/conflict-resolution> (accessed Nov 29, 2020).

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