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East Africa GEOHealth Hub: Ambient air pollution exposure and child respiratory health in Ethiopia, Uganda, Rwanda, and Kenya.

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Mycotoxin biomarkers and children's health in Africa: Translation of basic research to public health prevention.

Heavy Metal Exposure and Cardiometabolic Phenotypes.
Toxicodietary and genetic determinants of susceptibility to neurodegeneration in the Congo.

Environmental Exposures and Infectious Disease
Indoor residual spraying for malaria control and child development in South Africa.

Trace Elements and Risk of Severe Malaria and Neurodevelopmental Impairment.

Discussion of Research Needs and Future Directions

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H3Africa — Human Heredity and Health in Africa
Agenda

H3Africa — Human Heredity and Health in Africa
Environmental Health in Africa: Opportunities to Expand Research Capacity in the H3Africa Consortium

Workshop Preceding the 12th Human Heredity and Health in Africa (H3Africa) Consortium Meeting

Sunday, September 16, 2018
Kigali, Rwanda

AGENDA

8:00 – 8:15 a.m. Welcome
Gwen Collman, Director of NIEHS Division of Extramural Research and Training
Room MH1

Charge of the Workshop
Kim McAllister and Bonnie Joubert, NIEHS

8:15 – 8:30 a.m. History and Directions of the H3Africa Consortium
Michelle Skelton, University of Cape Town

Global Environmental and Occupational (GEO) Health

8:30 – 9:00 a.m. The Michigan-West Africa GEOHealth Hub: Environmental Exposures Due to Informal E-waste Recycling Activities and the Health of Workers
Julius Fobil, University of Ghana
Exposure Focus: Electronic Waste
Room MH1

9:00 – 9:30 a.m. East Africa GEOHealth Hub (Ethiopia): Ambient Air Pollution Exposure and Child Respiratory Health in Ethiopia, Uganda, Rwanda, and Kenya
Abera Kumie, Addis Ababa University
Exposure Focus: Ambient Air Pollution

Biomarkers and Mechanisms

9:30 – 10:00 a.m. Mycotoxin Biomarkers and Children’s Health in Africa: Translation of Basic Research to Public Health Prevention
Joshua Smith, Johns Hopkins University
Exposure Focus: Mold
Room MH1

10:00 – 10:15 a.m. Break

10:15 – 10:45 a.m. Heavy Metal Exposure and Cardiometabolic Phenotypes
Cathrine Hoyo, North Carolina State University
Exposure Focus: Metals

10:45 – 11:15 a.m. Toxicodietary and Genetic Determinants of Susceptibility to Neurodegeneration in the Congo
Daniel Tshala-Katumbay, Oregon Health Sciences University
Exposure Focus: Nutrition
Environmental Exposures and Infectious Disease  
Room MH1

11:15 – 11:45 a.m.  
Indoor Residual Spraying for Malaria Control and Child Development in the South African VHEMBE Birth Cohort  
Jonathan Chevrier, McGill University, ISEE Africa Chapter  
Exposure Focus: Pesticides

11:45 a.m. – 12:15 p.m.  
Trace Elements and Risk of Severe Malaria and Neurodevelopmental Impairment  
Chandy John, Indiana University  
Exposure Focus: Biomarkers of Exposure and Inflammation

12:15 – 1:30 p.m.  
Lunch (On Your Own)  
Poster Presentations  
Foyer 1C

Research Needs  
Room MH1

1:30 – 1:50 p.m.  
Report Back From Workshop Participant Survey; Aims for Breakout Group Discussions  
Bonnie Joubert and Kim McAllister, NIEHS

1:50 – 2:00 p.m.  
Transition to Breakout Group Rooms

2:00 – 3:15 p.m.  
Breakout Group Discussions  
Electronic Waste  
Ambient and Indoor Air Pollution (including Tobacco Smoke)  
Metals and Mycotoxins.  
Pesticides and Nutrition/Toxicodietary Exposures  
Biomarkers of Chemical Exposures and Infectious Disease  
Room AD4  
Room MH1  
Room AD11  
Room AD10  
Room AD12

3:15 – 3:30 p.m.  
Break and Transition Back to Main Room

Panel Discussion with Report Back From Breakout Groups  
Room MH1

3:30 – 5:00 p.m.  
Panelists and Breakout Group Leads  
Mark Nicol, University of Cape Town  
Michele Ramsay, Wits University  
Kiros Berhane, University of Southern California  
Brenda Eskenazi, University of California, Berkeley  
Adrie Steyn, Africa Health Research Institute

5:00 – 5:10 p.m.  
Closing Remarks  
Gwen Collman, NIEHS
Biographies

H3Africa — Human Heredity and Health in Africa
Kiros Berhane, Ph.D.
Kiros Berhane is professor and director of graduate programs in biostatistics and epidemiology at the Department of Preventive Medicine, University of Southern California. Originally from Ethiopia, he received his bachelor’s degree in statistics from Addis Ababa University (Ethiopia), Master of Science in statistics from University of Guelph (Canada), and doctorate in biostatistics from University of Toronto (Canada). He completed a postdoctoral fellowship at Johns Hopkins University (USA). He is a widely published international expert on the development of statistical methods and their application into a wide range of environmental health topics. Berhane is director of the Statistical Methods and Study Design Research Core of the Southern California Environmental Health Sciences Center. He is a co-principal investigator of the Global Environmental and Occupational Health (GEOHealth) Hub for Eastern Africa (covering Ethiopia, Kenya, Rwanda, and Uganda). He has served on several national and international advisory and review panels, including committees of the Institute of Medicine (National Academies of Science), the U.S. Environmental Protection Agency (EPA) Science Advisory Board, the Health Effects Institute Review Committee, a science advisory panel of the Western Interprovincial Scientific Studies Association (WISSA - Calgary, Canada), and the Biostatistical Methods and Research Design [BMRD] Study Section of the National Institutes of Health. He has chaired and is still a member of the Fisher lecture and award selection committee of the Committee of Presidents of Statistical Societies (COPSS). He is a member of the editorial boards of several prominent journals, including Environmental Epidemiology and the International Journal of Public Health. He was a Fulbright Scholar in Ethiopia (2016-2017). He is an elected fellow of the American Statistical Association.

Jonathan Chevrier, Ph.D.
Chevrier is assistant professor of epidemiology at McGill University, an associate member of the McGill School of Environment, and Canada Research Chair in Environmental Health Sciences. He uses traditional and causal inference methods to investigate the human health effects of exposure to common environmental contaminants such as pesticides, flame retardants, plastic components, and industrial by-products in North America, Asia, and Africa. He is the principal investigator of the Venda Health Examination of Mothers, Babies, and their Environment (VHEMBE), which investigates the health effects of exposure to air pollution and public health insecticides used for malaria control in South African children. He also applies and adapts causal methods to address methodological issues such as the healthy worker survivor effect (HWSE). More information on Chevrier’s work may be found at: https://jchevrier.weebly.com

Gwen Collman, Ph.D.
Gwen Collman, Ph.D., is director of the National Institute of Environmental Health Sciences (NIEHS) Division of Extramural Research and Training where she leads approximately 60 professional staff in areas of scientific program administration, peer review, and the management and administration of about 1,500 active grants each year. She directs scientific activities across the field of environmental health sciences, including basic sciences (i.e., DNA repair, epigenetics, environmental genomics), organ-specific toxicology (i.e., reproductive,
neurotoxicology, respiratory), public health-related programs (i.e., environmental epidemiology, environmental public health), and training and career development. She also oversees the implementation of the Superfund Research Program and the Worker Training Program.

Prior to her current role, Collman served in program development and management, beginning in 1992 as a member, then as chief of the Susceptibility and Population Health Branch. During this time, she directed research on the role of genetic and environmental factors on the development of human disease, from animal models of genetic susceptibility to population studies focusing on etiology and intervention. She was responsible for building the NIEHS grant portfolio in environmental and molecular epidemiology and developed several complex multidisciplinary research programs. These include the NIEHS Breast Cancer and the Environment Research Centers Program, the NIEHS/EPA Centers for Children's Environmental Health and Disease Prevention, and the Genes, Environment, and Health Initiative. Also, under her guidance, a team created a vision for the Partnerships for Environmental Public Health program for the next decade.

In recognition of her achievements, she is the recipient of numerous NIEHS Merit Awards, two NIH Director's Awards, and the HHS Secretary's Award for Distinguished Service. Collman received a doctorate in environmental epidemiology from the University of North Carolina School of Public Health where she was awarded the 2009 H.A. Tyroler Distinguished Alumni Award.

Brenda Eskenazi, Ph.D.

Eskenazi is the Jennifer and Brian Maxwell Professor of Maternal and Child Health and Epidemiology at the University of California, Berkeley; the director of the Center for Environmental Research and Children’s Health (CERCH); and the principal investigator of the CHAMACOS, VHEMBE, and Seveso Women’s Health Study among others. She is a neuropsychologist and epidemiologist whose long-standing research interest has been the effects of toxicants including lead, solvents, environmental tobacco smoke, dioxin, and pesticides, on human reproduction (both male and female) and child development.

Julius Fobil, Dr.P.H.

Fobil is an associate professor at the University of Ghana School of Public Health, heading its Department of Biological, Environmental & Occupational Health Sciences. His research focuses on urban environmental health in low-income economies with emphasis on the impact of sanitation infrastructure, neighborhood environmental conditions, environmental change, and area-based socioeconomic inequalities on human health. While the general interest is in environmental determinants of health, specific research endeavors include environmental exposure assessment, the fate and effects of waste materials in the environment, environmental pollution studies, and the impact of informal sector activities on environment and human health. Key activities of interest within the informal sector include electronic waste
(e-waste) recycling/processing activities, artisanal gold mining activities, and informal transportation which directly contribute to environmental pollution by specifically modifying air, water, and soil quality. In trying to understand the complex interaction between informal sector activities and environmental quality, his research is concerned with how the specific environmental media (air, water, and soil) mediate informal sector activities to produce human health outcomes. More recently, he has focused her energies on building research capacity in environmental and occupational health in West and Central Africa as well as institutional capacity strengthening in emergency preparedness, its management and health in complex emergencies. Though a small working group, they have an ultimate goal to unravel the unintended urban health vulnerabilities associated with complex urban changes such as the growing consequence of urban air pollution and the multiple urban land uses on urban mortalities and urban health in general.

**Cathrine Hoyo, Ph.D.**

Cathrine Hoyo, Ph.D., is an associate professor of epidemiology in the Department of Biological Sciences at North Carolina State University. She is the co-director of the Integrated Health Sciences Facility Core in the Center for Human Health and the Environment, and director of the Epidemiology and Environmental Epigenomics Laboratory. Her research program aims to improve our understanding of how early development influences risk of common chronic diseases, especially those that exhibit racial/ethnic differences in incidence and/or mortality, including cardiovascular and metabolic diseases and some cancers. To accomplish this, her group has taken a two-pronged approach. They have developed and continue to follow a cohort of newborns to identify stable epigenetic targets that are acquired early, are mitotically heritable, and are associated with known risk factors for early subclinical indicators of cardiovascular and metabolic dysfunction including pre-hypertension, accelerated adiposity gains, and frank obesity as such markers can serve as stable risk markers useful for early detection of exposure. Her group also conducts population-based case control studies in adults to determine if identified epigenetic targets are associated with risk of these cardio-metabolic risks and these cancers in adulthood.

**Chandy John, M.D.**

Dr. John holds the Ryan White Endowed Chair in Pediatric Infectious Diseases and is director of the Ryan White Center for Pediatric Infectious Disease and Global Health at Indiana University. Dr. John’s research focuses on malaria pathogenesis, immunology, and epidemiology. Key discoveries of his collaborative research team include: 1) the first prospective studies to establish that severe malaria is associated with long-term cognitive impairment in children, 2) identification of immunologic factors that increase risk of severe malaria and cognitive impairment after severe malaria, 3) determination of geographic and immunologic factors that affect risk of malaria in areas of unstable malaria transmission, and 4) the first studies to show that hydroxyurea treatment is safe and effective for children with sickle cell anemia in malaria-endemic areas.
John is an active clinician, specializing in pediatric infectious diseases and tropical medicine. He conducts research and training programs in Kenya in collaboration with colleagues at the Kenya Medical Research Institute and Moi University, and in Uganda in collaboration with colleagues at Makerere University. He is the author of more than 140 peer-reviewed publications and 30 book chapters. Dr. John is the president-elect of the American Society of Tropical Medicine and Hygiene.

**Bonnie Joubert, Ph.D.**

Joubert is a scientific program director in the Population Health Branch at the NIEHS and manages part of the extramural epidemiology program. Her portfolio includes molecular epidemiology; cardiovascular, respiratory, metabolic, immune, and kidney epidemiology research; as well as statistical methods development. She also co-leads NIEHS engagement in the H3Africa consortium. Bonnie received her M.P.H. in epidemiology from Tulane University School of Public Health and Tropical Medicine, and her doctorate in epidemiology from the University of North Carolina at Chapel Hill. She has public health and research experience in Africa and computer programming proficiency for the analysis of big data. She spent time as a postdoctoral environmental health scientist at the EPA and a research fellow at the NIEHS in the Division of Intramural Research. Her prior research included genetic epidemiology of mother-to-child transmission of HIV, genome-wide association studies of respiratory disease, and epigenome-wide association studies of early life environmental exposures.

**Abera Kumie, Ph.D.**

Kumie is the department head of Environmental and Occupational Health. He received his Master of Science from Tulane University, and doctorate at Addis Ababa University. He is an associate professor since 2010 at Addis Ababa University, teaching undergraduate and graduate students, advising and supervising Master of Public Health and doctoral candidates. His research focuses in areas of environmental and occupational health. He has more than 70 publications in peer reviewed journals. He is currently lead principal investigator of an NIH/IDRC-funded GEOHealth project for Eastern Africa focusing on environmental and occupational health since 2012 that extends to Aug 2020 for the planning and research grant. He provides public service to the Ministry of Health of Ethiopia and Research Ethical Committee of the University. Kumie is involved in postdoctoral training under “Reduction of the burden of injuries and occupational exposures through capacity building in low income countries,” funded by a Norwegian grant (NORHED).

**Kimberly McAllister, Ph.D.**

McAllister received a Bachelor of Science in honors biology at the University of Illinois and a doctorate in human genetics at the University of Michigan. Her dissertation involved identifying the first gene known to cause the disease Hereditary Hemorrhagic Telangiectasia. She completed postdoctoral training and a research fellowship in the Division of Intramural Research at NIEHS with research focusing on the development of BRCA2-deficient mice as a
model for breast cancer and Fanconi Anemia. McAllister is presently a program administrator in the extramural division of NIEHS in the Genes Environment and Health Branch. She manages a portfolio of grants in genetic epidemiology and gene-environment interaction studies, human genetics, GxE statistical and bioinformatics methods, basic genetics, DNA repair, animal models of human disease, and comparative biology approaches. She represents NIEHS on multiple trans-NIH committees relating to genetics and genomics. Kim (along with Bonnie Joubert) is the NIEHS representative for the H3Africa consortium and is facilitating a new environmental health working group for H3Africa to explore environmental risk factors for many H3Africa research projects.

**Mark Nicol, Ph.D.**

Mark Nicol is a medical microbiologist who holds the Wernher and Beit Chair of Medical Microbiology at the University of Cape Town, South Africa. He has a joint appointment with the National Health Laboratory Service (NHLS) of South Africa, which provides diagnostic pathology services to the public sector, and heads a diagnostic microbiology laboratory at the University teaching hospital. He studied medicine and medical microbiology at the University of the Witwatersrand and completed his doctorate in childhood tuberculosis in Cape Town. His research interests are primarily in the field of respiratory tract infections. Specifically, his research focuses on the pathogenesis and diagnosis of respiratory infection in children; the development, evaluation and implementation of novel diagnostic tests for tuberculosis; the cascade of care for patients with drug-resistant tuberculosis; and the role of the microbiome in early childhood development and illness.

**Michèle Ramsay, Ph.D.**

Michèle Ramsay is the director of the Sydney Brenner Institute for Molecular Bioscience (SBIMB) and professor in the Division of Human Genetics, University of the Witwatersrand, Johannesburg (Wits). Her research interests include studying African population genetic diversity and environmental factors to better understand their role in diseases. Her areas of research span rare monogenic eye and skin disorders (including albinism and keratolytic winter erythema), African population genetics, pharmacogenomics, and complex disease traits in African populations. She is the co-lead for the Southern African Human Genome Programme (SAHGP) with a view to exploring precision medicine in an African context. The SAHGP pilot study on 24 whole genome sequences was published in Nature Communications in December 2017. As an active steering committee member of the Human Heredity and Health in Africa (H3Africa) Consortium, she promotes ethical genomic research in Africa. She is the principal investigator of an NIH-funded Collaborative Centre under the H3Africa Consortium for “Genomic and environmental risk factors for cardiometabolic diseases in Africans.” This is a Wits INDEPTH partnership referred to as AWI-Gen. Building research capacity in genomics in Africa is important to her, and she teaches at undergraduate level, supervises postgraduate students, host postdoctoral fellows, and enjoys mentoring young African scientists. Ramsay holds a South African Research Chair on Genomics and Bioinformatics of African Populations and is president of the African Society for Human Genetics.
Michelle Skelton, Ph.D.
Michelle Skelton did her undergraduate training at the University of the Western Cape. After completing her Masters in Oesophageal Cancer and the role of Tumour Suppressor genes she was employed as a Research officer at the University of Witwatersrand in the Department of Molecular Hepatology. Her doctorate explored the role of Hepatitis B Virus genome variation in liver cancer, this was followed by short research projects in HIV diversity at the University of Cape Town where she subsequently enrolled for a Post doctorate with Professor Dandara's Pharmacogenomics Group in the Division of Human Genetics UCT. During her Post doctorate Michelle was particularly interested in the role of virus restriction genes and how variation in these genes between various ethnicities may contribute to differences in the prevalence of HIV infection. Currently, Michelle is the Principal Investigator of the H3Africa Project “H3Africa Administrative Coordinating Centre: Enabling and Supporting Genomics and Health Research Capacity Building in Africa”. She is passionate about supporting the organizational activities of researchers and scholars to strengthen their collective global position. She also functions as a liaison between key leaders, policy makers and partners at various levels.

Joshua Smith, Ph.D.
Joshua W. Smith obtained degrees from The Ohio State University (Bachelor of Science, dietetics) and the University of Illinois at Urbana-Champaign (doctorate, nutritional sciences). He is currently a postdoctoral fellow with John D. Groopman in the Department of Environmental Health and Engineering at the Johns Hopkins Bloomberg School of Public Health. With a foundation in nutritional sciences, Joshua has worked extensively with animal models for the investigation of dietary bioactive components in the prevention of chronic disease, particularly cancer. Previous work has involved murine knockout models for interrogation of carotenoid metabolism, biosynthesis and dosing of isotopically labeled tracers for investigation of lutein biodistribution in non-human primates, and transgenic murine models of prostate cancer for dietary tomato prevention and intervention studies.

Currently, Joshua uses various mass spectrometry approaches for the quantification and discovery of human biomarkers of environmental carcinogen exposures. One aspect of this work involves assessment of aflatoxin exposure in mother-child pairs from large clinical trials in Bangladesh and Malawi, for the purposes of determining aflatoxin-related risks of in utero growth restriction and postnatal stunting. A second major project seeks to discover and characterize biomarkers of ambient exposure to outdoor air pollution in the Yangtze River delta region, which experiences both increasing levels of outdoor air pollution and accelerating rates of lung cancer in non-smokers. Overall, Joshua’s research interests converge upon the application of mass spectrometry techniques in animal models and human populations for the interrogation of environmental and dietary agents in the etiology and progression of cancer.
Adrie Steyn, Ph.D.

Adrie Steyn is a basic scientist with appointments at the Africa Health Research Institute (AHRI) formerly known as the KwaZulu-Natal Research Institute for Tuberculosis (TB) and HIV (K-RITH), and the University of Alabama at Birmingham in the USA. K-RITH is an Howard Hughes Medical Institute- and Welcome Trust-funded basic research institute in Durban, South Africa, whose mission is to examine the mechanisms of HIV and TB disease. She has a broad background in molecular genetics, with specific in-depth training and expertise in Mtb virulence and pathogenesis using different animal models for tuberculosis (TB). As a postdoctoral fellow at the Albert Einstein College of Medicine (AECOM) and Harvard University, she studied the genetic mechanisms of Mtb virulence and persistence. As a principle investigator on NIH grants, as well as a Burroughs Welcome Investigator in the Pathogenesis of Infectious Disease, she laid the groundwork for developing novel tools and approaches for studying Mtb bioenergetics and redox homeostasis using the Agilent Seahorse XF96, studying the effect of NO, CO, and hypoxia on Mtb persistence in vivo, and by establishing strong ties with the UAB Center for Free Radical Biology and Center for AIDS Research. She successfully administered the NIH-, UAB-, and K-RITH-funded projects (e.g., budget and staffing) including directing the UAB, K-RITH BSL3, and A-BSL3 laboratories. Her laboratory at AHRI allowed her to integrate her basic science expertise with clinical science. She is leading efforts for the Human Lung Project, a prospective cohort established to collect resected lung tissue samples from TB patients. Her team has acquired substantial experience in handling MDR and XDR-infected human lung samples, including but not limited to processing lung TB tissue for flow cytometry analysis, collecting blood, and the isolation of genomic DNA, RNA, metabolites, and proteins from human TB lung tissue. Her research focus shifted slightly towards applying her basic science training to understand the fundamental principles of disease and persistence in human pulmonary TB patients. She has also recently adapted Agilent XF96 technology for studying the mode of action of the electron transport chain-targeting drugs bedaquiline, Q203, and clofazimine bioenergetics, and examining the bioenergetics of MDR and XDR Mtb strains.

Daniel Tshala-Katumbay, M.D., Ph.D., M.P.H.

Tshala-Katumbay earned his medical degree with a specialty in neurology from the University of Kinshasa in Zaire a Master of Public Health from Oregon Health & Science University (OHSU) in Portland, Oregon, USA; and a doctorate degree in neurology from the University of Uppsala in Uppsala, Sweden. He joined the Center for Research on Occupational and Environmental Toxicology (CROET) at OHSU in 2001 for a postdoctoral training in the Department of Experimental Neurotoxicology & Neurology. He currently holds a position as professor of neurology in the School of Medicine at OHSU. His main research is fully funded by the NIH to study the impact of food cyanogenic toxicants and genetic polymorphisms on the human brain.
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Fingerprints and Prevalence of Multidrug-resistant *P. shigelloides* in Selected Surface Waters in Southwest Nigeria

Ibukun Modupe Adesiyan
Institute of Ecology and Environmental Studies, Obafemi Awolowo University, Nigeria

**Introduction**
Globally, emerging pathogens and new strains of well-known pathogens that cause infectious water-related diseases such as diarrhea and cholera are beginning to manifest with unusual antibiotic resistance characteristics and virulence, posing a huge threat to public health. In sub-Saharan Africa region, especially Nigeria, lack of clean water continues to expose communities to virulent, multidrug-resistant water-borne pathogens. This study for the very first time assessed the incidence of multidrug resistant *P. shigelloides* recovered from selected rivers in South Western Nigeria.

**Methods**
Water samples were collected over a period of one year from four different river sources in southwestern Nigeria and analyzed by membrane filtration method using a standard procedure. The filter papers were placed aseptically on inositol brilliant green bile salt agar and pink colonies were selected as presumptive *P. shigelloides*. Simplex PCR was used to screen 148 isolates of *P. shigelloides* out of which 66 were confirmed positive. Phenotypic antibiotic-resistant *P. shigelloides* obtained from the four sample sites were screened for the presence of 11 virulence genes: sulfonamides (sulI, sulII), trimethoprim (dfr1, dfr18), β-lactamases-encoding genes (ampC), tetracycline (tetA, tetE), chloramphenicol (catII and cmlA1), and aminoglycosides (npt11, strB). Comparisons of the associations between resistance genes detected in the *P. shigelloides* isolates were performed separately by using Pearson's chi-square exact test.

**Results**
A total of 66 confirmed *P. shigelloides* isolates were profiled for their phenotypic resistance to 20 different antibiotics selected across nine antimicrobial families. Resistant genes were assessed on the isolates with high frequency of occurrence in phenotypically resistant *P. shigelloides*. Of the 66 sulfonamide-resistant isolates, 18% (n=12) possessed the sulI gene while 20% (n=13) harbored sulII gene. Also 70% (n=14) were dfr1 positive while only 5% (n=1) were confirmed to possess dfr18. The PCR amplification of Ampicillin (Beta-Lactams) shows that 37% of the 59 ampicillin-resistant isolates were ampC positive. Of the two tetracycline genes targeted, 56 % (n=18) and 41% (n=13) were positive for tetA and tetE gene respectively. Among the 38 chloramphenicol-resistant isolates screened, 11% (n=4) has the cmlA1 and 16% (n=6) were positive for catII gene. Out of the neomycin (n=25) and Streptomycin (n=42) resistant isolates, 36% (n=9) and 67% (n=28) were confirmed positive for npt11 and strB genes respectively. None of the genes were negatively associated with one another.

**Conclusion**
Our findings indicated unexpected high prevalence of multidrug resistant *P. shigelloides* towards the commonly prescribed antibiotics that implies increased risk of fatal infection especially in immune-compromised individuals. Multi-gene resistance was recorded in all sampling sites as more than one gene was associated with an observed phenotype, suggesting high frequency of resistance gene and hence need for genotypic resistance analysis inclusion in future epidemiological studies.

Bisi-Johnson, M., Obafemi Awolowo University, Nigeria
Ogunfowokan, A.O., The Technical University, Nigeria; Obafemi Awolowo University, Nigeria
Okoh, A., University of Fort Hare, Alice, South Africa
Skin Lighteners and Chemical Hair Product Use: Associated Breast Cancer Risk Among Women of African Ancestry

Rahaman Ahmed
University of Lagos

Breast cancer is the most common cancer worldwide and a leading cause of death among women in Africa. There has been a recent concern of breast cancer risk with the use of skin lightener, chemical relaxers, and dye following several reports of unlabeled carcinogens including parabens and phthalates in these products. More than ninety percent of African women regularly consume one or more of these cosmetic products to meet social beauty norms. It is therefore important to evaluate the level of recent findings and identify next line of actions on breast cancer risk as associated with these products in Africa. A systematic search was conducted on PubMed database for related articles using multiple combination terms: skin lightener, bleaching cream, hair relaxer, dye, breast cancer, Africa, and black women. Articles that addressed the associated risk were selected and critically reviewed while next lines of action were identified and detailed. Twenty four articles matched the objective of this study and were reviewed. An estimated 65% of women in sub-Saharan Africa use skin lighteners for either having fair skin or to treat dermal infections, while above 94% regularly use hair care products to straighten or color their hair. A consistent report of increased breast cancer risk was reported among African women who used dark hair dye shades and chemical relaxers. However, using relaxer with lye is associated with higher risk as compared to using relaxers without lye, and similarly with using dye with darker shades compared to using dye with light dye shades. There was no association of breast cancer risk with deep-conditioning creams containing placenta or cholesterol. Endocrine disrupting chemicals in childhood hair products also pose an increased breast cancer risk in African children at a later stage in life. However, there has not been a report of association of breast cancer risk with skin lighteners among African women despite report of carcinogens found in skin-lightening products. Further studies should establish the causal effect in these associations by carrying out an in vivo or molecular study of hair care products on mammary gland cells and estrogen regulation as well as generate a cohort study of association across sub-Saharan Africa. A sensitization program that will encourage hair organic products should also be established to reduce possible associated risk with these cosmetic products.

Ahmed, R., Environmental Genetics Unit, Cell Biology and Genetics Department, University of Lagos, Nigeria.
Julius, R., Faculty of Health Sciences, University of Cape Town. South Africa.
Kassim, S., Ain Shams University, Egypt
Street Vendors in Cape Coast, Ghana: Traffic-related Air Pollution Exposure and Adverse Health Experiences

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There is limited epidemiological research on the health effects of street vending activities. This is against the backdrop that street vending is a dominant occupation in cities of developing countries, and individuals engaged in the venture are exposed to high levels of traffic-related air pollution (TRAP) per their mode of operation. Our objective was therefore to establish the TRAP exposure experiences of street vendors in Cape Coast, Ghana, and the associated adverse respiratory, cardiovascular, reproductive, and musculoskeletal health effects. A cross-sectional study was conducted among 418 street vendors operating in commercial areas of Cape Coast. We categorized exposure to TRAP – low, moderate, and high – on the basis of street vending activity levels and self-reported traffic density in the vending area. Low-cost air sensors were used to monitor air quality in the vending areas over a three-day period with levels of PM2.5 and CO found to exceed the World Health Organization-recommended levels. Street vendors that reported high traffic density in the vending area had 2.68 (95% CI: 1.47, 4.88), 2.91 (95% CI: 1.18, 7.14) and 1.79 (95% CI: 1.03, 3.11) increased odds of cough, difficulty in breathing, and catarrh, respectively, compared to their counterparts who reported low traffic density in the vending area. Moderate vending activity levels was associated with 2.25 (1.00, 5.05) increased odds of sharp chest pains compared to low vending activity levels. Street vendors who reported moderate and high traffic density in the vending area respectively had 3.00 (95% CI: 1.23, 7.36) and 4.24 (95% CI: 1.73, 10.38) increased odds of difficulty in walking. Moderate TRAP exposure was associated with 1.76 (95% CI: 1.11, 2.79), 1.02 (95% CI: 1.02, 2.70) and 2.17 (95% CI: 1.09, 4.31) increased odds of catarrh, sneezing, and difficulty in kneeling and stooping, respectively. None of the exposure variables were associated with adverse reproductive outcomes among the street vendors. In conclusion, street vending and the associated air pollution exposure was found to be associated with various adverse health outcomes in this population. Genome-wide association studies exploring the biological mechanisms of respiratory and cardiovascular injury from exposure to air pollution among street vendors is recommended to help better tailor treatment and preventive strategies.

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Exposure Assessment of Ambient PM$_{2.5}$ Concentration in Kampala, Uganda: Preliminary Results of Ambient PM$_{2.5}$ Concentrations from the Four Sub Cities, June 2018, The Eastern Africa GEOHealth Hub

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Ambient air pollution especially from fine particulate matter (PM) less than or equal to 2.5 micrometers in aerodynamic diameter (PM$_{2.5}$) has been ranked as sixth highest risk factor responsible for morbidity and premature deaths worldwide. It accounts for an estimated 4.2 million deaths per year due lung and heart related diseases. In Uganda, ambient air pollution is on the rise due to rapidly increasing use of vehicles, population growth, congestion, dirty fuels, industrial development-steel and rolling mills, cement factories, the recycling industry, and incinerators. We measured ambient PM$_{2.5}$ using E-samplers centrally installed in public primary schools in four sub cities - Kawempe, Central, Makindye and Lubaga, Kampala Capital City Authority. The E-samplers generate real time data for PM$_{2.5}$. Data analysis was done using MS Excel 2016 to generate monthly mean PM$_{2.5}$ concentrations for the month of June 2018.

Our results showed the lowest and highest average daily PM$_{2.5}$ concentrations for month of June 2018 appeared in Kawempe - St. Paul Primary School (6/5/2018 min 17 µg/m$^3$ and 6/18/2018 max 44 µg/m$^3$); Central - Buganda Rd. Primary School (6/19/2018 min 14 µg/m$^3$ and 6/29/2018 max 45 µg/m$^3$); Makindye - Kibuli Demonstration Primary School (6/19/2018 min 9 µg/m$^3$ and 6/7/2018 max 46 µg/m$^3$); Rubaga - Queen of Peace Primary School (6/1/2018 min 9 µg/m$^3$ and 6/21/2018 max 110 µg/m$^3$). Only two public primary schools in two sub cities experienced acceptable PM$_{2.5}$ concentrations in accordance with WHO levels (PM$_{2.5}$ 0-12 µg/m$^3$ considered good)- Rubaga - Queen of Peace Primary School (6/1/2018 5 µg/m$^3$, 6/4/2018 10 µg/m$^3$, 6/8/2018 µg/m$^3$, 6/9/2018 µg/m$^3$ and 6/10/2018 8 µg/m$^3$, and Makindye - Kibuli Demonstration Primary School (6/19/2018 9 µg/m$^3$, 6/22/2018 12 µg/m$^3$).

The acceptable ambient PM$_{2.5}$ concentration was experienced for five days at Rubaga - Queen of Peace Primary School, and for two days only at Makindye - Kibuli Demonstration Primary School in June 2018. This is an indicator that daily PM$_{2.5}$ levels across the four sub cities was beyond the World Health Organization acceptable levels. These results provide a genesis of findings for generating scientific evidence on air pollution exposure in Uganda.
Exposure to Household Air Pollution as a Risk Factor for Stroke Among Africans
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Daily changes in levels of ambient fine particulate matter (PM) air pollution less than or equal to 2.5 µm in diameter (PM2.5) have been associated with higher risk of acute cardiovascular events, excess hospitalizations, and deaths. The World Health Organization (WHO) reported that 5.7 out of 17.1 million deaths in 2004 resulting from indoor air pollution were due to cardiovascular disease. The model-based Global Burden of Diseases study suggests that air pollution may be a major risk factor for stroke among Africans but this has never been confirmed in actual studies. This study is therefore designed to determine the relationship between household air pollution and stroke occurrence, severity, and outcome among Africans within the SIREN study. This is a case-control study of individuals aged 18 years and above across SIREN sites in Ghana and Nigeria. Cases will be 1,000 patients ≥ 18 years who present with acute stroke confirmed by brain scan magnetic resonance imaging or computed tomography investigation at the selected health facilities. Stroke severity will be assessed using National Institues of Health Stroke Scale. An equal number of controls matched by age, , and ethnicity will be selected among healthy individuals from communities around the health facilities. A semi-structured questionnaire will be administered to cases and controls to elicit information on solid fuel use. Cases and controls will be followed home for household assessment using an observational checklist. Indoor air quality monitoring for PM10/PM2.5, NO, SO2, and CO would be carried out using TSI DustTrak Aerosol monitor for gravimetric analysis following a standard procedure. Blood samples will be collected from cases and controls for the identification and analysis of biomarkers of exposure to air pollution such as interleukin 6. Chi-square test will be used for categorical variables. Students t-test will be used for continuous variables and a logistic regression model will be employed to adjust for confounders. The pollution-attributable risk (PAR) due to air pollution will be calculated. The resulting levels of PM10/PM2.5 and other pollutants and the effect size of the association with stroke occurrence, severity, and outcome will inform policy formulation to reduce the burden of stroke in Africa.

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Exploration of the Impact of Mode of Delivery on Tunisians Newborns’ Phageome
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Introduction
The human gut microbiota is harbored by a large community of bacteriophages named phageome. Bacteriophages play a key role in shaping the human gut microbiota through their lytic life cycle. They can also modify the bacterial phenotypes through horizontal gene transfer of antibiotic resistance genes and virulence factor-encoding genes. Colonization of the microbiota begins in utero and determines the future health status of an individual. The majority of the studies on microbiota colonization concerned only the bacterial community and bacteriophage diversity analysis remains marginal. It has been reported that bacterial colonization can be influenced by various factors such as feeding mode, gestational age, and the mode of delivery. The latter factor is subject to debate.

Objectives
Thus, we aim to conduct comparative diversity studies on phageome and microbiome diversity between Cesarean- and vaginally delivered Tunisian newborns.

Methodology
We will collect meconium from two groups of vaginally and Caesarian section-delivered newborns at day 0, 7, and 14. DNA will be extracted, sequenced by shotgun sequencing, and analyzed by a dedicated bioinformatic pipeline.

Next Steps
We optimized a personalized protocol for sample collection and DNA extraction based on a bibliographic research. We received the ethical committee approval to conduct our study. Meanwhile, the downstream bioinformatic pipeline was developed and is currently on shotgun public data. A statistical analysis will be performed to highlight the role of the mode of delivery on phage communities in newborns’ gut microbiota. A prospective workshop is scheduled at the end of the study involving stakeholders, researchers, and the recruited participants.

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NIEHS Exposure Analysis Resources: CHEAR and HHEAR

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In 2015, the NIEHS established the Children’s Health Exposure Analysis Resource (CHEAR), an infrastructure to support the analysis of environmental exposures in NIH funded studies focused on children’s health. The goal of CHEAR has been to provide the research community access to laboratory and statistical resources to add exposure analysis in biological samples to studies that have not previously considered environmental exposures and the expansion of studies that have assessed exposures to consider exposure on a more comprehensive scale. Ultimately, CHEAR seeks to serve as a demonstration of the potential for integrating exposome analysis into existing children’s health studies and the untargeted discovery of associations between exposures and health outcomes. The CHEAR Consortium is a full-service analytical infrastructure with a Coordinating Center providing outreach and logistical support, a Network of Laboratory Hubs providing targeted, untargeted, and biological response analyses, and a Data Center providing a public access data repository and statistical and informatic analytical support. The resource is available at no cost to the investigator of an NIH funded study. The exposures measured by CHEAR include chemical, physical, and biological stressors, as well as lifestyle and social environments, from conception through adolescence. Only exposures that can be measured through laboratory analysis of human samples are addressed. To date, CHEAR has approved 34 projects and nearly 50,000 sample analyses, with the results of the first few being analyzed and shared with the clients. The final date for CHEAR requests for service was September 14, 2018. In 2018, NIEHS solicited applications for an expanded infrastructure, the Human Health Exposure Analysis Resource (HHEAR), replacing CHEAR. This resource will provide capacities for studies to capture environmental exposures across all life stages (prenatal through adulthood). The central focus will shift from a limited scope of children’s exposure and health to encompass all human health. This will increase our understanding of the influence of environment on health throughout the life-course and eventually support more comprehensive assessment of the developmental origins of health and disease. A series of funding opportunity announcements was published in 2018 to solicit applications for the coordinating center (RFA ES-18-010, U24), targeted laboratories (RFA ES-18-011), untargeted laboratories (RFA ES-18-012), data repository, analysis, and science center (RFA ES-18-014), and a new laboratory network for environmental monitoring (RFA ES-18-013), replacing the CHEAR biological response laboratories. Environmental exposures for the new network will be measured in soil, dust, and drinking water. This network will also enable the evaluation and provision of emerging tools and technologies for personal exposure assessment. The estimated start of HHEAR is fall 2019.

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The GEOHealth Hub for Eastern Africa is intended to explore the growing challenges from environmental and occupational health hazards through research on air pollution in Ethiopia, Uganda, Rwanda, and Kenya. The current GEOHealth research agenda (September 2015-August 2020) has stepped from the planning grant on Situational Analysis and Needs Assessment (2012-2014). We will present findings from the just-completed Children’s Health Study (CHS) in Addis Ababa, Ethiopia, and initial findings from the ongoing CHS in Kampala, Uganda. Both studies followed a multi-level design based on school children from ten sub cities, representing a diverse pollution profile due to variations in levels of traffic-related, industrial, and indoor pollution sources. Ambient PM2.5 for the CHS is monitored using Esamplers in 10 school sites while household PM2.5 used Berkley monitors. The time series study collects data actively the daily counts of hospital admitted patients and PM2.5 measurements from one central site. In Addis Ababa, lung function tests (LFT) were performed at schools on 1,086 children, 88.5% of whom had completed the LFT, out of which 89.4% (n=969) had acceptable performance. About 97% of the tested children had FEV1/FVC >70%, while 88% had FEV1/FVC > 80%. Based on questionnaires (n=969), mean age was 10 years (SD=1.0; Range=9-13) with 55% females; the majority of mothers have no education (80%), while 54% and 80% of mothers and fathers, respectively, were employed. The proportions of reported respiratory illness were generally low and varied by typology. Among the households, 60% used biomass fuel as their primary source of fuel for cooking. Charcoal and electricity are the most common types of fuel for all meals while “Injera” baking mainly involved electricity and wood. Most households (78%) used charcoal for the traditional coffee ceremony. A child was present at 61-91% of homes during cooking. There is a seasonal trend in the distribution of daily ambient PM2.5, the concentration being increased during wet seasons. This was highly correlated with the daily relative humidity, and was consistent with that in Kampala. PM2.5 levels were measured at school sites using Esamplers and showed wide spatial variations. Household air pollution levels are measured using fixed and personal monitors at strategically selected sites of 30% of homes to enable spatio-temporal modeling for estimation of exposure for all study homes.

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Coal Dust Exposure Assessment in the South African Coal Mining Industry: Constitution of Homogenous Exposure Groups

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Background
The current practice in the South African mining industry to constitute homogenous exposure groups (HEGs) is based on activity areas. Constitution of HEGs is a key factor in the exposure monitoring of workers, since HEGs are considered as an exposure entity. Unfortunately, this broad categorization of grouping introduces variances of coal dust exposure that may result in misclassification and masking of high risk jobs. Exposure to coal dust causes incurable lung diseases among coal miners.

Objectives
The objective of this study was to investigate the feasibility of using job titles as an additional parameter for grouping of workers according to exposure levels.

Methods
A dataset of 856 eight-hour time-weighted coal dust data was analyzed using Statistica V13. The measurements were comprised of 49 HEGs and 39 job titles across mines. Box plots and ANOVA were used to evaluate the homogeneity of different groupings.

Results and Discussion
Comparison of mean variation between job titles showed statistically highly non-significant differences (P>0.05). This analysis revealed that the introduction of job titles improved homogeneity of the HEGs, thus enabling improved identification according to the level of exposure.

Conclusion
Integration of the improved method to constitute HEGS has potential to improve exposure estimates. Follow-up research is initiated to identify job titles exposure levels to coal dust and compare with occupational exposure limits. Advanced statistics including principle components analysis (PCA) and Bayesian hierarchical framework will be used for the assessment.

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Respiratory Microbiota of Gambian Children and Inhaled Air Pollution (Gambia ReMAC) Study

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The “meningitis belt” spans 26 contiguous countries across Africa and is characterized by large recurrent meningitis epidemics and frequent seasonal outbreaks. Within the “meningitis belt,” Neisseria meningitidis (meningococcus) and Streptococcus pneumoniae (pneumococcus) account for all recurrent epidemics. The carriage dynamics of the meningococcus and pneumococcus strains that can cause large meningitis outbreaks are poorly understood in The Gambia, which lies in Africa’s meningitis belt. In 2012, The Gambia experienced a deadly outbreak of meningococcal meningitis. Of particular interest is the potential role of inhaled pollutants in modulating carriage of these deadly respiratory pathogens in our setting. A total of 505 children 5–14 years old will be randomly selected through previously collected census data from the Foni districts. The children will be followed up every three months for two years to capture seasonal variability. Inhaled air pollution will be measured in a randomly selected subset (20%) of the study participants. Upper airway carriage of pathogens will be determined using both molecular and bacteriologic tools. The bacterial and fungal components of the pharyngeal microbiome will be sequenced. This study will contribute towards an improved understanding of how carriage may predispose communities to large outbreaks cause by respiratory pathogens.

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Chlorine Tolerant Bacteria in Wastewater Effluent Impacts Public and Environmental Health

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A public and environmental health concern is the increasing tolerance of some microorganisms including coliforms to chlorine widely used in the treatment of wastewater. Consequently, bacterial pathogens are transmitted to waterbodies via discharge of inadequately treated wastewater effluents. This study investigated the chlorine tolerance of *E. coli* recovered from final effluents of two wastewater treatment plants in the Eastern Cape Province, South Africa.

Secondary effluent samples were collected from the clarifier of two wastewater treatment plants in Eastern Cape Province, South Africa. The bacterial survival (n=20) at the recommended chlorine dosage (0.5 ml) and lethal dose (n=3), and inactivation kinetics (n=3) at lethal doses were examined (Helbling and Vanbriesen, 2007). Bacterial isolates (n=20) were confirmed by PCR assay and isolates (n=3) that showed the highest chlorine tolerance were further identified using the 16S rRNA gene sequence. Nucleotide sequences were compared to known sequences in GenBank and submitted to the Basic Local Alignment Search tools (BLAST) search engine at the NCBI GenBank. Data was analyzed using analysis of variance (ANOVA) and multiple linear regression.

Presumptive isolates were identified as *E. coli* (n=20). The nucleotide sequences of the three isolates with the highest chlorine tolerance were deposited in GenBank as *E. coli* SAMRC-1 (accession number KX874327), *E. coli* SAMRC-2 (accession number KX874328), and *E. coli* SAMRC-3 (accession number KX874329), respectively. At the recommended free chlorine dose of 0.5 mg/L, *E. coli* isolates (n = 20) at initial bacterial density of 8.35 – 8.75 log were reduced to a range of 3.88 – 6.0 log at chlorine residuals of 0.14 – 0.44 mg/L after 30 minutes. Higher chlorine doses (0.75 – 1.5 mg/L) showed a marked reduction (p < 0.05) in the viability of *E. coli* isolates with less than 7.3 log inactivation of bacterial population, while inactivation kinetics showed a high rate of bacterial kill ($R^2 = 0.9 – 0.98$) over time (30 min) at chlorine dose of 1.5 mg/L.

Poor removal efficiency of *E. coli* isolates was obtained at 0.5 mg/L chlorine while higher disinfection efficiency was achieved at 0.75 – 1.5 mg/L and complete inactivation at 1.5 mg/L chlorine dosage. Data obtained indicates a need to review current wastewater guidelines as observed for 0.5 mg/L free chlorine especially in resource-poor countries dependent on cost-effective and available disinfectant for wastewater treatment.

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Air Pollution and Related Chronic Respiratory Health Risk in Informal Settlement in Kampala City, Uganda

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Rationale: The effect of indoor air pollutants on respiratory morbidity among patients with chronic obstructive pulmonary disease (COPD) in developing countries is uncertain. Objective: The first longitudinal study to investigate the independent effects of indoor particulate matter (PM) and nitrogen dioxide (NO2) concentration on COPD morbidity in a peri-urban/rural community. Method: Current and former smokers with COPD were recruited and indoor air was monitored over a two-week period in the participants’ home and main living area at survey, 3 months, and 7 months. At each visit, participants completed spirometry and questionnaires assessing respiratory symptoms. Exacerbations were assessed by questionnaires administered at health facility visits and monthly telephone calls. Results: Participants (n=84) had moderate or severe COPD with a mean FEV1 of 48.6% predicted. The mean (±SD) indoor PM2.5 and NO2 concentration were 11.4 ± 13.3 µg/m3 and 10.8 ± 10.6 ppb in the living room, and 12.2 ± 12.2 µg/m3 and 12.2±11.8 ppb in the main living area. Increases in PM2.5 concentrations in the main living area were associated with increases in respiratory symptoms, rescue medication use, and risk of severe COPD exacerbations, and were independently associated with worse dyspnea. Increases in bedroom NO2 concentrations were associated with increases in nocturnal symptoms and risk of severe COPD exacerbations. Conclusion: Indoor air pollution exposure, including PM2.5 and NO2, was associated with increased respiratory symptoms and risks of COPD exacerbations. Indoor pollutant exposure, including PM2.5 and NO2, was associated with of COPD exacerbation. The investigation should include research, capacity building, and intervention studies that optimize indoor air quality as a novel approach to improving COPD health outcomes.

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Pesticide Residues in Fruits and Vegetables Along the Food Supply and Consumption Chain and Associated Human Health Risks in Kampala, Uganda

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Background: Exposure to pesticides is associated with acute and chronic health effects. The use of pesticides in fruit and vegetable production has increased due to their demand for nourishment and prevention of non-communicable diseases. However, most farmers do not follow good agricultural practices during application of pesticides. As such, their residues accumulate on/in fruits and vegetables. This study is aimed at identifying the residual levels of selected pesticides used on fruits and vegetables at farms, markets, and restaurants and associated human health risks in central Uganda. Methods: This will be a laboratory-based study that will involve analysis of fruit and vegetable samples collected from selected farms, markets, and restaurants in three districts in Central Uganda. At the farm and market level, fruit and vegetable samples will be purchased from selected farms and markets. The samples will include six pesticide-intensive fruits and vegetables. Three replicate samples will be selected from each farm and market with each sample measuring at least 1 kg for small or medium fruits or vegetables, and 2 kg for big produce as suggested by the Codex Guidelines. All samples will be prepared on arrival and stored at -18°C. At restaurant level, samples of ready-to-eat food will be purchased from the production line of the selected restaurants. At least 700 g of each sample will be collected, and immediately taken for laboratory analysis. Sample extracts will be analyzed using gas chromatography (GC) and mass spectrometry techniques, and residues will be detected by GC-electron capture detectors and flame photometry detectors. To establish whether the pesticide residue levels are associated with human health effects, the average pesticide content will be calculated using a formula developed by Paulsen and colleagues using estimated daily intake (EDI) of pesticide residues for each combination of pesticide in fruits and vegetables to calculate the hazard quotient (HQ). Data will be entered in Microsoft Excel and analyzed using Stata version 14. Conclusion: It is expected that several fruits and vegetables will contain different pesticide residues associated with carcinogenic and non-carcinogenic effects. The findings will inform interventions geared towards reducing pesticide residue levels in fruits and vegetables.

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Characterization, Bulk Composition, and Seasonality of Ambient Particulate Matter (PM2.5) in Central Addis Ababa

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Ambient air pollution is apparently increasing and becoming a public health concern from health reports in big cities of the sub-Saharan Africa such as Addis Ababa. However, there is little empirical evidence to support this argument and little is known about the species composition and sources of the fine particulate matter with aerodynamic diameter less than 2.5 µm (PM2.5) air pollution. The aim of this paper is to determine the annual concentration, bulk composition, and seasonal pattern of PM2.5 in Addis Ababa, Ethiopia.

We collected 24-hr PM2.5 samples at a central location (Meteorological Station near Tikur Anbessa Specialized Hospital) in Addis Ababa city every 6 days for a full year from November 2015 to November 2016. The samples were analyzed for ions, organic carbon (OC) including water-soluble and water-insoluble portions, elemental carbon (EC), and all detectable elements.

The mean (SD) daily PM2.5 mass concentration was 53.81±25.0 µg/m3. The daily PM2.5 concentrations exceeded 25 µg/m3, the World Health Organization 24-h PM2.5 guideline values, on 90% of the sampling days. The principal species were organic matter (44%), EC (25.5%), dust (13%), secondary nitrogenous aerosols (SNA includes sulfate, ammonium, and nitrate ions) (4.83%), and other ions including Na+, Cl–, K+, and Ca2+ (1%), which defines 88% of PM2.5 mass. Seasonality affects the levels of PM2.5 whereby higher concentration was observed during the monsoonal rain season (summer) from June - September. The different components also vary with season, especially soil dust from 2.9% to 37.6% during wet and dry seasons of the year. The major heavy metal levels were also evaluated for seasonal variation and found to have higher levels during the cold season than hot or dry seasons.

The results of this study give an insight into the mass concentration, species composition, and seasonal nature of fine PM2.5 in Addis Ababa and perhaps beyond. We can conclude that the particulate matter pollution in Addis Ababa is in an alarmingly increasing stage to the extent that could adversely affect the health of the public. Further research is indicated to identify and apportion sources of ambient air pollution in the city.

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Survey of Breast Cancer Patients in Nigeria and Senegal

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Despite the increasing incidence rate and research on breast cancer in sub-Saharan Africa, few studies have been performed to identify and compare risk factors for breast cancer among breast cancer patients in the region. In this study, we examined the risk factors and clinical characteristics of breast cancer patients in Nigeria and Senegal. This was a case-only analysis of eligible females between ages 15 and 80 years who were diagnosed with breast cancer. In-person interviews were conducted using structured questionnaires to collect demographic and clinical parameters from 201 consecutive patients diagnosed with the disease in Senegal (February 2015 to June 2015) and Nigeria (November 2016 to July 2017). The mean (± standard deviation) age of the cases from Nigeria and Senegal was 49.1 ± 12.4 and 46.0 ± 14.0 years respectively (p value = 0.244) with the peak age at diagnosis between 41 to 50 years for both countries. Most of Nigerian (89.4 per cent) and the Senegalese (79.5 per cent) patients presented at stages III and IV. Histological type (p = 0.395), Scarff-Bloom-Richardson (SBR) grade (p = 0.237), and stage (p = 0.204) did not vary significantly between the two countries. Although the trend was in the same direction, the magnitude of some reproductive risk factors and marital status differed between the two populations: age at menarche (p < 0.001), age at first full term pregnancy (p < 0.001), parity (p < 0.001), contraceptive use (p = 0.001), and marital status (p = 0.005). The findings from this study demonstrate variable magnitudes of socio-demographic and reproductive characteristics between breast cancer patients in Nigeria and Senegal although the trend was in the same direction. We propose more studies, enlarged to include un-researched parts of Africa, and encompassing clinical, environmental, and biological parameters to fully unravel breast cancer and control its growing menace in the African continent. Keywords: Breast cancer; Risk factors; Nigeria; Senegal

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