CDC Kenya

CENTERS FOR DISEASE CONTROL AND PREVENTION • KENYA

Annual Report 2015

Center for Global Health

Office of the Director for Global Health

Cover Photo: A mother and child wait in line to receive treatment at a CDC Kenya supported clinic in Nairobi.

CDC Kenya

CENTERS FOR DISEASE CONTROL AND PREVENTION • KENYA

Annual Report 2015

Message from the Director

Colleagues and Friends,

"Preventing epidemics through our global health security agenda. Making sure that we are not just reacting to something like the Ebola crisis, but that we are systematically putting in place the kinds of global networks and responses that can help countries not only help their own people, but also make sure that … our own people are not put in harm's way." (President Obama, during his remarks to the Chief of Missions Conference at the State Department, March 14, 2016.)

These comments by President Obama well describe the mission of CDC's global work and remind us of the President's historic visit to Kenya in July 2015. I am pleased to share this short report summarizing CDC Kenya's activities during 2015, the year the world was to have delivered on the Millennium Development Goals (MDGs).

In addition to intense work to initiate activities under the Global Health Security Agenda, CDC Kenya continued productive research on malaria, HIV, tuberculosis, diarrhea, pneumonia, zoonotic diseases and neglected tropical diseases. Our programs supporting the President's Emergency Plan for AIDS Relief (PEPFAR) focused on working towards the 90:90:90 vision (identify 90% of people living with HIV; ensure 90% of them access antiretroviral therapy; and ensure 90% of those on treatment are virally suppressed) first defined by UNAIDS, and measuring impact. The almost 100 publications at the end of this report illustrate the breadth of ongoing work.

In the field of HIV/AIDS, the most important international events in 2015 were release of the results of the START trial and the commendably rapid response by the World Health Organization (WHO) to change its HIV treatment guidelines accordingly. START showed a 57% reduction in severe events or deaths in persons initiating antiretroviral therapy at high CD4+ lymphocyte counts compared to those in whom treatment was deferred. "Test and Start"—diagnose persons living with HIV and start them immediately on antiretroviral therapy—now becomes the overriding priority for CDC Kenya's PEPFAR program. Important preparatory work has been conducted for the implementation of ACT (the Accelerating Children's HIV/AIDS Treatment Initiative) and DREAMS (Determined, Resilient, Empowered, AIDS-free, Mentored and Safe women), initiatives aimed at increasing children's access to treatment and reducing HIV incidence in adolescent girls and young women. Much of our work in 2016 will focus on the highest burden counties in Kenya.

As 2015 recedes, we dare to believe that epidemic transmission of Ebola in West Africa is over. We are proud of the contributions made by CDC Kenya staff to the overall Ebola effort, with over 25 of our staff having deployed to the three heavily affected countries (Guinea, Liberia and Sierra Leone) over the past two years. Few events more convincingly convey our global interconnectedness and shared vulnerability than the Ebola epidemic. Although the epidemic now seems over, isolated cases or clusters can still occur as a result of sexual transmission or reactivation in survivors harboring the virus after initial recovery, illustrating the need for vigilance. The Global Health Security Agenda, with its overarching goal of strengthening capacity to implement WHO's International Health Regulations, is both timely and relevant. This agenda builds seamlessly on efforts over the years that CDC continues to support, such as influenza surveillance, the establishment of a Zoonotic Disease Unit, and the Field Epidemiology and Laboratory Training Program. The latter now has over 160 graduates in Kenya, most of whom are working in public health to prevent, detect and respond to disease threats.

CDC Kenya's research work in Western Kenya continues to attract international attention and remains policy-relevant. Working with partners, we are a participating site in the AIDS Clinical Trials Group (ACTG), with projects In HIV/AIDS and tuberculosis. We are also a participating site in studies to measure the impact of rotavirus vaccine in Africa. CDC Kenya, with partners and colleagues at CDC headquarters, participated in the RTS,S malaria vaccine trial and colleagues are involved in global discussions of the future use of that product. We look forward to implementation of a sporozoite malaria vaccine trial in the coming year.

As 2015 closed, Zika entered the global health lexicon and WHO has declared the cluster of microcephaly and other neurological disorders initially reported in Brazil an international public health emergency of international concern. The Ugandan origin of Zika's first description highlights the need to initiate appropriate surveillance and research in the East African region. The MDGs are now behind us—considerable success but much unfinished business—and we await the launch of the Sustainable Development Goals (SDGs). "Ensure healthy lives and promote well-being for all at all ages" is the aim of SDG 3 and its 13 associated targets, which call for ending the epidemics of HIV/AIDS, tuberculosis, malaria, and neglected tropical diseases by 2030.

There is, therefore, no shortage of challenges for 2016, including an on-going cholera epidemic in Kenya since December 2013 which has caused over 13,000 cases with a case fatality proportion of almost 2%. Over half of all counties have reported cases, with urban slums also affected. Kenya's devolved county structure and health services make a coordinated response to such a widespread problem difficult. This emphasizes the need for a Kenya National Public Health Institute whose functions should include surveillance and outbreak response. In 2015 the Cabinet Secretary for Health committed to establishing such an institute which should be a priority in the coming year.

CDC Kenya remains proud to be part of the health architecture in Kenya, working closely with the Ministry of Health and countless other organizations and individuals, national and international. On behalf of all CDC Kenya staff, thank you for your collaboration and all best wishes for 2016.

Kevin M. De Cock, MD, FRCP (UK), DTM&H
CDC Kenya Country Director
Nairobi, Kenya, May 2016

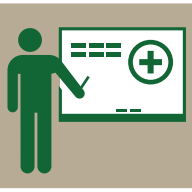
Contents

Acronyms

ACT	Accelerating Children's HIV/AIDS Treatment
ACTG	AIDS Clinical Trials Group
ACTs	Artemisnin-based Combination Therapies
AFI	Acute Febrile Illness
ANC	Antenatal Care
ART	Antiretroviral Therapy
ARV	Antiretroviral
CBS	Case-based Surveillance
CRS	Clinical Research Site
CTU	Clinical Trials Unit
DoD	Department of Defense
DGHP	Division of Global Health Protection
DGHT	Division of Global HIV/AIDS and Tuberculosis
DiCEs	Drop-in Centers
DLSP	Diagnostics and Laboratory Systems Program
DP	Dihydroartemisinin- Piperaquine
DREAMS	Determined, Resilient, Empowered, AIDS-free, Mentored, and Safe
DR-TB	Drug-Resistant Tuberculosis
DTRA	Defense Threat Reduction Agency (U.S. Department of Defense)
EIS	Epidemic Intelligence Service
EMR	Electronic Medical Record
EOC	Emergency Operations Center
EQA	External Quality Assessment
FELTP	Field Epidemiology and Laboratory Training Program
GDD	Global Disease Detection
GHS	Global Health Security
GHSA	Global Health Security Agenda
GID	Global Immunization Division
GoK	Government of Kenya
HDSS	Health and Demographic Surveillance System
HPTN	HIV Prevention Trials Network
HTC	HIV Testing and Counseling
ICAP	International Center for AIDS Care and Treatment Programs
IHR	International Health Regulations
IMPACT	Improving Public Health Management for Action
IOM	International Organization for Migration
IPC	Infection Prevention and Control
IPT	Isoniazid Preventive Therapy
IPTp	Intermittent Preventive Treatment in Pregnancy
ISO	International Organization for Standardization
KAIS	Kenya AIDS Indicator Survey
KEMRI	Kenya Medical Research Institute
KHQIF	Kenya HIV Quality Improvement Framework
KNH	Kenyatta National Hospital
KPP	Key and Priority Populations
M&E	Monitoring and Evaluation
MDR TB	Multidrug-Resistant Tuberculosis
MERS-Co	Middle East Respiratory Syndrome Coronavirus
MIA	Minimally Invasive Autopsy
MoH	Ministry of Health
MSM	Men Who Have Sex with Men
NACC	National AIDS Control Council (Kenya)

NASCOP	National AIDS & STI Control Programme (Kenya Ministry of Health)
NCBDDD	National Center on Birth Defects and Developmental Disabilities
NIC	National Influenza Center (Kenya)
NIH	National Institutes of Health
NPHI	National Public Health Institute
NPHLS	National Public Health Laboratory Services
OH	One Health
PBIDS	Population-Based Infectious Diseases Surveillance
PCR	Polymerase Chain Reaction
PEPFAR	President's Emergency Plan for AIDS Relief
PLHIV	People Living with HIV
PMI	President's Malaria Initiative
PMTCT	Prevention of Mother-to-Child Transmission of HIV
QI	Quality Improvement
RCER	Risk Communication and Emergency Response
RDT	Rapid Diagnostic Test
RRI	Rapid Results Initiative
RSV	Respiratory Syncytial Virus
RVF	Rift Valley Fever
SLMTA	Strengthening Laboratory Management Toward Accreditation
SP	Sulfadoxine-Pyrimethamins
STI	Sexually Transmitted Infection
TAC	TaqMan Array Card
TB	Tuberculosis
USAID	U.S. Agency for International Development
VMMC	Voluntary Medical Male Circumcision
WHO	World Health Organization
ZDU	Zoonotic Disease Unit
VMMC	Voluntary Medical Male Circumcision
WHO	World Health Organization
WRP	Walter Reed Project—U.S. Department of Defense
ZDU	Zoonotic Disease Unit

CDC'S Impact in 2015

 Down 11%	Prevalence of malaria reduces in the Lake Victoria region **from 38% in 2010 to 27% in 2015**
 425,348 Patients	425,348 adult and pediatric patients on ART, or **57% of total PEPFAR Kenya**
 154,776 VMMC	154,776 VMMC, or **67% of total PEPFAR Kenya**
 615 Systems	Roll-out of **Electronic Medical Record systems at 615 high-volume MoH health facilities** and faith-based organizations that serve ~70% of HIV clients
 28 Outbreaks	**28 outbreak investigations** supported
 86% of Responses	86% of outbreak responses **received laboratory support**
 18 Graduates	**18 FELTP graduated** from the advanced two year program
 266 Trained	**266 public health professionals trained** on topics including epidemiology, risk communications, scientific writing, policy, rapid response, and data management
 98 Articles	98 peer-reviewed **scientific articles published**

Protect and improve health in Kenya, and globally, through science, policy, partnership, and evidence-based **public health action**.

Cross Cutting Accomplishments

Implementing the Global Health Security Agenda in Kenya

In 2015, in collaboration with Kenya's Ministry of Health (MoH), CDC continued to play a leading role in the implementation of the Global Health Security Agenda (GHSA). Redefining and refining the mission of CDC's Division of Global Health Protection in the context of global health security provides new opportunities for CDC Kenya to assist the MoH to address prevention, detection, and response initiatives. These initiatives will support the Government of Kenya (GoK) in meeting International Health Regulations (IHR) compliance. CDC Kenya was allocated more than 15 million dollars to support GHSA activities in Kenya in fiscal years 2015-2017. Thus far, a five-year GHSA Road Map for Kenya has been developed through the U.S. government interagency working group in collaboration with the GoK and approved by the National Security Council. CDC supports the new initiative in Kenya and partners with other U.S. government agencies, such as the U.S. Agency for International Development (USAID), the Defense Threat Reduction Agency (DTRA) in the Department of Defense (DoD), to further support GHSA projects across the country.

Launch of the National Public Health Institute and New Ministry of Health Buildings

CDC Kenya's Gretchen Cowman (on the right) with a colleague outside the new Ministry of Health buildings.

On August 14, 2015, Kenya's MoH announced plans for a new National Public Health Institute (NPHI). CDC Kenya is providing technical support to build program capacity and has supported Kenya MoH staff participation in NPHI-related trainings and meetings to learn best practices from other NPHIs. The Kenya MoH also showcased a $9 million dollar investment in new public health reference laboratories and offices by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), built with CDC Kenya's management and technical expertise. Together these achievements are expected to assist Kenya in establishing sustainable, integrated public health systems that can address the country's major health challenges. Besides offering enhanced laboratory capabilities, the new buildings provided by PEPFAR helped make a new NPHI possible by opening up space in the MoH's former HIV and tuberculosis (TB) buildings. The MoH will now be able to bring the NPHI-related units under one roof at the MoH's Kenyatta National Hospital campus, with plans to establish its first Emergency Operations Center at the same site.

Response to the Ebola Outbreak

Since Ebola virus disease was identified in West Africa on March 23, 2014, CDC has undertaken the most intensive outbreak response in the agency's history. More than 3,000 CDC staff have been involved, including over 1,200 staff temporarily deployed to West Africa for more than 50,000 person workdays. All efforts were undertaken as part of national and global response activities with many partner organizations including national Ministries of Health, USAID and Médecins Sans Frontières (MSF). Twenty-five CDC Kenya staff members were deployed to the three heavily affected countries (Guinea, Liberia, and Sierra Leone), the largest number deployed from any single country office. The CDC Kenya team contributed to every aspect of the response including strengthening data management and epidemiologic investigation; supporting case management and isolation; conducting contact tracing; and establishing and coordinating Ebola diagnostic capacity. CDC Kenya also assisted in developing the standard operating procedures for Ebola preparedness for the Kenya MoH and Kenyatta National Hospital.

Since the Ebola virus disease was identified in West Africa, CDC has undertaken the most intensive outbreak response in the agency's history.

2015 Global HIV and TB Accomplishments

CDC's Division of Global HIV and TB (DGHT) Kenya continued to work intensively with the Kenya MoH and other stakeholders to strengthen national HIV/AIDS and TB prevention, care, and treatment programs; provide HIV and HIV/TB clinical services; conduct HIV surveillance and TB research; monitor and evaluate HIV and TB programs; build capacity among the Kenya health workforce; and strengthen laboratory and other health systems. Through DGHT, CDC is a leading implementing agency of PEPFAR in Kenya. CDC Kenya's TB research program conducts research to develop and improve methods of TB diagnosis, case detection, prevention, and treatment with support from the U.S. National Institutes of Health (NIH), USAID, and U.S. university partners.

HIV and TB Services

Developing a National Acceleration Plan for HIV Care and Treatment

With support from CDC Kenya, the Kenya MoH held a national and county-level meeting in November 2015 to develop a two-year National Acceleration Plan for HIV Care and Treatment. The plan will provide a strategic roadmap for accelerated implementation and outcome monitoring of HIV care and treatment to attain universal coverage for people living with HIV (PLHIV). The plan aims to accelerate HIV treatment gains, and reduce mortality and morbidity from HIV and AIDS across all counties. CDC implementing partners supported the counties in preparing county situational analyses; developing county profiles; and developing county-level population-specific HIV cascades that incorporate the steps that lead to HIV viral suppression among PLHIV, including HIV testing, linkage to care, and treatment.

Developing Kenya's HIV Testing Services Guidelines

CDC Kenya collaborated with the MoH to develop and provide peer review of the Kenya HIV Testing Services Guidelines, which were launched in November 2015. These guidelines adopted the updated WHO recommendations on HIV testing algorithms that maintained the principle of repeat testing, reduced the age of testing without parental consent to 15 years, expanded on testing coverage with more targeted testing for greater yield, and stressed referral and linkages to HIV care and treatment.

Increasing Access to TB Drug-Resistance Testing

Among PLHIV in Kenya, TB is a leading cause of death, and reduction in the effectiveness of drugs commonly used to treat TB due to drug resistance remains a significant concern. The GeneXpert® test is a highly sensitive diagnostic test capable of detecting TB and identifying resistance to rifampicin, an important TB treatment drug. In 2015, CDC Kenya supported the introduction of 70 GeneXpert® machines through test demand creation and strengthening of specimen referral networks. Over 77,000 tests were performed and 505 rifampicin-resistant TB cases were identified, which represented a fourfold increase in the number of tests done and a doubling of rifampicin-resistant cases identified. To ensure the quality of GeneXpert® testing, CDC Atlanta and CDC Kenya supported implementing external quality assessment (EQA) through GeneXpert® panel testing by laboratory technicians for 55 of the 126 high volume sites.

To address cases of drug-resistant TB (DR TB), CDC assists the national TB control program by supporting TB culture services for patient monitoring and detection of additional anti-TB drug resistance; designing a DR TB treatment regimen that includes newer, more potent drugs (e.g., bedaquline) that will significantly shorten the duration of DR TB treatment; and playing a pivotal role in mobilizing resources from the Global Fund to Fight AIDS, Tuberculosis, and Malaria for procurement of drugs for treatment of DR TB cases.

Improving Access to Isoniazid Preventive Therapy to Reduce TB among PLHIV

In 2015, through technical and financial support to the national TB and HIV control programs, CDC supported initiation of 70,000 PLHIV on isoniazid preventive therapy (IPT). This included 24,800 (13%) of those newly enrolled in HIV care. Due to challenges in rolling out IPT reporting tools, this number underrepresents those on IPT. To increase access to IPT in 2016, CDC and other PEPFAR implementing agencies are working with the Ministry of Health to increase availability of drugs and reporting tools, and to disseminate national policy documents to implementing partners and county- and site-level staff.

Supporting a TB Prevalence and Drug-Resistance Study

To develop more precise estimates of multidrug-resistant TB (MDR TB) incidence in Kenya and improve the quality of TB planning and programming, CDC Kenya supported implementation of a DR TB survey to estimate the prevalence of DR TB among new and previously smear-positive TB cases. Results from the survey, which was implemented in collaboration with the MoH and WHO, will be released in 2016.

Improving Quality in HIV Services

CDC Kenya supported the rollout of the Kenya HIV Quality Improvement Framework (KHQIF) indicators across the continuum of HIV care. The rollout of KHQIF has been made to all counties where CDC partners work. Fifteen CDC Kenya implementing partners have a Quality Improvement (QI) focal person and are collecting QI indicators on a quarterly basis. A three-part QI training has been completed, sponsored by the International Center for AIDS Care and Treatment Programs (ICAP), a CDC Kenya implementing partner. CDC Kenya, the MoH, and ICAP formed a Kenyan team with county and sub-county representation that participated in a CQI initiative to improve linkage of newly identified HIV-positive clients to care services from 70% to 95%. By November 2015, five months into the implementation period, linkage had already improved to 85%.

CDC Kenya staff provides guidelines on HIV testing to healthcare workers during a Site Improvement through Monitoring System (SIMS) visit.

Increasing Access to Pediatric HIV Services

Kenya is receiving support from the Accelerating *Children's HIV/AIDS Treatment (ACT)* initiative, a partnership between PEPFAR and the Children's Investment Fund Foundation to double the number of children receiving ART in ten priority sub-Saharan Africa countries. Through ACT, CDC Kenya plays an integral role in the acceleration of pediatric care and treatment. As of September 30, 2015, CDC was supporting over 46,000 children living with HIV with lifesaving antiretroviral therapy (ART), representing nearly 58% of all children on ART in Kenya. This number included nearly 6,700 children who started on ART in the previous year, accounting for 80% of the country's net new pediatric patients on ART (8,306).

Reducing HIV Infections among Adolescent Girls and Young Women

Adolescent girls and young women (AGYW) account for 71% of new HIV infections among adolescents in sub-Saharan Africa. Kenya is one of ten sub-Saharan Africa countries participating in DREAMS, an initiative to reduce new HIV infections among AGYW. Supported by PEPFAR in collaboration with the Bill & Melinda Gates Foundation and the Nike Foundation, the ultimate goal of the partnership is to help girls develop into Determined, Resilient, Empowered, Aids-free, Mentored and Safe women. DREAMS will provide a package of evidence-based interventions that address the drivers that increase girls' HIV risk, including poverty, gender inequality, sexual violence, and a lack of education.

At the World AIDS Day 2015 celebration held at City Stadium in Nairobi, the First Lady of the Republic of Kenya, Her Excellency Margaret Kenyatta, launched the Kenya DREAMS initiative. The launch was attended by the U.S. Ambassador to Kenya Robert F. Godec, the Office of

School girls do a presentation on DREAMS during the launch of the Kenya DREAMS initiative in Nairobi.

the U.S. Global AIDS Coordinator's Chief Strategy Officer Sandra Thurman, the Principal Secretary designate of the MoH, health development partners, private sector representatives, implementing partners, other dignitaries, and community members. The First Lady agreed to serve as DREAMS Goodwill Ambassador in Kenya. CDC Kenya is one of the U.S. government agencies in Kenya tasked with implementing the DREAMS initiative and helped prepare for the launch.

Eliminating Mother-to-Child Transmission of HIV

For pregnant women living with HIV, attending regular antenatal care (ANC) ensures that they and their infants will receive the medications needed to provide the best chance that their children are born free of HIV infection. In addition, CDC is supporting a treatment approach known as Option B+ that ensures that all pregnant women with HIV start or continue full HIV treatment after their pregnancy for their own health and the health of their future children. Option B+ was introduced in Kenya's revised national treatment guidelines in June 2014.

In 2015, CDC Kenya collaborated with the MoH to hold the first Kenya Elimination of Mother-to-Child Transmission of HIV stocktaking meeting. Participants reviewed prevention of mother-to-child transmission (PMTCT) data that showed that only about 50% of all pregnant women attend all four recommended ANC visits prior to delivery.

The maternal "cascade of care" includes ANC, skilled delivery, and follow-up of the mother-baby pair in the postnatal period and beyond. The review identified gaps within the cascade which prompted a rapid results initiative (RRI) to reach all pregnant women with HIV counseling and testing, and to ensure all pregnant women who are identified as HIV-positive received antiretroviral (ARV) treatment. The activity revealed a weakness in accurate data documentation and that healthcare workers (HCW) had a poor understanding of the PMTCT indicators. Revised MoH data collection tools will be rolled out, which will include re-training of HCW on the PMTCT indicators. Following extensive data verification as part of the RRI, the number of missed opportunities for maternal treatment dropped from more than 17,400 in 2014 to less than 10,700 in 2015.

Initiating a Medically Assisted Therapy Program for People Who Inject Drugs

Dr. Mercy Karanja meets with Rosemary to discuss her Medically Assisted Therapy (MAT) treatment.

In Kenya, an estimated 18,000 people use or inject heroin and other opiates. People who inject drugs (PWIDs) are at increased risk for infection with HIV; in Kenya, it is estimated that 18-30% of PWIDs are infected with HIV compared to an HIV prevalence of 5.6% in the general population. In addition, PWIDs are at increased risk of premature death, infection with hepatitis B and C, and other physical and mental health problems.

In December 2014, with support from CDC and PEPFAR, the MoH through NASCOP started the Medically Assisted Therapy (MAT) program for PWIDs at the Mathari Teaching and Referral Hospital in Nairobi. The program aims to help PWIDs reduce or stop injecting, decrease risks to their health, and return to productive lives. During 2015, over 470 PWIDs in the CDC-supported program had initiated MAT and remained on treatment for over six months. The national program was officially launched on August 19, 2015, by U.S. Ambassador Robert F. Godec and MoH Cabinet Secretary James Macharia.

Laboratory, Blood Safety, and Infection Control

Reducing Risk of Infection from Healthcare Waste

A laboratory technician points out to proper management of healthcare waste.

Proper management of healthcare waste helps reduce the risk of infection from HIV and other bloodborne pathogens among workers and patients in healthcare facilities. On August 19, 2015, the Kenya MoH launched its Healthcare Waste Management (HCWM) Strategic Plan 2015–2020 and training and guidance on HCWM for healthcare workers. CDC Kenya provided technical support in developing these tools.

Ensuring High Quality Laboratory Services

The Strengthening Laboratory Management Toward Accreditation (SLMTA) process helps medical laboratories achieve the highest quality standards to support sustainable control of HIV/AIDS. Achievement of high quality standards is documented by attaining the International Organization for Standardization (ISO) version 15189 accreditation for medical laboratories. Through SLMTA, CDC Kenya continued to collaborate with the MoH, implementing partners, and other stakeholders to enroll more laboratories, support the challenging but stepwise improvement of quality systems, and monitor and evaluate progress. In 2015, two hospital laboratories—Bomu Hospital in Mombasa and Chogoria PCEA Hospital in Meru—successfully completed the SLMTA series of quality improvements and achieved ISO 15189 accreditation.

Improving Accuracy of Rapid HIV Testing Services

In November 2015, CDC Kenya and CDC Atlanta staff assessed the progress of Kenya's Rapid Testing Quality Improvement Initiative which is an effort to ensure the accuracy of rapid HIV testing services. The initiative is currently being spearheaded by the Kenya MoH Division of National Public Health Laboratory Services (NPHLS). Talks are in progress for Kenya to give south-to-south technical assistance to countries like Tanzania and Côte d'Ivoire. Representatives from the American Society for Clinical Pathology and the Clinical and Laboratory Standards Institute also visited Kenya to understand its HIV testing and counseling (HTC) site and tester certification programs. Through their visit with the National AIDS & STI Control Programme (NASCOP) and HTC site visits, the team gained insights into the HTC program in Kenya that can be used in developing a framework document to guide countries on implementing HTC site and tester certification.

Achieving HIV Viral Suppression Among People on ART

To end the AIDS epidemic by 2020, UNAIDS has outlined three ambitious HIV treatment goals, dubbed the UNAIDS 90/90/90 goals: 90 percent of people living with HIV will know their status, 90 percent of all people diagnosed with HIV will receive ART, and 90 percent of all people receiving ART will achieve viral suppression.

Viral suppression, which means there is a low level of the HIV virus in the blood, is an indication of treatment success. Additionally, PLHIV who have achieved viral suppression are much less likely to transmit the virus. CDC is working closely with the MoH to implement the use of viral load tests, which measure the level of HIV in the blood. A multi-partner global taskforce developed a set of viral load (VL) training tools, and in November 2015 a VL Scale-up Tools workshop was piloted in Kenya to review the tools that were intended for release by WHO as a reference guide. In addition to representatives from CDC Kenya, the workshop was attended by NASCOP and representatives from Kenya's seven VL testing laboratories.

HIV Surveillance and Epidemiology

Evaluating Progress in Reducing Deaths due to HIV

Understanding mortality is an important part of understanding the dynamics of an HIV epidemic. CDC epidemiologists supported a study of HIV infection among adult deaths in Nairobi which found that nearly 20% of deceased adults and adolescents aged 15 and older were infected with HIV and 15% of all deaths could be attributed to HIV infection. The study was carried out in 2015 at Kenyatta National Hospital and Nairobi City Mortuaries under the leadership of NASCOP in collaboration with the Kenya Field Epidemiology and Laboratory Training Program (FELTP). Civil records from Nairobi City Hall were also assessed to document overall death rates during the study period. The study piloted techniques of measuring HIV-related mortality in mortuaries which will help Kenya evaluate progress in reducing deaths due to HIV through the scale-up of national HIV treatment programs. An FELTP resident's scientific poster on the study was accepted for presentation at the 2016 Conference on Retroviruses and Opportunistic Infections.

Expansion to Kisumu, in western Kenya, is planned for 2016.

Using HIV Case-Based Surveillance to Track Patient Care and Outcomes

Case-based surveillance (CBS) is used in the United States and elsewhere to follow the "clinical life" of an HIV patient, from diagnosis to treatment to viral suppression, loss-to-follow up, or death. CBS can reduce duplicate counting and can track individual patients as they move between clinics, and thereby provide more accurate and complete data on Kenya's cascade of care for HIV. Led by NASCOP, Kenya has launched a pilot of HIV CBS in western Kenya. National and county health staff, in collaboration with CDC, University of California, San Francisco and the Kenya Medical Research Institute (KEMRI), conducted a pilot study in 53 facilities in Siaya and Kisumu counties. Sentinel events were collected using a tablet-based platform. Plans for expansion are underway for 2016, including automatic upload of data from electronic medical records and laboratory data, and implementation in a wider geographic area.

Modeling Kenya's HIV Epidemic

Understanding and predicting the future of the HIV epidemic involves understanding population demographics, disease progression and HIV intervention coverage, among other factors. To support Kenya's MoH in using mathematical modeling and spatial and geographical analysis to understand HIV dynamics and insights into HIV care, treatment and prevention strategies, CDC Kenya is collaborating with Kenya's National AIDS Control Council (NACC) to organize a Mathematical Modeling Task Force. The task force is composed of CDC statisticians and epidemiologists, mathematicians from local universities, and the NACC Strategic Information team. The Task Force will oversee short- and long-term HIV modeling needs.

Disseminating Regional Results of the Kenya AIDS Indicator Survey

After the national level results of the 2012 Kenya AIDS Indicator Survey (KAIS 2012) were released in 2014, CDC Kenya and NASCOP, the National Council for Population and Development, and the Kenya National Bureau of Statistics disseminated the KAIS 2012 regional results at the county level in May 2015. KAIS 2012 was conducted with PEPFAR funding and technical assistance from CDC.

Health Systems and Evaluation

Ensuring Sustainability of Health Systems Activities

One of the goals of PEPFAR and CDC is to ensure sustainability of its programs, including building capacity among and transferring programs to local partners. In August 2015, CDC implementing partner mHealth Kenya held a stakeholders forum to mark the transition of its role as a sub-partner of the CDC Foundation to a directly funded "prime" partner of CDC Kenya. The organization developed a mobile commodity ordering system and mobile post-exposure prophylaxis registry.

A lab technician checks blood samples at the national HIV and TB lab The laboratory was funded by PEPFAR and CDC provided technical and management support in its building.

Implementing Electronic Medical Records to Improve Care and Service Delivery

WHO recommends the use of ART cohort analysis to monitor retention in care among groups of patients on ART, an important factor in improving health outcomes. Through PEPFAR funding, CDC Kenya has supported Kenya's implementation of Electronic Medical Record (EMR) Systems to nearly 650 public health facilities offering comprehensive clinical care. In 2015, the Strategic Information Unit of NASCOP initiated the use of EMR data for the national cohort analysis through implementation of a national Health Data Warehouse with support from Palladium. Due to the implementation and effective use of EMRs, the availability of patient level data from health facilities increased dramatically in 2015 in comparison to 2014 when the service delivery process was largely paper-based. This has greatly improved the availability and use of data for national cohort analysis, clinical decision support, and PEPFAR reporting.

Western Kenya

People who work in and around the fishing industry on Lake Victoria are among the priority populations in western Kenya and with rates of HIV infection markedly higher than in Kenya's general population.

Developing a Dashboard to Monitor ART Scale-Up

The five counties of Homa Bay, Kisumu, Siaya, Migori and Kisii are home to nearly one-third of all PLHIV in Kenya. One of PEPFAR Kenya's goals is to have 80% of all PLHIV in these counties receiving ART by 2017, which requires a massive scale-up of services in a short period of time. Working with implementing partners and counties on a monthly basis is critical to facilitate developing flexible and responsive strategies. In response, CDC Kenya developed a template that allows managers and analysts to look at performance on key indicators by implementing partner, county and across CDC Kenya's HIV program, as well as to track progress toward achieving targets. With this innovation, implementing partners can learn from each other, and CDC is able to provide rapid technical assistance where most needed. The same concept has also been adopted by Kenya's MoH to track national performance on the achievement of the UNAIDS "90-90-90" strategy. Globally, PEPFAR countries implementing pediatric scale-up of HIV treatment (ACT) have expressed interest in adopting the same tool.

Building Epidemiology and Statistics Capacity

CDC Kenya conducted three trainings in western Kenya to build the capacity of implementing partner data and public health staff on using Stata, a software tool for statistical and spatial data analysis. The goal was to increase data use for program improvement and scientific output from the implementing partners' rich and extensive program data. Program managers, data analysts and managers, statisticians, programmers, research officers, and others were among the 69 participants in the trainings. Post-training technical assistance to increase program data use and scientific output was initiated with two implementing partners in 2015. More implementing partner engagements are planned for 2016.

Conducting Sero-surveillance for Key and Priority Populations

People who work in and around the fishing industry on Lake Victoria (fisherfolk) are among the priority populations in western Kenya with rates of HIV infection markedly higher than in Kenya's general population. In 2014 and 2015, CDC Kenya worked with KEMRI to carry out a sero-surveillance census in the villages adjoining Lake Victoria in Asembo, Siaya County. Approximately 24% of the fisherfolk surveyed were HIV-positive, and only slightly more than half reported using HIV care or treatment services. Further analyses of these data are ongoing to improve HIV services for fisherfolk, and to better understand differences in HIV risk and service use among fisherfolk compared to their non-fishing neighbors.

Providing Combination Prevention for Key and Priority Populations

For key and priority populations (KPP) who are at increased risk for HIV infection, combination prevention services (bio-medical, prevention, and structural interventions) are now available and accessible through drop-in centers (DiCEs) and outreach programs. DiCEs are sites that provide safe space and services, including ART, to key populations who may otherwise experience barriers or stigma while seeking care in general population settings. To promote stigma and discrimination-free services at all facilities, KPP awareness and sensitization trainings will be offered to healthcare workers. As a sustainable long-term effort, KPP services are being integrated in selected primary healthcare facilities, including Makongeni Health Center in Homa Bay and Gucha District Hospital in Kisii. Six months after its program was initiated, Makongeni had enrolled more than 400 female sex workers, 40 men who have sex with men (MSM), and 300 fisherfolk.

Improving Voluntary Medical Male Circumcision Services

Studies have shown that men who are circumcised are 60% less likely to contract HIV heterosexually than men who are not circumcised. In the four counties of Homa Bay, Kisumu, Siaya and Migori, the population of males aged 15–49 years is about 1.1 million and about 763,000 of these males come from non-circumcising communities. In 2015 over 146,000 male circumcisions were performed in the western Kenya region, achieving 100% of the year's target. The program achieved a follow-up rate of 83%, and an adverse event rate of less than 1%. The voluntary medical male circumcision (VMMC) program has expanded VMMC services to underserved areas including the Lake Victoria islands and faith-based health facilities. Additionally, early infant male circumcision service delivery has started in western Kenya in 2015 through the support of two partners, Impact Research and Development Organization and Nyanza Reproductive Health Society.

The VMMC program continues to improve quality of its services with particular emphasis on mitigating the risk of tetanus, which caused the only death ever associated with VMMC since the program's inception in 2008. PrePex is the first medical device to be pre-qualified by WHO for circumcision of adult males. The device applies the principle of elastic collar compression and has been offered in Kenya as an equally effective, alternative method of male circumcision to conventional surgery for adults seeking VMMC. Following favorable results of a pilot study of PrePex in 2013, Kenya has been implementing active adverse event surveillance for the device since August 2015 with majority of the sites (86%) under the oversight of CDC Kenya in the western region.

CDC Kenya's Contribution to 2015 PEPFAR Indicators

The tables below include the results for CDC Kenya and its implementing partners for each PEPFAR indicator (CDC Kenya) and the total results for all PEPFAR implementing agencies (CDC, USAID, DoD, and the Peace Corps) for each PEPFAR indicator (Total PEPFAR Kenya). Exceptions to use of PEPFAR data are noted by asterisks (*).

HIV Care and Treatment

PEPFAR Indicator	CDC Kenya	Total PEPFAR Kenya
HIV Care and Treatment		
# of HIV-positive adults and children who received at least one of the following during the reporting period: clinical assessment (WHO staging) OR CD4 count OR viral load	544,296	975,075
# of adults and children newly enrolled on antiretroviral therapy (ART)	92,534	165,472
# of adults and children currently enrolled on ART	503,180	860,297
Percentage of adults and children known to be alive and on treatment 12 months after initiation of ART	90%	87%
TB/HIV		
# of registered new and relapsed TB cases with documented HIV status	37,753*	76,085*
% of registered new and relapsed TB cases with documented HIV status	94%*	91%*
Prevention of Mother-to-Child Transmission		
# of pregnant women who know their HIV status	414,771	1,236,756
# of HIV positive pregnant women who received antiretroviral prophylaxis to reduce risk of mother-to-child transmission of HIV	30,851	55,807
Percentage of HIV positive pregnant women who received antiretroviral prophylaxis	95%	91%
Percentage of infants born to HIV-positive women who received an HIV test within 12 months of birth	82%	78%

*Data from the Kenya Ministry of Health's Program Management System for Tuberculosis (TIBU)

(continued...)

Laboratory

PEPFAR Indicator	CDC Kenya	Total PEPFAR Kenya
Clinical Testing Capacity and Accreditation		
# of testing facilities with the capacity to perform clinical laboratory tests	1,590	1,705
# of PEPFAR-supported testing facilities (laboratories) that are recognized by national, regional, or international standards for accreditation or have achieved a minimal acceptable level towards attainment of such accreditation	51**	54**
Viral Load Testing		
% of ART patients with a viral load results documented in the medical record in the past 12 months	71%	73%
# of viral load tests performed in a 12-month period	465,208***	563,784***
% of viral load tests with an undetectable viral load (<1000 copies/ml)	83%	83%

**Meets SLIPTA level 1 or higher

***Data from the Kenya National AIDS & STI Control Programme's Early Infant Diagnosis/Viral Load website

HIV Prevention

PEPFAR Indicator	CDC Kenya	Total PEPFAR Kenya
Voluntary Medical Male Circumcision		
# of males circumcised as part of a minimum package of voluntary male medical circumcision services	147,998	233,244
Evidence-Based Behavioral Interventions		
# of target population who completed a standardized HIV prevention intervention	413,423	852,591
# of key populations who received evidence-based HIV prevention interventions	161,232	251,695
HIV Testing and Counseling		
# of HIV testing and counseling sessions performed with results received by client	4,285,359	7,911,307
Medication-Assisted Therapy for People Who Inject Drugs		
# of people who inject drugs (PWID) on medication-assisted therapy for at least 6 months	475	520
Gender-based Violence Care		
# of people receiving post-gender-based violence care (including sexual, physical, and emotional violence)	8,218	30,942

Health System Strengthening

PEPFAR Indicator	CDC Kenya	Total PEPFAR Kenya
# of new health care workers who graduated from a preservice training institution as a result of PEPFAR-supported strengthening efforts	308	342

2015 Global Health Protection Accomplishments

The Division of Global Health Protection (DGHP) Kenya supports efforts to protect the public's health by developing and strengthening Kenya's ability to rapidly detect and effectively respond to disease outbreaks and emerging infectious diseases.

DGHP coordinates CDC Kenya's expertise in emerging infectious diseases; field epidemiology training; immunization; pandemic preparedness; diagnostic laboratory systems and biosafety; zoonotic disease research; emergency preparedness; non-communicable diseases; and immigrant and refugee health. Over the last decade, these capacities have been developed locally and are strengthened by support from CDC headquarters subject matter experts, academia, and other key partners.

DGHP is the CDC Kenya led platform for Global Health Security Agenda (GHSA) activities that aim to assist Kenya in developing systems to prevent, detect and respond to national health threats and those in the region. Using the International Health Regulations (2005) as an organizing framework, CDC has helped Kenya and the East Africa region advance sustainable systems and a capable workforce—relying on local rather than remote resources. GHSA affords Kenya a unique opportunity to use the platforms and partnerships developed through the center to deepen and expand Kenya's research and prevention efforts.

DGHP also serves as a GDD center, part of a network of centers across the world conducting public health science to understand the burden and threat of emerging infectious diseases and other threats to public health in Kenya and global health security.

Global Disease Detection Epidemiology and Surveillance

Examining the Impact of Rotavirus Vaccine Introduction in Kenya

Rotavirus is the most common cause of severe gastroenteritis among children worldwide. In 2015, CDC and KEMRI participated in two multi-center studies to examine the impact and effectiveness of rotavirus vaccine, which was introduced in the routine infant immunization program in Kenya in July 2014. The Vaccine Impact on Diarrhea in Africa (VIDA) study, led by the University of Maryland, is being conducted in three countries—Kenya, Mali, and Gambia. VIDA aims to assess the impact of rotavirus vaccine on the burden of diarrhea among children and to determine the leading causes of childhood diarrhea following rotavirus vaccine introduction. The Rotavirus Immunization Program Evaluation in Kenya (RIPEK) will synthesize data from multiple ongoing rotavirus surveillance platforms across Kenya (including sites in Siaya, Kisumu, Nairobi, and Kilifi counties). Collaborators include Emory University, the Walter Reed Army Institute of Research, and KEMRI-Wellcome Trust. RIPEK will examine trends in rotavirus diarrhea burden and diarrhea-related child mortality following vaccine introduction, evaluate rotavirus vaccine effectiveness against rotavirus hospitalizations,

The rotavirus vaccine was introduced in the routine infant immunization program in Kenya in July 2014.

and examine changes in circulating rotavirus vaccine genotypes. Both projects are expected to run through 2017 and will provide important information about the benefits of rotavirus vaccine in the real-world context in Kenya and sub-Saharan Africa.

Implementing of New Protocol for the Population-Based Infectious Diseases Surveillance Platforms

The Population-Based Infectious Diseases Surveillance (PBIDS) platform in Lwak (rural western Kenya) and Kibera (informal settlement in Nairobi) underwent important changes to improve efficiency and to strengthen scientific work in 2015. A new protocol for PBIDS, which had been approved in 2014, was implemented in 2015. The new protocol emphasizes using the platform to measure the impact and effectiveness of interventions to reduce infectious disease burden. It also adds routinely-collected socioeconomic variables that are important determinants of disease. The new protocol also strengthens the link between PBIDS and the Health and Demographic Surveillance System (HDSS) in Siaya County; both sites are now using the same HDSS database for routinely-collected demographic, socioeconomic, and healthcare-seeking data. In an effort to reduce costs while still maintaining the quality of scientific data, the frequency of household visits to PBIDS participants has been reduced to twice per year (from every two weeks); however, clinic-based morbidity surveillance has been maintained and continues to provide data on the burden and causes of respiratory, diarrheal, and febrile illness in Lwak and Kibera.

Monitoring Invasive Salmonella Infections

Invasive Salmonella infections cause a very high burden of disease in Kenya, particularly among young children. However the epidemiology of Salmonella infections is variable, with Salmonella enterica serotype Typhi (S Typhi) as the leading cause of blood stream infections in Kibera, and non-Typhi Salmonella (NTS) predominating in rural, western Kenya. In 2015, CDC used data from PBIDS to more closely examine the burden of invasive S typhi and NTS infections in order to guide prevention efforts. A spatial analysis of S typhi cases in Kibera revealed that among children, those living at lower elevations had the highest risk of developing disease, while the risk among adults was consistent throughout the community; these results suggest that environmental transmission of pathogens may be an important determinant of typhoid fever among children and can help target prevention interventions. An analysis of trends in invasive NTS infections from 2009 to 2014 found extremely high rates of NTS in western Kenya and a substantial burden in Kibera as well. Although rates of disease generally declined in both sites over the study period, NTS is an important cause of morbidity, particularly among children in rural areas. Efforts and interventions to reduce exposure through unsafe food and water are currently being explored.

One Health Program

Enhancing Rift Valley Fever Surveillance

In July 2015, the Food and Agriculture Organization (FAO) Emergency Prevention System for Animal Health issued an alert of possible Rift Valley Fever (RVF) outbreak in the eastern Africa region based on predicted El Niño weather pattern that is associated with outbreaks of RVF. In response to this alert, FAO, WHO and the World Organization of Animal Health advised countries at risk to put in place risk mitigation strategies including enhanced active surveillance and immediate notification of RVF cases in livestock to limit human morbidity and mortality.

In the absence of an active surveillance system for livestock diseases, CDC Kenya mobilized GHSA funding and collaborated with the Washington State University and the Kenya Ministry of Agriculture, Livestock and Fisheries (MALF) to establish an RVF early warning system. The system established in November 2015 has over 1,000 sentinel flocks under surveillance in 22 high-risk counties, 55 veterinarians trained for RVF detection and reporting through a toll free number within an RVF Alert Center set up in the Department of Veterinary Services, MALF.

Launching the Brucellosis Incidence Study

Brucellosis is a priority disease for the MoH and Ministry of Agriculture, Livestock and Fisheries. It is the most common bacterial zoonotic infection and is associated with significant agricultural economic losses and human suffering. In 2015, the CDC Kenya One Health (OH) Program launched the Brucellosis Incidence Study in Kajiado county. In February 2015, 504 compounds with 4,729 household members and 5,746 livestock (cattle, sheep, and goats) were enrolled in the one-year study.

As a part of this study the DGHP team also did an assessment among households to understand the socioeconomic impact of human and animal brucellosis on the community. These results are expected to contribute to the development of a prevention and control strategy for brucellosis in the Kenya. The study was implemented in collaboration with subject matter experts from CDC's National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) and Bacterial Special Pathogens branch with support from DTRA.

Stakeholders of the Brucellosis incidence study handed over 8 motorcycles in Kajiado County to trained health technicians to support field visits and one health decentralization.

Prioritizing Zoonotic Diseases in Kenya

CDC Kenya, the Kenya MoH Zoonotic Disease Unit (ZDU), and partners held a workshop in September 2015 to guide allocation of resources for zoonotic disease prevention and control. The workshop had 36 participants drawn from ZDU; MoH; the Kenya Ministry of Agriculture, Livestock and Fisheries; FELTP; KEMRI; the International Livestock Research Institute, Kenya Agricultural and Livestock Research Organization, Kenya Wildlife Service, University of Nairobi, and the U.N. Food and Agriculture Organization. Thirty-six diseases were considered for prioritization. Anthrax, trypanosomiasis, rabies, brucellosis and Rift Valley fever were the top five priority diseases in descending order. This was one of the key activities for implementation from the Kenya OH strategic plan 2012–2017.

Detecting Middle East Respiratory Syndrome Coronavirus in Camels and Humans

Previous studies among camels in Kenya have demonstrated exposure to MERS-CoV but the exposure among humans in Kenya has not been evaluated. CDC Kenya and ZDU in collaboration with University of Bonn Medical Centre tested archived human and camel sera that had been collected during a brucellosis survey in 2013 in Marsabit county, where camel rearing is

practiced. A quarter of the participants from Marsabit reported having had contact (defined as milking, feeding, watering, slaughtering or herding) with camels. 2.3% of the human sera were reactive to MERS-CoV by ELISA, but were all negative on the confirmatory test. However, 90% of the camel sera were positive for MERS CoV. The findings showed that the transmission of MERS-CoV from camels to humans is generally low and there was no evidence of exposure to the virus among persons who are in regular contact with camels that show high exposure to MERS-CoV. CDC Kenya plans to initiate studies to detect and isolate virus and conduct genetic characterization of MERS CoV virus in camels and human populations.

Field Epidemiology and Laboratory Training Program

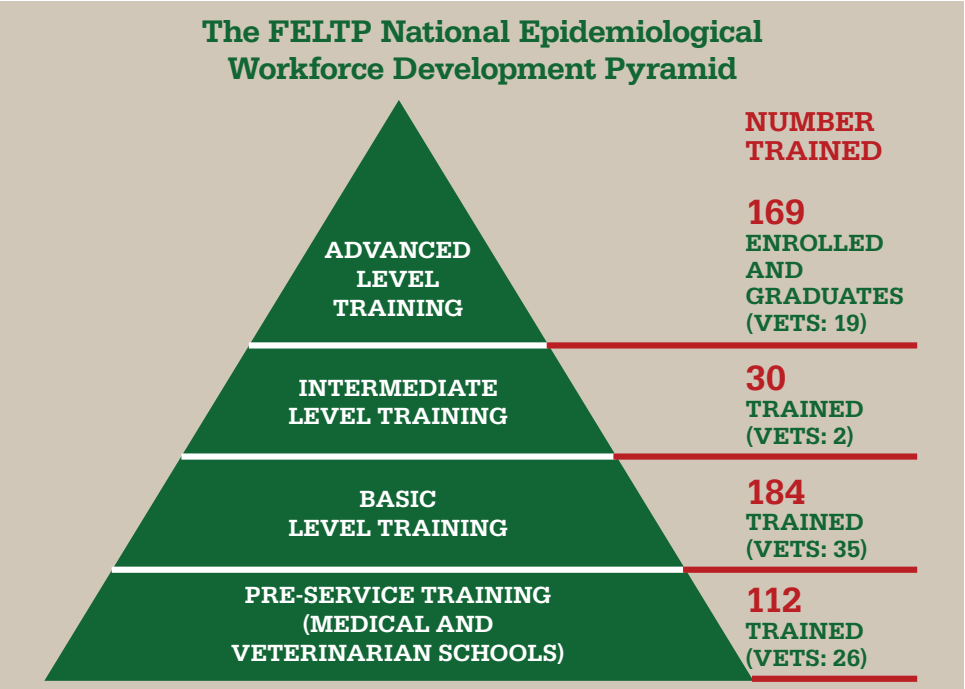
Implementing the New Three-tiered, Pyramid Approach to Building Capacity

In 2015, the Kenya FELTP fully implemented the pyramid approach to building field capacity in Kenya. This approach includes training epidemiologists within the MoH at the national and sub-national level over three tiers: basic, intermediate, and advanced. The advanced level training started in 2004 and is a two-year program where residents will earn a Master of Sciences degree from Moi University upon successful completion of all field based and classroom course requirements.

The basic level training was added to FELTP in 2014 where the students learn about basic epidemiology, surveillance and undertake a data project. In 2015, FELTP initiated the intermediate level training program where students receive six months of mentored and classroom training and complete an analytic epidemiological or surveillance project during their course. Full implementation of the pyramidal approach ensures that the advanced-level residents have had basic-level and intermediate-level training, thereby increasing their initial knowledge level and skill set and improving their potential to perform as epidemiologists.

Field Training in Surveillance and Epidemiology

A new cohort of 19 residents joined the advanced-level training program in September 2015. The FELTP residents were placed in various counties across the country. An advanced-level resident was placed in the Uasin Gishu county health department to further build field capacity in the new nationally-devolved county structure. A second resident was placed to work at CDC Kenya supporting disease surveillance. In addition to the usual resident placements at the national level MoH Departments and the Ministry of Agriculture, Livestock and Fisheries, one new field placement site was initiated at a University of California, San Francisco office in Kenya to support the work of NASCOP.



In 2015, the Kenya FELTP fully implemented the pyramid approach to building field capacity in Kenya.

Outbreak Investigations by FELTP Residents

FELTP deployed residents to multiple locations in Kenya to conduct outbreak and mortality assessments, the majority of which were cholera-related. The cholera outbreak which began on the 26th December 2014 has affected a total of 26 counties. Eighteen of these counties have managed to successfully control the outbreak. As of April 1, 2016, a total of 13, 572 cases and 221 deaths have been reported nationally. The FELTP residents conducted Knowledge, Attitudes, and Practices surveys on cholera among healthcare workers and community members from Mombasa, Nairobi, Kisumu, and Homa Bay counties in collaboration with CDC Epidemic Intelligence Service (EIS) officers from Atlanta who had expertise in cholera and waterborne diseases. In the same four counties, water contamination was evaluated for cholera risk in the course of the investigations. In addition to the cholera outbreak, FELTP residents also investigated a suspected increase in malaria mortality among children in Kakamega County; foodborne illnesses linked to consumption of beef from an ill cow in Meru County; ceftriaxone resistant non typhoidal salmonella in western parts of Kenya; and suspected Q fever, a zoonotic disease, in East Pokot county.

Piloting of the 'Improving Public Health Management for Action Program'

Kenya was identified as one of two pilot countries for the initial Improving Public Health Management for Action (IMPACT) program, and the only country selected in Africa. Through IMPACT, CDC is partnering with Kenya's MoH to create a cadre of well-trained mid-level public health professionals who will improve their health program management skills. CDC will build on existing management training programs to create a program with evidence-based core competencies that can be adapted to meet Kenya's needs. In 2015, the IMPACT team engaged the Kenya FELTP to understand how they define competent managers, what they want from a management training program, what resources they will dedicate to the program, and what their view of success looks like. Plans are underway to commence IMPACT training during 2016.

Diagnostic Laboratory and Systems

Launching the Regional Culture Media Production Facility

CDC Kenya in collaboration with KEMRI launched Kenya's first regional culture media production facility in March 2015 at the KEMRI complex. The KEMRI Production Department (KDP) aims to develop a commercial source for quality microbiologic media in Kenya. KDP took on the role of media production which has the potential to greatly enhance the quality of bacterial culture in Kenya. Quality media are required to make accurate diagnoses of illnesses and are generally unavailable in Kenya. Creating this capability domestically is a key supporting task to increase Kenya's capacity in disease diagnosis.

A Kenya government official reveals the Culture Media Production plaque during the launch of the facility.

This project was jointly supported by CDC Kenya's DGHP and DGHT. With PEPFAR funding, DGHT supported a business and strategic assessment and purchased start-up equipment for KEMRI's production laboratory. CDC Kenya was able to bring in DTRA's Cooperative Biological Engagement Program to provide assistance and advice to Kenya for producing the media.

Attaining International ISO Accreditation for the CDC Kenya-supported KEMRI Laboratory

In 2015, CDC Kenya continued to work closely with the government of Kenya to support improved laboratory infrastructure and management. This has aided the MoH and KEMRI in achieving international accreditation for several of its laboratory facilities. The KEMRI microbiology laboratory received ISO accreditation 15189:2012. ISO 15189 is used by medical laboratories in developing their quality management systems and in assessing their own competencies as a reference laboratory. With ISO 15189 accreditation, the microbiology facility is now recognized as a reference laboratory in the region.

Risk Communication and Emergency Response

The upcoming first Emergency Operations Centre at the Ministry of Health Buildings.

Developing Kenya's First Public Health Emergency Operating Center

CDC Kenya's Risk Communication and Emergency Response (RCER) Program had an important role in the development of Kenya's first Public Health Emergency Operations Center (EOC). In 2015, the RCER program was heavily involved in the EOC space design with stakeholders and CDC Atlanta. The program is currently working with the MoH and stakeholders on developing the EOC frameworks and protocols. CDC, WHO and the Kenya MoH are looking forward to the activation of the Public Health EOC in 2016.

Influenza

Conducting the Pediatric Respiratory Etiology Surveillance Study

In Kenya, approximately 16% of annual deaths in children less than 5 years of age are attributed to acute respiratory infections (ARI). In most health facilities in Kenya, resources are limited; having a better understanding of which children hospitalized with respiratory illness are at greatest risk of adverse outcomes could improve patient treatment and inform resource allocation. CDC Kenya's Influenza Program in partnership with KEMRI and the Kenyatta National Hospital, has set up the Pediatric Respiratory Etiology Surveillance Study (PRESS) that aims to identify specific causes of death among children hospitalized with acute respiratory illness. This study merges traditional pathology, new laboratory technology, and information from autopsies to better understand the cause of respiratory disease among children. The study should produce comprehensive data on respiratory deaths among children and is also evaluating the value

The Pediatric Respiratory Etiology Surveillance Study (PRESS) study in Kenya is producing some of the most comprehensive data on respiratory deaths among children in Africa.

of minimally invasive autopsies, which is sometimes a more culturally acceptable way than standard autopsies. This will likely guide future investigations of pediatric mortality in the field, as many children die from respiratory illness before reaching medical care.

Implementing the New Maternal-Infant Study Platform

In collaboration with KEMRI, CDC Kenya implemented a study in western Kenya to look at the impact of influenza and other respiratory viruses on pregnancy and related outcomes. This new maternal-infant study platform has enrolled approximately 500 pregnant women thus far and is following them up to 12 weeks after delivery. The study's data on influenza disease severity during pregnancy and its impact on pregnancy outcome will help the Kenya National Immunization Technical Advisory Group to assess the value of influenza vaccine recommendations for pregnant women.

Development of Screening Guidelines for Middle East Respiratory Syndrome Coronavirus

Kenya's MOH Division of Disease Surveillance and Response (DDSR), together with CDC Kenya, and residents from FELTP implemented enhanced surveillance for the Middle East Respiratory Syndrome Coronavirus (MERS-CoV), and the H7N9 influenza virus in multiple private and public hospitals in Nairobi and Mombasa. These initiatives supported early detection of pathogens with pandemic potential to protect both African and global populations by improving global health security.

Supporting the National Influenza Center

With support from CDC's Influenza Division in Atlanta and the KEMRI laboratory in Nairobi, the National Influenza Center (NIC) started operating in 2015 within the National Public Health Laboratory Services (NPHLS) under the Kenya MoH. This has been a crucial step towards receiving laboratory accreditation from the World Health Organization (WHO). NICs collect virus specimens in the countries where they are based and perform preliminary analysis. Clinical specimens and isolated viruses are then shipped to WHO for advanced antigenic and genetic analysis, contributing to recommendations on the composition of influenza vaccine each year. NICs are also important to identify and track novel influenza viruses that could lead to global health threats. The Kenya NIC will be an important contributor towards the development of the influenza vaccine.

Integrating Surveillance for Respiratory Pathogens and HIV at Siaya District Hospital

Hospitalized respiratory illness can be caused by a variety of viral and bacterial pathogens that are often not clinically distinguishable from one another. Data describing the etiology of hospitalized patients with respiratory illnesses are limited because testing for a large number of viruses and bacteria has historically required an assortment of molecular and culture assay modalities, which can prove cumbersome and resource-intensive. This study monitors the etiology and incidence of hospitalized respiratory illness among patients of all ages, and among those with underlying HIV and TB, using a multi-pathogen detection platforms (Taqman Array Card) to obtain a better understanding of the contributions of viral and bacterial pathogens in the etiology of hospitalized respiratory illness. In 2015, this study finished enrollment for adult patients (based on target sample size) and will likely be finalized in 2016.

Non-Communicable Diseases

Conducting Survey on Hypertension in Kibera Informal Settlement

Hypertension is a public health problem affecting at least one in three adults aged 35-64 years.

In 2015, CDC conducted a survey in Kibera informal settlements in Nairobi that showed that hypertension in the slum is a public health problem affecting at least one in three adults aged 35–64 years. Age, marital status, wealth index, physical inactivity and body mass index are important risk factors associated with hypertension. Prevention measures targeting the modifiable risk factors associated with hypertension are warranted to curb hypertension and its progressive effects.

Developing Surveillance for Birth Defects

In 2015, the Kenya National Center on Birth Defects and Developmental Disabilities (NCBDDD) made great strides in the development of surveillance for birth defects in Kenya. With technical support from CDC and the International Clearinghouse on Birth Defects Surveillance and Research, the Kenya MoH refined and developed their surveillance protocol while simultaneously holding advocacy meetings with stakeholders to garner support for birth defects surveillance. NCBDDD also supported FELTP residents in 2015 by providing mentorship, technical assistance and funding for surveillance pilot projects and other surveys on birth defects. Additionally, in March 2015, the Kenya FELTP conducted a collaborative intermediate level training on birth defects in Arusha Tanzania. With these efforts, surveillance for birth defects is scheduled to start in 2016 in selected hospitals.

Refugee Health Program

CDC's Division of Global Migration and Quarantine (DGMQ), assisted by the Division of Global Health Protection, sponsors the Africa Field Program for refugee health at CDC Kenya. The DGMQ Africa Field Program is dedicated to the improvement and promotion of health for refugees and immigrants, and to ensuring healthy resettlement of U.S.-bound refugees from Africa. Major partners in this effort are the Kenya Medical Research Institute, International Organization for Migration, UN High Commissioner for Refugees, non-governmental organizations, and Ministries of Health.

Providing Technical Assistance for a Cholera Outbreak Among Refugees in Tanzania

In 2015, Tanzania experienced a large cholera outbreak, affecting 18 regions of the country and involving more than 400 asylum-seekers in Nyarugusu refugee camp in the Kigoma region. CDC Kenya's Refugee Health Program (RHP) provided technical assistance to identify measures to prevent cholera infections and outbreaks among hundreds of refugees temporarily residing in a transit center prior to resettlement. CDC issued recommendations to the International Organization of Migration (IOM), the United Nations High Commissioner for Refugees (UNHCR), and the Tanzania Ministry of Health and Social Welfare on measures to improve water and sanitation facilities at the transit center, and to ensure the healthy, uninterrupted resettlement of more 2,200 U.S.-bound refugees from Tanzania in 2015.

Responding to Hepatitis E among U.S.-Bound Ethiopian Refugees

More than 4,500 refugees were resettled to the United States from Ethiopia in 2015. In July 2015, CDC Kenya was notified of two recently resettled refugees from Ethiopia who were hospitalized with hepatitis E virus (HEV) infection in the United States. HEV is a potentially serious infection—particularly in pregnant women and immunocompromised individuals. HEV is transmitted through consumption of water or food contaminated with the stool of an infected person. To ensure safe travel of refugees and prevent infections in the United States, CDC Kenya's RHP worked closely with the U.S. State Department's Bureau of Population, Refugees, and Migration (PRM) and IOM to implement enhanced surveillance for signs and symptoms of acute viral hepatitis among all U.S.-bound refugees prior to departure from Ethiopia.

Introduction of the Vaccination Program for U.S.-Bound Refugees in Rwanda

In July 2015, the Rwanda MoH concurred with the IOM proposal to initiate the enhanced vaccination program for U.S.-bound refugees, making it the fourth country in Africa to initiate this program alongside Ethiopia, Kenya, and Uganda. With assistance from CDC Kenya RHP, IOM has successfully launched the program and procured equipment for the Rwanda MoH to support vaccination of long-term refugees in Byumba and Kibue refugee camps. The expanded vaccination program is implemented in partnership with IOM, CDC, and the State Department's PRM as a cost-effective means to ensure healthy, uninterrupted travel of refugees to the United States. The program enables early enrollment of children in school after resettlement, and prevents outbreaks of vaccine-preventable diseases both overseas and in the United States.

Supporting Surveillance for Multi-Drug Resistant Tuberculosis in Dadaab Refugee Camp

The number of MDR-TB cases in Dadaab has increased substantially in recent years, from three cases in 2009 to 61 cases in 2015. Among the 227 patients diagnosed with MDR-TB since 2009, 186 were immigrants, 32 were refugees—including two United States Refugee Admissions Program applicants, and ninewere local residents. The ongoing issue with MDR TB in Dadaab underscores an urgent need to decongest the TB treatment facility in the camp, which is already operating

well above its capacity. To better monitor the situation and evaluate efforts to decrease infections with MDR-TB in Dadaab, CDC Kenya is working with the International Rescue Committee to improve surveillance for MDR-TB under the Global Health Security Agenda (GHSA).

Identifying Causes of Splenomegaly among U.S.-Bound Congolese Refugees

In 2015, CDC Kenya's RHP provided technical support to IOM in a clinical evaluation to identify causes of splenomegaly (enlarged spleen) among U.S.-bound Congolese refugees in Uganda. Out of the 987 refugees assessed during the mobile medical mission in Hoima in March and June 2015, 145 (14.7%) had splenomegaly and agreed to additional diagnostic testing to determine a possible cause, including, among others, malaria and other parasitic infections. Results and a complete analysis and report of the clinical evaluation are still pending.

In the meantime, all refugees who participated were provided treatment for malaria and other common parasitic infections prior to departure. CDC has also provided guidance to refugee coordinators and health providers in the United States on recommended evaluation and follow-up of individuals with splenomegaly after resettlement.

Providing Technical Assistance for a Cholera Outbreak Among Refugees in Tanzania

In 2015, Tanzania experienced a large cholera outbreak, affecting 18 regions of the country and involving more than 400 asylum-seekers in Nyarugusu refugee camp in the Kigoma region. CDC Kenya's Refugee Health Program (RHP) provided technical assistance to identify measures to prevent cholera infections and outbreaks among hundreds of refugees temporarily residing in a transit center prior to resettlement. CDC issued

The refugee health program is dedicated to the improvement and promotion of health for refugees and immigrants.

recommendations to the International Organization of Migration (IOM), the United Nations High Commissioner for Refugees, and the Tanzania Ministry of Health and Social Welfare on measures to improve water and sanitation facilities at the transit center, and to ensure the healthy, uninterrupted resettlement of more 2,200 U.S.-bound refugees from Tanzania in 2015.

Responding to Hepatitis E among U.S.-Bound Ethiopian Refugees

More than 4,500 refugees were resettled to the United States from Ethiopia in 2015. In July 2015, CDC Kenya was notified of two recently resettled refugees from Ethiopia who were hospitalized with hepatitis E virus (HEV) infection in the United States. HEV is a potentially serious infection—particularly in pregnant women and immunocompromised individuals—that is transmitted through consumption of water or food contaminated with the stool of an infected person. To ensure safe travel of refugees and prevent infections in the United States, CDC Kenya's RHP worked closely with the U.S. State Department's Bureau of Population, Refugees, and Migration (PRM) and IOM to implement enhanced surveillance for signs and symptoms of acute viral hepatitis among all U.S.-bound refugees prior to departure from Ethiopia.

Introduction of the Vaccination Program for U.S.-Bound Refugees in Rwanda

In July 2015, the Rwanda MoH concurred with the IOM proposal to initiate the enhanced vaccination program for U.S.-bound refugees, making it the fourth country in Africa to initiate this program alongside Ethiopia, Kenya, and Uganda. With assistance from CDC Kenya RHP, IOM has successfully launched the program and procured equipment for the Rwanda MoH to support vaccination of long-term refugees in Byumba and Kibue refugee camps. The expanded vaccination program is implemented in partnership with IOM, CDC, and the State Department's PRM as a cost-effective means to ensure healthy, uninterrupted travel of refugees to the United States, enable early enrollment of children in school after resettlement, and prevent outbreaks of vaccine-preventable diseases both overseas and in the United States.

Supporting Surveillance for Multi-Drug Resistant Tuberculosis in Dadaab Refugee Camp

The number of MDR-TB cases in Dadaab has increased substantially in recent years, from 3 cases in 2009 to 61 cases in 2015. Among the 227 patients diagnosed with MDR-TB since 2009, 186 were immigrants, 32 were refugees—including 2 United States Refugee Admissions Program applicants—and 9 were local residents. The ongoing issue with MDR TB in Dadaab underscores an urgent need to decongest the TB treatment facility in the camp, which is already operating well above its capacity. To better monitor the situation and evaluate efforts to decrease infections with MDR-TB in Dadaab, CDC Kenya is working with the International Rescue Committee to improve surveillance for MDR-TB under the GHSA.

Identifying Causes of Splenomegaly among U.S.-Bound Congolese Refugees

In 2015, CDC Kenya's RHP provided technical support to IOM in a clinical evaluation to identify causes of splenomegaly (enlarged spleen) among U.S.-bound Congolese refugees in Uganda. Out of the 987 refugees assessed during the mobile medical mission in Hoima in March and June 2015, a total of 145 (14.7%) had splenomegaly and agreed to additional diagnostic testing to determine a possible cause, including among others, malaria and other parasitic infections. Results and a complete analysis and report of the clinical evaluation are still pending. In the meantime, all refugees who participated were provided treatment for malaria and other common parasitic infections prior to departure. CDC has also provided guidance to refugee coordinators and health providers in the United States on recommended evaluation and follow-up of individuals with splenomegaly after resettlement.

Global Immunization Division

A nurse at a CDC supported clinic examines a child who came in for routine immunization.

Linking Civil Registration and Vital Statistics with Immunization Information Systems

The CDC Global Immunization Division in collaboration with relevant stakeholders is working to strengthen the usage and linkage of Civil Registration and Vital Statistics (CRVS) systems and immunization registries. In 2015, GID in Kenya worked at interfacing with the MoH and non-governmental partners in the country to drive dialogue and oversee the development of pilot projects to increase use of electronic immunization registries and electronic birth/civil registries.

National Immunization Information Systems Assessment and Data Quality Improvement Plan

In October 2015, a rapid immunization information systems assessment (IISA) was conducted to address new data quality requirements for GAVI supported countries. The IISA was conducted in collaboration with the MoH's Unit of Vaccines and Immunization Services, County Health Records Information Officers, WHO,UNICEF, and the Clinton Health Access Initiative. The assessment included a desk review of available EPI documents, a focus group with national EPI staff, national data trend analysis, and a field questionnaire completed in four counties, eight sub-counties, and 16 health facilities. The assessment findings and stakeholders recommendations will be included in the Data Quality Improvement Plan to be launched in 2016.

2015 Western Kenya Accomplishments

Western Kenya programs are implemented in close collaboration with KEMRI. This collaboration of more than 35 years has developed into a sophisticated and comprehensive platform for scientific study and service delivery. The Malaria Research Program and the President's Malaria Initiative (PMI) focus on prevention and monitoring, as well as evaluation of interventions such as vaccines, drugs, and insecticide-treated bed nets. The HIV Research Program evaluates new tools to prevent the spread of the epidemic and improve the health of persons infected with HIV. The Tuberculosis Research Program measures the burden of TB and helps develop new ways to prevent and treat the disease.

Through KEMRI, CDC supports the Health and Demographic Surveillance System, which allows scientists to monitor the health and demographic information for over 225,000 people. Surveillance data are used to inform policy and plan and evaluate public health interventions. In addition, CDC supports research on neglected tropical diseases.

TB Research Program

Identifying Best Approaches to Increasing TB Case Detection

At Kenya's World TB Day event on March 24, 2015, CDC Kenya helped launch the "Improving Tuberculosis Case Detection in Western Kenya" study. The study aims to improve TB control by examining the best way to increase TB case detection. Conducted in Kisumu and Siaya counties, the study is piloting three approaches to improving TB case detection, each of which is feasible in western Kenya. Implemented by CDC, the DoD's Walter Reed Project, and KEMRI in collaboration with the Kenya MoH, the study will help the MoH identify which approach will have the greatest impact and be the best one to scale-up in Kenya. Funding for the study is being provided by USAID, the Global Emerging Infections Surveillance division at the Armed Forces Health Surveillance Center, CDC, and the MoH.

Improving Pediatric TB Diagnosis

In 2015, CDC Kenya completed enrollment of participants in a large study of TB diagnosis in children under the age of five (the "Toto TB" study). The study enrolled its 300th participant in August. Preliminary results, presented at the Union World Conference for Lung

CDC Kenya's Kevin Cain (left) received the "Improving Tuberculosis Case Detection in Western Kenya" study during the 2015 World TB day celebrations.

Health in December 2015, found that testing of two specimens collected through non-invasive methods (nasopharyngeal aspirate and stool specimen) may be able to replace the much more invasive testing by gastric aspiration that is currently the gold standard. If this is confirmed, this could substantially impact the approach to TB diagnosis in children globally. The study is being conducted with support from USAID and CDC's Division of Tuberculosis Elimination.

HIV Research Program

CDC's Division of HIV/AIDS Prevention has laboratories which support clinical trials and validation studies.

Enrolling Participants in National Institutes of Health Studies

In 2014, CDC worked collaboratively with KEMRI to be designated an NIH-recognized Clinical Research Site (CRS), the culmination of decades of joint capacity building by CDC and KEMRI. The field station was approved as a new research and laboratory site in the AIDS Clinical Trials Group's (ACTG) worldwide network sponsored by the NIH. In early 2015, the CRS rapidly activated and successfully enrolled participants in five NIH-studies including a multi-site, cohort study of men who have sex with men (MSM) in Africa.

Conclusion of the HPTN 052 Trial

The HIV Research Program was the only site in East Africa and the only CDC-affiliated site participating in the HPTN 052 clinical trial, an ongoing multi-country NIH-sponsored randomized clinical trial. In 2015, the HIV Research Program concluded participation in the HPTN 052 ART treatment and prevention trial. The HPTN 052 study was a Phase III randomized clinical trial with the primary objective of evaluating whether ARV drugs, which are mainly licensed to treat HIV infection, can prevent the sexual transmission of HIV among couples in which one partner is HIV-infected and the other is not (serodiscordant couples). Additionally, the study was designed to evaluate the optimal time to begin ART in order to reduce illness and death among people infected with HIV. Preliminary findings of the trial were declared the "Scientific Breakthrough of the Year 2011" by The Economist. Study findings were influential in the development and issuance of the WHO 2013 guidelines for HIV Treatment. These findings showed that starting HIV treatment early, when the immune system is relatively healthy, reduced the risk of sexually transmitting the virus to an uninfected partner by 96 percent. ART, when taken until viral suppression is achieved and sustained, is a highly effective and durable intervention for HIV prevention.

Implementing the CD4 Point-of-Care Study

In most regions of sub-Saharan Africa, when an individual is diagnosed with HIV, the standard procedure is to send blood samples to an external laboratory for CD4 testing. Patients must then return to the clinic to learn their test results, which determine whether they meet local standards to receive ART, and additional visits are often required to educate patients on the procedures necessary for successful treatment. Patients may have limited ability to travel to clinics that are far from their home communities, so many fail to return after initial diagnosis and never receive the care they need. A point-of-care test can reveal an individual's CD4 result the same day as the original diagnosis, allowing expedited initiation of ART for those who meet local standards. In 2015, the CD4 point-of-care randomized clinical trial demonstrated substantial increase in linkage to care when point-of-care CD4 results were provided to participants. In the setting of a home-based HIV testing campaign point-of-care CD4 testing improved linkage to care at six months, by a relative 70% and reduced the time to ART initiation from 70 days to 47 days after diagnosis.

Completing the NuvaRing® Clinical Trial

The options currently available to protect women from HIV infection and unwanted pregnancy (e. g., condom use, abstinence, monogamy) are not consistently available, practical, or under women's control. Intravaginal rings (IVRs) containing drugs are an important technology that can be long-acting and woman-controlled and are being developed for HIV prevention with and without co-formulated hormonal contraception. Availability of IVRs in sub-Saharan Africa is limited; hence, it is important to evaluate acceptability, utilization, and biologic effects of IVR usage among African women. The HIV Research Branch successfully completed a clinical trial that measured the acceptability, adherence and biological effects of the NuvaRing® vaginal ring. The study aimed to assess adherence and utilization patterns for NuvaRing®, behaviorally and biologically; to assess acceptability and effect of NuvaRing® on sexual behavior among women and their sexual partners in a setting where there is no routine IVR use; and to assess biologic effects of NuvaRing® including standard safety monitoring and, among a subset of participants, genital compartment immunology and microbiology. Eighty-four percent of the 207 women who initiated 6 months of ring use completed the study, and initial analysis suggests acceptance of future vaginal ring studies in western Kenya. Analysis of ring adherence, satisfaction, and tolerability are underway.

Malaria Research Program

Generating Evidence for Malaria in Pregnancy Prevention Policy

Malaria infection during pregnancy is a major public health problem, with substantial risks for the mother and fetus. Intermittent preventive treatment of malaria in pregnancy (IPTp) is a full therapeutic course of antimalarial medicine given to pregnant women at routine prenatal visits, regardless of whether the recipient is infected with malaria. IPTp with sulfadoxine-pyrimethamine (SP) reduces maternal malaria episodes, maternal and fetal anemia, placental parasitemia, low birth weight, and neonatal mortality. In 2015, the malaria research program completed and published a study in The Lancet demonstrating that in the context of high SP resistance and malaria transmission, intermittent screening with malaria rapid diagnostic tests and treatment of women who test positive with dihydroartemisinin-piperaquine (DP) is not a suitable alternative strategy to IPTp with SP. However, DP is a promising alternative drug to replace SP for IPTp.

Assessing the Safety of Potential Antimalarial Drug Exposures in Pregnancy

The search for safe, effective, and well-tolerated alternative drugs to replace SP for IPTp has proven elusive. While artemisinin-based combination therapies (ACTs) have been widely adopted as first line antimalarial treatment in all endemic countries, they are currently not recommended for use in the first trimester of pregnancy due to scarcity of safety data from humans. Despite this

A health worker hands a mother and her young child a mosquito net during a routine visit at a CDC Kenya supported health clinic.

policy, women are frequently inadvertently exposed to ACTs in early pregnancy, and the risk-benefit profile of such exposure remains unclear. Between August 2012 and June 2015, CDC in collaboration with KEMRI and the Liverpool School of Tropical Medicine carried out a community-based surveillance of women where 1134 early pregnancies were identified and followed to assess the effect of potential antimalarial drug exposures in pregnancy. This study found that exposure to artemisinin combination therapies in early pregnancy was more common than quinine exposure. Compared to oral quinine there was no increased risk of miscarriage, stillbirth or congenital anomalies following inadvertent artemisinin treatment for uncomplicated malaria in either the first trimester of pregnancy or during the embryo-sensitive period. The data on the safety of artemisinins in the first trimester of pregnancy formed a critical part of the evidence that led WHO's Malaria Policy Advisory Committee to endorse the use of artemisinins in the first trimester of pregnancy.

Supporting the RTS,S Malaria Vaccine Study

RTS,S is a malaria vaccine that has been developed through a partnership between GlaxoSmithKline Biologicals and the PATH Malaria Vaccine Initiative, with support from the Bill & Melinda Gates Foundation and from a network of African research centers that performed the studies. Final results of the RTS,S malaria vaccine study that included administration of a booster dose were published in The Lancet. It demonstrated that a substantial number of cases of clinical malaria were averted over a 3–4 year period in young infants and children and the efficacy was improved by the administration of the booster dose.

Completing the Evaluation of Mass Screening and Treatment for Rapid Malaria Transmission Reduction

In 2015, CDC Kenya's Malaria Research Program completed a study evaluating intermittent community-based mass screening and treatment for rapid malaria transmission reduction. During the study over 150,000 malaria tests were performed and over 75,000 treatments were given. The study found that, in an area of high malaria transmission and in the context of high coverage with insecticide-treated bed nets, three annual rounds of mass screening with malaria rapid diagnostic tests, and treatment with DP for those who test positive, for two consecutive years had low impact on malaria. This area is known as one of the most biologically complex for malaria transmission in sub-Saharan Africa and the source of malaria transmission to the rest of western Kenya and urban slums in Nairobi.

Initiating a Study to Evaluate Antenatal Women as a Sentinel Population for Malaria Surveillance

In 2015, CDC Kenya's Malaria Research Program initiated a study to evaluate whether pregnant women attending first ANC visits can be used as a sentinel population for malaria surveillance when compared to both continuous malaria indicator surveys and health facility reporting using scannable teleforms. The accessibility of this population would greatly diminish surveillance costs and would improve timeliness of reporting if it is proven to accurately reflect the malaria burden in the community and at the health facilities.

Launching of a Health Economics Unit

In Kenya, there are an estimated 6.7 million new clinical cases of malaria and 4,000 deaths each year, and those living in western Kenya have an especially high risk of malaria. As it does in many countries around the world, CDC has worked closely with the Kenya MoH to fight malaria. CDC's efforts in Kenya are also supported by the PMI. In February 2015, the CDC Kenya Malaria Research Program in Kisian, western Kenya inaugurated a Health Economics Unit, which kicked-off with a 3-day workshop. The mission of this unit is to provide technical advice, analysis, and research into the economic inputs and outputs of CDC Kenya programs, interventions, and studies. This unit maintains a close collaboration with the Liverpool School of Tropical Medicine.

Neglected Tropical Diseases Research

CDC Kenya and other implementing partners provide financial support for neglected tropical diseases (NTD) research conducted by CDC and KEMRI. The research focuses on understanding the immunology, geographic distribution, and prevalence of neglected tropical diseases such as schistosomiasis, studying their impact on co-infections with other illnesses like TB and HIV, and developing control strategies for affected communities.

School going children during a school deworming exercise in Kibera.

Deworming activities targeting schistosomiasis and soil-transmitted helminthes

In partnership with the MoH, about 75,000 individuals in most-at-risk areas were dewormed through NTDs annual mass drug administration programs targeting schistosomiasis and soil-transmitted helminths in western Kenya. Preventive chemotherapy is considered the key component in the control of schistosomiasis and intestinal worms. Researchers are currently investigating several questions related to the NTDs research platform, such as how different deworming strategies (whether community-wide or school-based) impact on morbidity in areas with different infection prevalence thresholds. Health education and awareness campaigns accompanied the deworming activities and are ongoing.

VIP Visits

President Obama's Historic Visit to Kenya

On his historic visit to the Republic of Kenya, President Barack Obama noted, "Across Africa, Kenya, and the United States, we'll keep working to strengthen public health systems and deal with outbreaks of diseases before they become epidemics. Together we can save lives."

President Barack Obama made a historic visit to Kenya from July 24–26, 2015. During a press conference at Kenya's State House, he noted, "Across Africa, Kenya, and the United States, we'll keep working to strengthen public health systems and deal with outbreaks of diseases before they become epidemics. Together we can save lives." Several CDC Kenya staff volunteered to support logistics, transport, and public affairs for the visit.

Visit by CDC Director Tom Frieden

CDC Director Tom Frieden, MD, MPH, made a brief stop in Kenya on August 6, 2015 and met with staff from CDC Kenya. L-R John Neatherlin, Dr. Kevin Cain, Katherine Robinson, Dr. Kevin De Cock, and Dr. Martien Borgdorff.

On August 6, 2015, CDC Director Dr. Tom Frieden made a brief stop in Kenya and met with staff from CDC Kenya. During his time in Nairobi, Dr. Frieden held discussions with CDC Kenya leadership on the planned establishment of a National Public Health Institute, increased collaboration in the area of health security, and on the progress Kenya is making in TB, malaria, and HIV.

Opening of New PEPFAR-funded Ministry of Health Buildings

US Ambassador Robert F. Godec looks at specimen through a microscope at the new Public Health Reference laboratory.

On August 14, 2015, the Kenya Ministry of Health (MoH) opened two PEPFAR-funded buildings constructed with CDC Kenya management and technical support—the Afya House Annex office building for the MoH's HIV and TB programs and the National Public Health Reference Laboratories building which will house the HIV and TB laboratories and the Ministry's first Biosafety Level 3 laboratories.

CDC Kenya Volunteers at Community Center

On November 30, 2015, in support of World AIDS Day and the PEPFAR DREAMS initiative, CDC and U.S. Embassy Nairobi staff volunteered their time with LVCT Health, a CDC Kenya implementing partner, in the Korogocho informal settlement in Nairobi. They were joined by Ambassador Robert F. Godec who met with LVCT Health leaders and staff and addressed youth attending the event. LVCT Health provides HIV prevention, care, and treatment activities at the site with a particular emphasis on youth in the community. It will be one of five implementing partners implementing CDC's DREAMS

To honor World AIDS Day, CDC and Embassy staff volunteered to paint rooms in the Korogocho community center where LVCT Health, a PEPFAR-funded site and a CDC partner, implements the One Child at a Time program for vulnerable youth.

initiative activities. Volunteers painted rooms at the community center where LVCT Health implements its programs in Korogocho, and donated items including clothing, food, solar lighting, and sanitary supplies for adolescent girls and young women.

Ambassador Godec Visit to Key Populations Programs in Western Kenya

US Ambassador Robert F. Godec gives his remarks at CDC-supported Makongeni Health center in Western Kenya.

On October 18, 2015, the U.S. Ambassador to Kenya Robert F. Godec and Homa Bay County Governor Cyprian Awiti visited the CDC-supported Makongeni Health Centre, the first site in Kenya's Western region to integrate health services for key populations at risk for HIV with general population services. The visit included an open forum discussion between the Ambassador, Governor, CDC Kenya Director Kevin De Cock, and key populations groups.

CDC Kenya 2015 Publications

DGHT 2015 Publications

1. Agaya J, Nnadi CD, Odhiambo J, Obonyo C, Obiero V, Lipke V, Okeyo E, Cain K, Oeltmann JE. **Tuberculosis and latent tuberculosis infection among healthcare workers in Kisumu, Kenya.** Trop Med Int Health. 2015;20:1797-804.
2. Angell SY, De Cock KM, Frieden TR. **A public health approach to global management of hypertension.** Lancet. 2015;385:825-7.
3. Arwady MA, Bawo L, Hunter JC, Massaquoi M, Matanock A, Dahn B, Ayscue P, Nyenswah T, Forrester JD, Hensley LE, Monroe B, Schoepp RJ, Chen TH, Schaecher KE, George T, Rouse E, Schafer IJ, Pillai SK, De Cock KM. E**volution of Ebola virus disease from exotic infection to global health priority, Liberia, mid-2014.** Emerg Infect Dis. 2015;21:578-84.
4. Blanton E, Wilhelm N, O'Reilly C, Muhonja E, Karoki S, Ope M, Langat D, Omolo J, Wamola N, Oundo J, Hoekstra R, Ayers T, De Cock K, Breiman R, Mintz E, Lantagne D. **A rapid assessment of drinking water quality in informal settlements after a cholera outbreak in Nairobi, Kenya.** J Water Health. 2015;13:714-25.
5. Borgdorff MW, Cain KP, DeCock KM. **The molecular epidemiology of tuberculosis in settings with a high HIV prevalence: implications for control.** J Infect Dis. 2015;211:8-9.
6. Burmen B, Modi S, Cavanaugh JS, Muttai H, McCarthy KD, Alexander H, Cain K. **Tuberculosis screening outcomes for newly diagnosed persons living with HIV, Nyanza Province, Kenya, 2009.** Int J Tuberc Lung Dis. 2016;20:79-84.
7. Cain K, Marano N, Kamene M, Sitienei J, Mukherjee S, Galev A, Burton J, Nasibov O, Kioko J, De Cock KM. **The movement of multidrug-resistant tuberculosis across borders in East Africa needs a regional and global solution.** PLoS Med. 2015;12(2):e1001791.
8. Cain KP, Shah NS. **(Not) measuring in the dark.** Int J Tuberc Lung Dis. 2015;19:1270.
9. Christie A, Davies-Wayne GJ, Cordier-Lassalle T, Blackley DJ, Laney AS, Williams DE, Shinde SA, Badio M, Lo T, Mate SE, Ladner JT, Wiley MR, Kugelman JR, Palacios G, Holbrook MR, Janosko KB, de Wit E, van Doremalen N, Munster VJ, Pettitt J, Schoepp RJ, Verhenne L, Evlampidou I, Kollie KK, Sieh SB, Gasasira A, Bolay F, Kateh FN, Nyenswah TG, De Cock KM. **Possible sexual transmission of Ebola virus - Liberia, 2015.** MMWR Morb Mortal Wkly Rep. 2015;64:479-81.
10. De Cock KM and El-Sadr WM. **A tale of two viruses: HIV, Ebola and health systems.** AIDS. 2015;29:989-91.
11. De Cock KM and El-Sadr WM. **From START to finish: Implications of the START study.** Lancet Infect Dis. 2016;16:13-14.
12. Djomand G, Gao H, Singa B, Hornston S, Bennett E, Odek J, McClelland RS, John-Stewart G, Bock N. **Genital infections and syndromic diagnosis among HIV-infected women in HIV care programs in Kenya.** Int J STD AIDS. 2016;27:19-24.
13. Duong YT, Kassanjee R, Welte A, Morgan, De A, Dobbs T, Rottinghaus E, Nkengasong J, Curlin ME, Kittinunvorakoon C, Raengsakulrach B, Martin M, Choopanya K, Vanichseni S, Jiang Y, Qiu M, Yu H, Hao Y, Shah N, Le LV, Kim AA, Nguyen TA, Ampofo W, Parekh BS. **Recalibration of the limiting antigen avidity EIA to determine mean duration of recent infection in divergent HIV-1 subtypes.** PLoS One. 2015;10(2):e0114947.
14. Hagan JE, Smith W, Pillai SK, Yeoman K, Gupta S, Neatherlin J, Slutsker L, Lindblade KA, DeCock KM, Kateh F, Nyenswah T. **Implementation of Ebola case-finding using a village chieftaincy taskforce in a remote outbreak - Liberia, 2014.** MMWR Morb Mortal Wkly Rep. 2015;64:183-5.
15. Kateh F, Nagbe T, Kieta A, Barskey A, Gasasira AN, Driscoll A, Tucker A, Christie A, Karmo B, Scott C, Bowah C, Barradas D, Blackley D, Dweh E, Warren F, Mahoney F, Kassay G, Calvert GM, Castro G, Logan G, Appiah G, Kirking H, Koon H, Papowitz H, Walke H, Cole IB, Montgomery J, Neatherlin J, Tappero JW, Hagan JE, Forrester J, Woodring J, Mott J, Attfield K, DeCock K, Lindblade KA, Powell K, Yeoman K, Adams L, Broyles LN, Slutsker L, Larway L, Belcher L, Cooper L, Santos M, Westercamp M, Weinberg MP, Massoudi M, Dea M, Patel M, Hennessey M, Fomba M, Lubogo M, Maxwell N, Moonan P, Arzoaquoi S, Gee S, Zayzay S, Pillai S, Williams S, Zarecki SM, Yett S, James S, Grube S, Gupta S, Nelson T, Malibiche T, Frank W, Smith W, Nyenswah T. **Rapid response to Ebola outbreaks in remote areas - Liberia, July-November 2014.** MMWR Morb Mortal Wkly Rep. 2015 Feb 27;64:188-92.
16. Kimeu M, Burmen B, Audi B, Adega A, Owuor K, Arodi S, Bii D, Zielinski-Gutiérrez E. **The relationship between adherence to clinic appointments and year-one mortality for newly enrolled HIV infected patients at a regional referral hospital in Western Kenya, January 2011–December 2012.** AIDS Care. 2016 Apr;28:409-15.

17. Kruk ME, Jakubobowski A, Rabkin M, Kimanga DO, Kundu F, Lim T, Lumumba V, Oluoch T, Robinson KA, El-Sadr W. **Association between HIV programs and quality of maternal health Inputs and processes in Kenya.** Am J Public Health. 2015;105(Suppl 2):S207-10.
18. Lecher S, Ellenberger D, Kim AA, Fonjungo PN, Agolory S, Borget MY, Broyles L, Carmona S, Chipungu G, De Cock KM, Deyde V, Downer M, Gupta S, Kaplan JE, Kiyaga C, Knight N, MacLeod W, Makumbi B, Muttai H, Mwangi C, Mwangi JW, Mwasekaga M, Ng'Ang'A LW, Pillay Y, Sarr A, Sawadogo S, Singer D, Stevens W, Toure CA, Nkengasong J. **Scale-up of HIV viral load monitoring — seven Sub-Saharan African countries.** MMWR Morb Mortal Wkly Rep. 2015;64:1287-90.
19. Lindblade KA, Kateh F, Nagbe TK, Neatherlin JC, Pillai SK, Attfield KR, Dweh E, Barradas DT, Williams SG, Blackley DJ, Kirking HL, Patel MR, Dea M, Massoudi MS, Wannemuehler K, Barskey AE, Zarecki SL, Fomba M, Grube S, Belcher L, Broyles LN, Maxwell TN, Hagan JE, Yeoman K, Westercamp M, Forrester J, Mott J, Mahoney F, Slutsker L, DeCock KM, Nyenswah T. **Decreased Ebola Transmission after Rapid Response to Outbreaks in Remote Areas, Liberia, 2014.** Emerg Infect Dis. 2015;21:1800-7.
20. Mate SE, Kugelman JR, Nyenswah TG, Ladner JT, Wiley MR, Cordier-Lassalle T, Christie A, Schroth GP, Gross SM, Davies-Wayne GJ, Shinde SA, Murugan R, Sieh SB, Badio M, Fakoli L, Taweh F, de Wit E, van Doremalen N, Munster VJ, Pettitt J, Prieto K, Humrighouse BW, Ströher U, DiClaro JW, Hensley LE, Schoepp RJ, Safronetz D, Fair J, Kuhn JH, Blackley DJ, Laney AS, Williams DE, Lo T, Gasasira A, Nichol ST, Formenty P, Kateh FN, De Cock KM, Bolay F, Sanchez-Lockhart M, Palacios G. **Molecular Evidence of Sexual Transmission of Ebola Virus.** N Engl J Med. 2015;373:2448-54.
21. Mital S, Miles G, McLellan-Lemal E, Muthui M, Needle R. **Heroin shortage in Coastal Kenya: a rapid assessment and qualitative analysis of heroin users' experiences.** Int J Drug Policy. 2015;pii:S0955-3959(15)00245-5.
22. Mudany MA, Sirengo M, Rutherford GW, Mwangi M, Nganga LW, Gichangi A. **Enhancing maternal and child health using a combined mother & child health booklet in Kenya.** J Trop Pediatr. 2015;61:442-7.
23. Muraguri N, Tun W, Okal J, Broz D, Raymond HF, Kellogg T, Dadabhai S, Musyoki H, Sheehy M, Kuria D, Kaiser R, Geibel S. **HIV and STI prevalence and risk factors among male sex workers and other men who have sex with men in Nairobi, Kenya.** J Acquir Immune Defic Syndr. 2015;68(1):91-6.
24. Musau S, McCarthy K, Okumu A, Shinnick T, Wandiga S, Williamson J, Cain K. **Experience in implementing a quality management system in a tuberculosis laboratory, Kisumu, Kenya.** Int J Tuberc Lung Dis. 2015;19:693-5.
25. Mwangi MW, Kellogg TA, Brookmeyer K, Buluma R, Chiang L, Otieno-Nyunya B, Chesang K, Kenya 2010 Violence against Children Survey Team. **Perpetrators and context of child sexual abuse in Kenya.** Child Abuse Negl. 2015;44:46-55.
26. Nyenswah TG, Kateh F, Bawo L, Massaquoi M, Gbanyan M, Fallah M, Nagbe TK, Karsor KK, Wesseh CS, Sieh S, Gasasira A, Graaff P, Hensley L, Rosling H, Lo T, Pillai SK, Gupta N, Montgomery JM, Ransom RL, Williams D, Laney AS, Lindblade KA, Slutsker L, Telfer JL, Christie A, Mahoney F, De Cock KM. **Ebola and Its Control in Liberia, 2014-2015.** Emerg Infect Dis. 2016;22:169-77.
27. Ojwang'VO, J Penner, C Blat, Agot K, Bukusi EA, Cohen CR. **Loss to follow-up among youth accessing outpatient HIV care and treatment services in Kisumu, Kenya.** AIDS Care. 2016;28:500-7.
28. Oluoch T, de Keizer N, Langat P, Alaska I, Ochieng K, Okeyo N, Kwaro D, Cornet R. **Structured approach to recording AIDS-defining illnesses in Kenya: A SNOMED CT based solution.** J Biomed Inform. 2015;56:387-94.
29. Oluoch T, Kwaro D, Ssempija V, Katana A, Langat P, Okeyo N, Abu-Hanna A, de Keizer N. **Better adherence to pre-antiretroviral therapy guidelines after implementing an electronic medical record system in rural Kenyan HIV clinics: a multicenter pre–post study.** Int J Infect Dis. 2015;33:109-13.
30. Oluoch T, Muturi D, Kiriinya R, Waruru A, Lanyo K, Nguni R, Ojwang J, Waters KP, Richards J. **Do interoperable national information systems enhance availability of data to assess the effect of scale-up of HIV services on health workforce deployment in resource-limited countries?** Stud Health Technol Inform. 2015;16:677-81.
31. Pintye J, Langat A, Singa B, Kinuthia J, Odeny Beryne, Katana A, Nganga L, John-Stewart G, McGrath CJ. **Maternal tenofovir disoproxil fumarate use in pregnancy and growth outcomes among HIV-exposed uninfected Infants in Kenya.** Infect Dis Obstet Gynecol. 2015;218080.
32. Reed JB, Grund J, Liu Y, Mwandi Z, Howard AA, McNairy ML, Chesang K, Cherutich P, Bock N. **Evaluation of loss-to-follow-up and postoperative adverse events in a voluntary medical male circumcision program in Nyanza Province, Kenya.** J Acquir Immune Defic Syndr. 2015;69(1):e13-23.

33. Sharma A, Musau S, Heilig CM, Okumu AO, Opiyo EO, Basiye FL, Miruka FO, Kioko JK, Sitienei JK, Cain KP. **Assessing the effect of decentralisation of laboratory diagnosis for drug-resistant tuberculosis in Kenya.** Int J Tuberc Lung Dis. 2015;19:1348-53.
34. Sharma A, Ndisha M, Ngari F, Kipruto H, Cain KP, Sitienei J, Bloss E. **A review of data quality of an electronic tuberculosis surveillance system for case-based reporting in Kenya.** Eur J Public Health. 2015;25:1095-7.
35. Wong JM, Cosmas L, Nyachieo, Williamson JM, Olack B, Okoth G, Njuguna H, Feikin DR, Burke H, Montgomery JM, Breiman RF. **Increased rates of respiratory and diarrheal illnesses in HIV-negative persons living with HIV-infected individuals in a densely populated urban slum in Kenya.** J Infect Dis. 2015;212:745-53.

DGHP 2015 Publications

1. Akullian A, Ng'eno E, Matheson AI, Cosmas L, Macharia D, Fields B, Bigogo G, Mugoh M, John-Stewart G, Walson JL, Wakefield J, Montgomery JM. **Environmental transmission of typhoid fever in an urban slum**. PLoS Negl Trop Dis 9(12): 2015:e0004212.
2. Angell SY, De Cock KM, Frieden TR. **A public health approach to global management of hypertension**. Lancet. 2015 Feb 28;385(9970):825-7.
3. Arwady MA, Bawo L, Hunter JC, Massaquoi M, Matanock A, Dahn B, Ayscue P, Nyenswah T, Forrester JD, Hensley LE, Monroe B, Schoepp RJ, Chen TH, Schaecher KE, George T, Rouse E, Schafer IJ, Pillai SK, De Cock KM. **Evolution of ebola virus disease from exotic infection to global health priority, Liberia, mid-2014**. Emerg Infect Dis. 2015 Apr;21(4):578-84.
4. Arvelo W, Gura Z, Amwayi S, Wiersma P, Omolo J, Becknell S, Jones D, Ongore D, Dicker R. **Establishing a field epidemiology elective for medical students in Kenya: A strategy for increasing public health awareness and workforce capacity**. J Epidemiol Glob Health. 2015;5:33-9.
5. Blanton E, Wilhelm N, O'Reilly C, Muhonja E, Karoki S, Ope M, Langat D, Omolo J, Wamola N, Oundo J, Hoekstra R, Ayers T, De Cock K, Breiman R, Mintz E, Lantagne D. A **rapid assessment of drinking water quality in informal settlements after a cholera outbreak in Nairobi, Kenya**. J Water Health. 2015 Sep;13(3):714-25.
6. Breiman RF, Cosmas L, Njenga M, Williamson J, Mott JA, Katz MA, Erdman DD, Schneider E, Oberste M, Neatherlin JC, Njuguna H, Ondari DM, Odero K, Okoth GO, Olack B, Wamola N, Montgomery JM, Fields BS, Feikin DR. **Severe acute respiratory infection in children in a densely populated urban slum in Kenya, 2007-2011**. BMC Infect Dis. 2015;15:95.
7. Burton DC, Bigogo GM, Audi AO, Williamson J, Munge K, Wafula J, Ouma D, Khagayi S, Mugoya I, Mburu J, Muema S, Bauni E, Bwanaali T, Feikin DR, Ochieng PM, Mogeni OD, Otieno GA, Olack B, Kamau T, Van Dyke MK, Chen R, Farrington P8, Montgomery JM1, Breiman RF9, Scott JA10, Laserson KF2. (2015) **Risk of injection-site abscess among infants receiving a preservative-free, two-dose vial formulation of pneumococcal conjugate vaccine in Kenya**. PLoS ONE. 2015;10(10): e0141896.
8. Cain KP, Marano N, Kamene M, Sitienei J, Mukherjee S, Galev A, Burton J, Nasibov O, Kioko J, De Cock KM. **The movement of multidrug-resistant tuberculosis across borders in East Africa needs a regional and global solution**. PLoS medicine. 2015;12(2):e1001791.
9. Christie A, Davies-Wayne GJ, Cordier-Lassalle T, Blackley DJ, Laney AS, Williams DE, Shinde SA, Badio M, Lo T, Mate SE, Ladner JT, Wiley MR, Kugelman JR, Palacios G, Holbrook MR, Janosko KB, de Wit E, van Doremalen N, Munster VJ, Pettitt J, Schoepp RJ, Verhenne L, Evlampidou I, Kollie KK, Sieh SB, Gasasira A, Bolay F, Kateh FN, Nyenswah TG, De Cock KM. **Possible sexual transmission of Ebola virus - Liberia, 2015**. MMWR Morb Mortal Wkly Rep. 2015 May 8;64(17):479-81.
10. De Cock KM and El-Sadr WM. **A tale of two viruses: HIV, Ebola and health systems**. AIDS. 2015;29(9):989-91.
11. Ellis EM, Neatherlin JC, Delorey M, Ochieng M, Mohamed AH, Mogeni DO, Hunsperger E, Patta S, Gikunju S, Waiboic L, Fields B, Ofula V, Konongoi SL, Torres-Velasquez B, Marano N, Sang R, Margolis HS, Montgomery JM, Tomashek KM. **A household serosurvey to estimate the magnitude of a dengue outbreak in Mombasa, Kenya, 2013**. PLoS Negl Trop Dis. 2015;9(4):e0003733.

12. Emukule GO, Paget J, Velden K, Mott JA. **Influenza-Associated Disease Burden in Kenya: a systematic review of literature**. PloS One. 2015; 10(9):e0138708.
13. Halliday JE, Knobel DL, Agwanda B, Bai Y, Breiman RF, Cleaveland S, Njenga MK, Kosoy M. **Prevalence and diversity of small mammal-associated Bartonella species in rural and urban Keny**a. PLoS Negl Trop Dis. 2015;9(3):e0003608.
14. Hagan JE, Smith W, Pillai SK, Yeoman K, Gupta S, Neatherlin J, Slutsker L, Lindblade KA, DeCock KM, Kateh F, Nyenswah T. I**mplementation of Ebola case-finding using a village chieftaincy taskforce in a remote outbreak—Liberia, 2014**. MMWR Morb Mortal Wkly Rep. 2015 Feb 27;64(7):183-5.
15. Harris JR, Worrell CM, Davis SM, Odero K, Mogeni OD, Deming MS, Mohammed A, Montgomery JM, Njenga SM, Fox LM, Addiss DG. **Unprogrammed deworming in the Kibera slum, Nairobi: implications for control of soil-transmitted helminthiases**. PLoS Negl Trop Dis. 2015;9(3):e0003590.
16. George G, Rotich J, Kigen H, Catherine K, Waweru B, Boru W, Galgalo T, Githuku J, Obonyo M, Curran K, Narra R, Crowe SJ, O'Reilly CE, Macharia D, Montgomery J, Neatherlin J, De Cock KM, Lowther S, Gura Z, Langat D, Njeru I, Kioko J, Muraguri N. **Notes from the Field: Ongoing Cholera Outbreak—Kenya, 2014-2016**.
17. Jima DD, Luce-Fedrow A, Yang Y, Maina AN, Snesrud EC, Otiang E, Njenga K, Jarman RG, Richards AL, Hang J. **Whole-genome sequence of "candidatus rickettsia asemboensis" strain NMRCii, isolated from fleas of Western Kenya**. Genome Announcements. 2015;3(2):e00018-15.
18. Judd MC, Emukule GO, Njuguna H, McMorrow ML, Arunga GO, Katz MA, Montgomery JM, Wong JM, Breiman RF, Mott JA. **The role of HIV in the household introduction and transmission of influenza in an urban slum, Nairobi, Kenya, 2008-2011**. J Infect Dis. 2015;212(5):740-4. Epub 2015.
19. Kateh F, Nagbe T, Kieta A, Barskey A, Gasasira AN, Driscoll A, Tucker A, Christie A, Karmo B, Scott C, Bowah C, Barradas D, Blackley D, Dweh E, Warren F, Mahoney F, Kassay G, Calvert GM, Castro G, Logan G, Appiah G, Kirking H, Koon H, Papowitz H, Walke H, Cole IB, Montgomery J, Neatherlin J, Tappero JW, Hagan JE, Forrester J, Woodring J, Mott J, Attfield K, DeCock K, Lindblade KA, Powell K, Yeoman K, Adams L, Broyles LN, Slutsker L, Larway L, Belcher L, Cooper L, Santos M, Westercamp M, Weinberg MP, Massoudi M, Dea M, Patel M, Hennessey M, Fomba M, Lubogo M, Maxwell N, Moonan P, Arzoaquoi S, Gee S, Zayzay S, Pillai S, Williams S, Zarecki SM, Yett S, James S, Grube S, Gupta S, Nelson T, Malibiche T, Frank W, Smith W, Nyenswah T. **Rapid response to Ebola outbreaks in remote areas - Liberia, July-November 2014**. MMWR Morb Mortal Wkly Rep. 2015 Feb 27;64(7):188-92.
20. Lindblade KA, Kateh F, Nagbe TK, Neatherlin JC, Pillai SK, Attfield KR, Dweh E, Barradas DT, Williams SG, Blackley DJ, Kirking HL, Patel MR, Dea M, Massoudi MS, Wannemuehler K, Barskey AE, Zarecki SL, Fomba M, Grube S, Belcher L, Broyles LN, Maxwell TN, Hagan JE, Yeoman K, Westercamp M, Forrester J, Mott J, Mahoney F, Slutsker L, DeCock KM, Nyenswah T. **Decreased Ebola Transmission after Rapid Response to Outbreaks in Remote Areas, Liberia, 2014**. Emerg Infect Dis. 2015 Oct;21(10):1800-7.
21. Liu J, Ochieng C, Wiersma S, Ströher U, Towner JS, Whitmer S, Nichol ST,Moore CC, Kersh GJ, Kato C, Sexton C, Petersen J, Massung R, Hercik C, Crump JA,Kibiki G, Maro A, Mujaga B, Gratz J, Jacob ST, Banura P, Scheld WM, Juma B,Onyango CO, Montgomery JM, Houpt E, Fields B. **Development of a TaqMan array card for acute-febrile-illness outbreak investigation and surveillance of emerging pathogens, including Ebola virus**. J Clin Microbiol. 2016;54:49-58.
22. Mate SE, Kugelman JR, Nyenswah TG, Ladner JT, Wiley MR, Cordier-Lassalle T, Christie A, Schroth GP, Gross SM, Davies-Wayne GJ, Shinde SA, Murugan R, Sieh SB, Badio M, Fakoli L, Taweh F, de Wit E, van Doremalen N, Munster VJ, Pettitt J, Prieto K, Humrighouse BW, Ströher U, DiClaro JW, Hensley LE, Schoepp RJ, Safronetz D, Fair J, Kuhn JH, Blackley DJ, Laney AS, Williams DE, Lo T, Gasasira A, Nichol ST, Formenty P, Kateh FN, De Cock KM, Bolay F, Sanchez-Lockhart M, Palacios G. **Molecular Evidence of Sexual Transmission of Ebola Virus**. N Engl J Med. 2015 Dec 17;373(25):2448-54.
23. McCarron M, Munyua P, Cheng PY, Manga T, Wanjohi C, Moen A, Mounts A, Katz MA. **Understanding the poultry trade network in Kenya: Implications for regional disease prevention and control**. Prev Vet Med. 2015;120(3-4):321-7.
24. McMorrow ML, Emukule GO, Njuguna HN, Bigogo G, Montgomery JM, Nyawanda B, et al. **The unrecognized burden of influenza in young Kenyan children, 2008-2012**. PloS One. 2015;10(9):e0138272.
25. McMorrow ML, Emukule GO, Njuguna HN, Bigogo G, Montgomery JM, Nyawanda B, Audi A, Breiman RF, Katz MA, Cosmas L, Waiboci LW, Duque J, Widdowson MA, Mott JA. **Severe acute respiratory illness deaths in Sub-Saharan Africa and the role of influenza: a case series from 8 countries**. J Infect Dis. 2015;212(6):853-60. Epub 2015.

26. Mohamed GA, Ahmed JA, Marano N, Mohamed A, Moturi E, Burton W, Otieno S, Fields B, Montgomery J, Kabugi W, Musa H, Cookson ST. **Etiology and incidence of viral acute respiratory infections among refugees 5 years and older in Hagadera Camp, Dadaab, Kenya**. Am J Trop Med Hyg. 2015;93(6):1371-6.
27. Mosites EM, Rabinowitz PM, Thumbi SM, Montgomery JM, Palmer GH, May S, Rowhani-Rahbar A, Neuhouser ML, Walson JL. **The relationship between livestock ownership and child stunting in three countries in eastern Africa using national survey data**. PLoS One. 2015;10(9):e0136686.
28. Nanyingi MO, Munyua P, Kiama SG, Muchemi GM, Thumbi SM, Bitek AO, Bett B, Muriithi RM, Njenga MK. **A systematic review of Rift Valley Fever epidemiology 1931-2014**. Infect Ecol Epidemiol. 2015;5:28024.
29. Nichols C, Cruz Espinoza LM, von Kalckreuth V, Aaby P, Ahmed El Tayeb M, Ali M, Aseffa A, Bjerregaard-Andersen M, Breiman RF, Cosmas L, Crump JA, Dekker DM, Gassama Sow A, Gasmelseed N, Hertz JT, Im J, Kabore LP, Keddy KH, Konings F, Valborg Løfberg S, Meyer CG, Montgomery JM, Niang A, Njariharinjakamampionona A, Olack B, Pak GD, Panzner U, Park JK, Park SE, Rabezanahary H, Rakotondrainiarivelo JP, Rakotozandrindrainy R, Raminosoa TM, Rubach MP, Teferi M, Seo HJ, Sooka A, Soura A, Tall A, Toy T, Yeshitela B, Clemens JD, Wierzba TF, Baker S, Marks F. **Bloodstream infections and frequency of pretreatment associated with age and hospitalization status in sub-Saharan Africa**. Clin Infect Dis. 2015;61(Suppl 4):S372-9.
30. Njenga MK, Njagi L, Thumbi SM, Kahariri S, Githinji J, Omondi E, Baden A, Murithi M, Paweska J, Ithondeka PM, Ngeiywa KJ, Dungu B, Donadeu M, Munyua PM4. **Randomized controlled field trial to assess the immunogenicity and safety of rift valley fever clone 13 vaccine in livestock.** PLoS Negl Trop Dis. 2015;9(3):e0003550.
31. Njuguna HN, Montgomery JM, Cosmas L, Wamola N, Oundo JO, Desai M, Buff AM, Breiman RF. **Malaria parasitemia among febrile patients seeking clinical care at an outpatient health facility in an urban informal settlement area in Nairobi, Kenya**. Am J Trop Med Hyg. 2015;15-0293. Epub 2015.
32. Nyenswah TG, Kateh F, Bawo L, Massaquoi M, Gbanyan M, Fallah M, Nagbe TK, Karsor KK, Wesseh CS, Sieh S, Gasasira A, Graaff P, Hensley L, Rosling H, Lo T, Pillai SK, Gupta N, Montgomery JM, Ransom RL, Williams D, Laney AS, Lindblade KA, Slutsker L, Telfer JL, Christie A, Mahoney F, De Cock KM. **Ebola and Its Control in Liberia, 2014-2015**. Emerg Infect Dis. 2016 Feb;22(2):169-77.
33. Ochieng C, Ahenda P, Vittor AY, Nyoka R, Gikunju S, Wachira C, Waiboci L, Umuro M, Kim AA, Nderitu L, Juma B, Montgomery JM, Breiman RF, Fields B. **Seroprevalence of infections with dengue, rift valley fever and chikungunya viruses in Kenya, 2007**. PloS One. 2015;10(7):e0132645.
34. Olack B, Wabwire-Mangen F, Smeeth L, Montgomery JM, Kiwanuka N, Breiman RF. **Risk factors of hypertension among adults aged 35–64 years living in an urban slum, Nairobi, Kenya**. BMC Public Health. 2015;15:1251.
35. Omballa VO, Musyoka RN, Vittor AY, Wamburu KB, Wachira CM, Waiboci LW, Abudo MU, Juma BW, Kim AA, Montgomery JM, Breiman RF, Fields BS. **Serologic evidence of the geographic distribution of bacterial zoonotic agents in Kenya, 2007**. Am J Trop Med Hyg. 2016;94(1):43-51.
36. O'Meara WP, Mott JA, Laktabai J, Wamburu K, Fields B, Armstrong J, Taylor SM, MacIntyre C, Sen R, Menya D, Pan W, Nicholson BP, Woods CW, Holland TL. **Etiology of pediatric fever in Western Kenya: a case-control study of falciparum malaria, respiratory viruses, and streptococcal pharyngitis**. Am J Trop Med Hyg. 2015;92(5):1030-7.
37. Omore R, Osawa F, Musia J, Rha B, Ismail A, Kiulia NM, Moke F, Vulule J, Wainaina AM, Tole J, Machoki SM, Nuorti JP, Breiman RF, Parashar UD, Montgomery JM, Tate JE. **Intussusception cases among children admitted to referral hospitals in Kenya, 2002—2013: implications for monitoring postlicensure safety of rotavirus vaccines in Africa**. J Pediatric Infect Dis Soc. 2015;2015::1-5. Epub 2015.
38. Osoro EM, Munyua P, Omulo S, Ogola E, Ade F, Mbatha P, Mbabu M, Ng'ang'a Z, Kairu S, Maritim M, Thumbi SM, Bitek A, Gaichugi S, Rubin C, Njenga K, Guerra M. S**trong association between human and animal brucella seropositivity in a linked study in Kenya, 2012-2013**. Am J Trop Med Hyg.2015;93(2):224-31.
39. Thumbi SM, Njenga MK, Marsh TL, Noh S, Otiang E, Munyua P, Ochieng L, Ogola E, Yoder J, Audi A, Montgomery JM, Bigogo G, Breiman RF, Palmer GH, McElwain TF. **Linking human health and livestock health: a "one-health" platform for integrated analysis of human health, livestock health, and economic welfare in livestock dependent communities**. PloS One. 2015;10(3):e0120761.

40. Verani JR, Toroitich S, Auko J, Kiplang'at S, Cosmas L, Audi A, Mogeni OD, Aol G, Oketch D, Odiembo H, Katieno J, Wamola N, Onyango CO, Juma BW, Fields BS, Bigogo G, Montgomery JM. **Burden of invasive nontyphoidal salmonella disease in a rural and urban site in Kenya, 2009-2014**. Clin Infect Dis. 2015;61(Suppl 4):S302-9.
41. Wong JM, Cosmas L, Nyachieo D, Williamson JM, Olack B, Okoth G, Njuguna H, Feikin DR, Burke H, Montgomery JM, Breiman RF. **Increased rates of respiratory and diarrheal illnesses in HIV-negative people living with HIV-infected individuals in a densely populated urban slum**. J Infect Dis. 2015;212(5):745-53. Epub 2015.

Western Kenya 2015 Publications

1. Adjuik MA, Allan R, Anvikar AR, Ashley EA, Ba MS, Barennes H, Barnes KI, Bassat Q, Baudin E, Björkman A, Bompart F, Bonnet M, Borrmann S, Brasseur P, Bukirwa H, Checchi F, Cot M, Dahal P, D'Alessandro U, Deloron P, Desai M, Diap G, Djimde AA, Dorsey G, Doumbo OK, Espié E, Etard JF, Fanello CI, Faucher JF, Faye B, Flegg JA, Gaye O, Gething PW, González R, Grandesso F, Guerin PJ, Guthmann JP, Hamour S, Hasugian AR, Hay SI, Humphreys GS, Jullien V, Juma E, Kamya MR, Karema C, Kiechel JR, Kremsner PG, Krishna S, Lameyre V, Ibrahim LM, Lee SJ, Lell B, Mårtensson A, Massougbodji A, Menan H, Ménard D, Menéndez C, Meremikwu M, Moreira C, Nabasumba C, Nambozi M, Ndiaye JL, Nikiema F, Nsanzabana C, Ntoumi F, Ogutu BR, Olliaro P, Osorio L, Ouédraogo JB, Penali LK, Pene M, Pinoges L, Piola P, Price RN, Roper C, Rosenthal PJ, Rwagacondo CE, Same-Ekobo A, Schramm B, Seck A, Sharma B, Sibley CH, Sinou V, Sirima SB, Smith JJ, Smithuis F, Somé FA, Sow D, Staedke SG, Stepniewska K, Swarthout TD, Sylla K, Talisuna AO, Tarning J, Taylor WR, Temu EA, Thwing JI, Tjitra E, Tine RC, Tinto H, Vaillant MT, Valecha N, Van den Broek I, White NJ, Yeka A, Zongo I. **The effect of dosing strategies on the therapeutic efficacy of artesunate-amodiaquine for uncomplicated malaria: a meta-analysis of individual patient data**. BMC Med. 2015; 13:66
2. Agaya J, Nnadi CD, Odhiambo J, Obonyo C, Obiero V, Lipke V, Okeyo E, Cain K, Oeltmann JE. **Tuberculosis and latent tuberculosis infection among healthcare workers in Kisumu, Kenya**. Trop Med Int Health. 2015;20(12):1797-804.
3. Behling J, Chan AK, Zeh C, Nekesa C, Heinzerling L. **Evaluating HIV prevention programs: herpes simplex virus type 2 antibodies as biomarker for sexual risk behavior in young adults in resource-poor countries**. PLoS One. 2015;10(5):e0128370.
4. Borgdorff MW, Cain KP, DeCock KM. **The molecular epidemiology of tuberculosis in settings with a high HIV prevalence: implications for control**. J Infect Dis. 2015;211(1):8-9.
5. Burmen B, Modi S, Cavanaugh JS, Muttai H, McCarthy KD, Alexander H, Cain K. **Tuberculosis screening outcomes for newly diagnosed persons living with HIV, Nyanza Province, Kenya, 2009**. Int J Tuberc Lung Dis. 2016;20(1):79-84.
6. Burton DC, Bigogo GM, Audi AO, Williamson J, Munge K, Wafula J, Ouma D, Khagayi S, Mugoya I, Mburu J, Muema S, Bauni E, Bwanaali T, Feikin DR, Ochieng PM, Mogeni OD, Otieno GA, Olack B, Kamau T, Van Dyke MK, Chen R, Farrington P, Montgomery JM, Breiman RF, Scott JA, Laserson KF. **Risk of injection-site abscess among infants receiving a preservative-free, two-dose vial formulation of pneumococcal conjugate vaccine in Kenya**. PLoS One. 2015;10(10):e0141896.
7. Byass P, Herbst K, Fottrell E, Ali MM, Odhiambo F, Amek N, Hamel MJ, Laserson KF, Kahn K, Kabudula C, Mee P, Bird J, Jakob R, Sankoh O, Tollman SM. **Comparing verbal autopsy cause of death findings as determined by physician coding and probabilistic modelling: a public health analysis of 54, 000 deaths in Africa and Asia**. J Glob Health. 2015;5(1):010402.
8. Briët OJ, Huho BJ, Gimnig JE, Bayoh N, Seyoum A, Sikaala CH, Govella N, Diallo DA, Abdullah S, Smith TA, Killeen GF. **Applications and limitations of Centers for Disease Control and Prevention miniature light traps for measuring biting densities of African malaria vector populations: a pooled-analysis of 13 comparisons with human landing catches**. Malar J. 2015;14:247.
9. Cooke MK, Kahindi SC, Oriango RM, Owaga C, Ayoma E, Mabuka D, Nyangau D, Abel L, Atieno E, Awuor S, Drakeley C, Cox J, Stevenson J. **'A bite before bed': exposure to malaria vectors outside the times of net use in the highlands of Western Kenya**. Malar J. 2015;14:259.
10. Davis SM, Wiegand RE, Mulama F, Kareko EI, Harris R, Ochola E, Samuels AM, Rawago F, Mwinzi PM, Fox LM, Odiere MR, Won KY. **Morbidity associated with schistosomiasis before and after treatment in young children in Rusinga Island, Western Kenya**. Am J Trop Med Hyg. 2015;92(5):952-8.

11. Dellicour S, Desai M, Aol G, Oneko M, Ouma P, Bigogo G, Burton DC, Breiman RF, Hamel MJ, Slutsker L, Feikin D, Kariuki S, Odhiambo F, Pandit J, Laserson KF, Calip G, Stergachis A, ter Kuile FO. **Risks of miscarriage and inadvertent exposure to artemisinin derivatives in the first trimester of pregnancy: a prospective cohort study in Western Kenya**. Malar J. 2015;14(1):461.
12. Desai M, Gutman J, Taylor SM, Wiegand RE, Khairallah C, Kayentao K, Ouma P, Coulibaly SO, Kalilani L, Mace KE, Arinaitwe E, Mathanga DP, Doumbo O, Otieno K, Edgar D, Chaluluka E, Kamuliwo M, Ades V, Skarbinski J, Shi YP, Magnussen P, Meshnick S, Ter Kuile FO. **Impact of sulfadoxine-pyrimethamine resistance on effectiveness of intermittent preventive therapy for malaria in pregnancy at clearing infections and preventing low birth weight**. Clin Infect Dis. 2016;62(3):323-33.
13. Desai M, Gutman J, L'lanziva A, Otieno K, Juma E, Kariuki S, Ouma P, Were V, Laserson K, Katana A, Williamson J, Ter Kuile FO. **Intermittent screening and treatment or intermittent preventive treatment with dihydroartemisinin-piperaquine versus intermittent preventive treatment with sulfadoxine-pyrimethamine for the control of malaria during pregnancy in Western Kenya: an open-label, three-group, randomised controlled superiority trial**. Lancet. 2015;386(10012):2507-19.
14. Fernandes S, Sicuri E, Kayentao K, van Eijk AM, Hill J, Webster J, Were V, Akazili J, Madanitsa M, ter Kuile FO, Hanson K. **Cost-effectiveness of two versus three or more doses of intermittent preventive treatment for malaria during pregnancy in sub-Saharan Africa: a modelling study of meta-analysis and cost data**. Lancet Glob Health. 2015;3(3):e143-53.
15. Fonjungo PN, Boeras DI, Zeh C, Alexander H, Parekh BS, Nkengasong JN. **Access and quality of HIV-related point-of-care diagnostic testing in global health programs**. Clin Infect Dis. 2016;62(3):369-74.
16. Foo KT, Blackstock AJ, Ochola EA, Matete DO, Mwinzi PN, Montgomery SP, Karanja DM, Secor WE. **Evaluation of point-of-contact circulating cathodic antigen assays for the detection of Schistosoma mansoni infection in low-, moderate-, and high-prevalence schools in Western Kenya**. Am J Trop Med Hyg. 2015;92(6):1227-32.
17. Gatei W, Gimnig JE, Hawley W, Ter Kuile F, Odero C, Iriemenam NC, Shah MP, Howard PP, Omosun YO, Terlouw DJ, Nahlen B, Slutsker L, Hamel MJ, Kariuki S, Walker E, Shi YP. **Genetic diversity of Plasmodium falciparum parasite by microsatellite markers after scale-up of insecticide-treated bed nets in Western Kenya**. Malar J. 2015;13(Suppl 1):S495.
18. Hill J, Kayentao K, Achieng F, Diarra S, Dellicour S, Diawara SI, Hamel MJ, Ouma P, Desai M, Doumbo OK, ter Kuile FO, Webster J. **Access and use of interventions to prevent and treat malaria among pregnant women in Kenya and Mali: a qualitative study**. PLoS One. 2015;10(3):e0119848.
19. Inzaule SC, Hamers RL, Zeh CE, Rinke de Wit TF. **Stringent HIV viral load threshold for virological failure using dried blood spots: is the perfect the enemy of the good**. J Acquir Immune Defic Syndr. 2016;71(1):e30-3.
20. Iuliano AD, Weidle PJ, Brooks JT, Masaba R, Girde S, Ndivo R, Ogindo P, Omolo P, Zeh C, Thomas TK. **Neutropenia in HIV-infected Kenyan women receiving triple antiretroviral prophylaxis to prevent mother-to-child HIV transmission is not associated with serious clinical sequelae**. J Int Assoc Provid AIDS Care. 2015;14(3):261-8.
21. Jima DD, Luce-Fedrow A, Yang Y, Maina AN, Snesrud EC, Otiang E, Njenga K, Jarman RG, Richards AL, Hang J. **Whole-genome sequence of "candidatus rickettsia asemboensis" strain NMRCii, isolated from fleas of Western Kenya**. Genome Announcements. 2015;3(2):e00018-15.
22. Kimeu M, Burmen B, Audi B, Adega A, Owuor K, Arodi S, Bii D, Zielinski-Gutiérrez E. **The relationship between adherence to clinic appointments and year-one mortality for newly enrolled HIV infected patients at a regional referral hospital in Western Kenya, January 2011-December 2012**. AIDS Care. 2015;2015:1-7.
23. Kinuthia J, Drake AL, Matemo D, Richardson BA, Zeh C, Osborn L, Overbaugh J, McClelland RS, John-Stewart G. **HIV acquisition during pregnancy and postpartum is associated with genital infections and partnership characteristics**. AIDS. 2015;29(15):2025-33.

24. Kleinschmidt I, Mnzava AP, Kafy HT, Mbogo C, Bashir AI, Bigoga J, Adechoubou A, Raghavendra K, Knox TB, Malik EM, Nkuni ZJ, Bayoh N, Ochomo E, Fondjo E, Kouambeng C, Awono-Ambene HP, Etang J, Akogbeto M, Bhatt R, Swain DK, Kinyari T, Njagi K, Muthami L, Subramaniam K, Bradley J, West P, Massougbodji A, Okê-Sopoh M, Hounto A, Elmardi K, Valecha N, Kamau L, Mathenge E, Donnelly MJ. **Design of a study to determine the impact of insecticide resistance on malaria vector control: a multi-country investigation**. Malar J. 2015;14:282.
25. Lucchi NW, Komino F, Okoth SA, Goldman I, Onyona P, Wiegand RE, Juma E, Shi YP, Barnwell JW, Udhayakumar V, Kariuki S. **In vitro and molecular surveillance for antimalarial drug resistance in Plasmodium falciparum parasites in Western Kenya reveals sustained artemisinin sensitivity and increased chloroquine sensitivity. Antimicrob Agents Chemother**. 2015;59(12):7540-7.
26. Lucchi NW, Okoth SA, Komino F, Onyona P, Goldman IF, Ljolje D, Shi YP, Barnwell JW, Udhayakumar V, Kariuki S. **Increasing prevalence of a novel triple-mutant dihydropteroate synthase genotype in Plasmodium falciparum in Western Kenya**. Antimicrob Agents Chemother. 2015;59(7):3995-4002.
27. Maman D, Zeh C, Mukui I, Kirubi B, Masson S, Opolo V, Szumilin E, Riche B, Etard JF. **Cascade of HIV care and population viral suppression in a high-burden region of Kenya**. AIDS. 2015;29(12):1557-65.
28. Mason L, Dellicour S, Ter Kuile F, Ouma P, Phillips-Howard P, Were F, Laserson K, Desai M. **Barriers and facilitators to antenatal and delivery care in Western Kenya: a qualitative study**. BMC Pregnancy Childbirth. 2015;15:26.
29. McMorrow ML, Emukule GO, Njuguna HN, Bigogo G, Montgomery JM, Nyawanda B, Audi A, Breiman RF, Katz MA, Cosmas L, Waiboci LW, Duque J, Widdowson MA, Mott JA. **The unrecognized burden of influenza in young Kenyan children, 2008-2012**. PLoS One. 2015; 10(9):e0138272.
30. Musau S, McCarthy K, Okumu A, Shinnick T, Wandiga S, Williamson J, Cain K. **Experience in implementing a quality management system in a tuberculosis laboratory, Kisumu, Kenya**. Int J Tuberc Lung Dis. 2015;19(6):693-5.
31. Mwinzi PN, Muchiri G, Wiegand RE, Omedo M, Abudho B, Karanja DM, Montgomery SP, Secor WE. **Predictive value of school-aged children's schistosomiasis prevalence and egg intensity for other age groups in Western Kenya**. Am J Trop Med Hyg. 2015;93(6):1311-7.
32. Nduba V, Hoog AH, Mitchell E, Onyango P, Laserson K, Borgdorff M. **Prevalence of tuberculosis in adolescents, Western Kenya: implications for control programs**. Int J Infect Dis. 2015;35:11-7.
33. Njuguna HN, Montgomery JM, Cosmas L, Wamola N, Oundo JO, Desai M, Buff AM, Breiman RF. **Malaria parasitemia among febrile patients seeking clinical care at an outpatient health facility in an urban informal settlement area in Nairobi, Kenya**. Am J Trop Med Hyg. 2016;94(1):122-7.
34. Ochomo E, Subramaniam K, Kemei B, Rippon E, Bayoh NM, Kamau L, Atieli F, Vulule JM, Ouma C, Gimnig J, Donnelly MJ, Mbogo C. **Presence of the knockdown resistance mutation, Vgsc-1014F in Anopheles gambiae and An. arabiensis in Western Kenya**. Parasit Vectors. 2015; 8:616.
35. Odhiambo C, Zeh C, Ondoa P, Omolo P, Akoth B, Lwamba H, Lando R, Williamson J, Otieno J, Masaba R, Weidle P, Thomas T, KiBS Team. **Anemia and red blood cell abnormalities in HIV-infected and HIV-exposed breastfed infants: a secondary analysis of the Kisumu breastfeeding study**. PLoS One. 2015;10(11):e0141599.
36. Odhiambo C, Oyaro B, Odipo R, Otieno F, Alemnji G, Williamson J, Zeh C. **Evaluation of locally established reference intervals for hematology and biochemistry parameters in Western Kenya**. PLoS One. 2015;10(4):e0123140.
37. Ojwang'VO, J Penner, C Blat, Agot K, Bukusi EA, Cohen CR. **Loss to follow-up among youth accessing outpatient HIV care and treatment services in Kisumu, Kenya**. AIDS Care. 2015;2015:1-8.
38. O'Meara WP, Mott JA, Laktabai J, Wamburu K, Fields B, Armstrong J, Taylor SM, MacIntyre C, Sen R, Menya D, Pan W, Nicholson BP, Woods CW, Holland TL. **Etiology of pediatric fever in Western Kenya: a case-control study of falciparum malaria, respiratory viruses, and streptococcal pharyngitis**. Am J Trop Med Hyg. 2015;92(5):1030-7.
39. Otieno FO, Ndivo R, Oswago S, Pals S, Chen R, Thomas T, Kunneke E, Mills LA, McLellan-Lemal E. **Correlates of prevalent sexually transmitted infections among participants screened for an HIV incidence cohort study in Kisumu, Kenya**. Int J STD AIDS. 2015;26(4):225-37.

40. Phillips-Howard PA, Otieno G, Burmen B, Otieno F, Odongo F, Odour C, Nyothach E, Amek N, Zielinski-Gutierrez E, Odhiambo F, Zeh C, Kwaro D, Mills LA, Laserson K. **Menstrual needs and associations with sexual and reproductive risks in rural Kenyan females: a cross-sectional behavioral survey linked with HIV prevalence**. J Womens Health (Larchmt). 2015;24(10):801-11.
41. Reed JB, Grund J, Liu Y, Mwandi Z, Howard AA, McNairy ML, Chesang K, Cherutich P, Bock N. **Evaluation of loss-to-follow-up and postoperative adverse events in a voluntary medical male circumcision program in Nyanza Province, Kenya**. J Acquir Immune Defic Syndr. 2015;69(1):e13-23.
42. Shah M, Omosun Y, Lal A, Odero C, Gatei W, Otieno K, Gimnig JE, ter Kuile F, Hawley WA, Nahlen B, Kariuki S, Walker E, Slutsker L, Hamel M, Shi YP. **Assessment of molecular markers for anti-malarial drug resistance after the introduction and scale-up of malaria control interventions in Western Kenya**. Malar J. 2015;14:75.
43. Sharma A, Ndisha M, Ngari F, Kipruto H, Cain KP, Sitienei J, Bloss E. **A review of data quality of an electronic tuberculosis surveillance system for case-based reporting in Kenya**. Eur J Public Health. 2015;25(6):1095-7.
44. Sharma A, Musau S, Heilig CM, Okumu AO, Opiyo EO, Basiye FL, Miruka FO, Kioko JK, Sitienei JK, Cain KP. **Assessing the effect of decentralisation of laboratory diagnosis for drug-resistant tuberculosis in Kenya**. Int J Tuberc Lung Dis. 2015;19(11):1348-53.
45. Sicuri E, Fernandes S, Macete E, González R, Mombo-Ngoma G, Massougbodgi A, Abdulla S, Kuwawenaruwa A, Katana A, Desai M, Cot M, Ramharter M, Kremsner P, Slustker L, Aponte J, Hanson K, Menéndez C. **Economic evaluation of an alternative drug to sulfadoxine-pyrimethamine as intermittent preventive treatment of malaria in pregnancy**. PLoS One. 2015;10(4):e0125072.
46. Sewe M, Rocklöv J, Williamson J, Hamel M, Nyaguara A, Odhiambo F, Laserson K. **The association of weather variability and under five malaria mortality in KEMRI/CDC HDSS in Western Kenya 2003 to 2008: a time series analysis**. Int J Environ Res Public Health. 2015;12(2):1983-97.
47. Slayton RB, Murphy JL, Morris J, Faith SH, Oremo J, Odhiambo A, Ayers T, Feinman SJ, Brown AC, Quick RE. **A cluster randomized controlled evaluation of the health impact of a novel antimicrobial hand towel on the health of children under 2 years old in rural communities in Nyanza Province, Kenya**. Am J Trop Med Hyg. 2016;94(2):437-44.
48. Taylor SM, Parobek CM, DeConti DK, Kayentao K, Coulibaly SO, Greenwood BM, Tagbor H, Williams J, Bojang K, Njie F, Desai M, Kariuki S, Gutman J, Mathanga DP, Mårtensson A, Ngasala B, Conrad MD, Rosenthal PJ, Tshefu AK, Moormann AM, Vulule JM, Doumbo OK, Ter Kuile FO, Meshnick SR, Bailey JA, Juliano JJ. **Absence of putative artemisinin resistance mutations among plasmodium falciparum in sub-Saharan Africa: a molecular epidemiologic study**. J Infect Dis. 2015; 211(5):680-8.
49. Tinto H, Sevene E, Dellicour S, Calip GS, d'Alessandro U, Macete E, Nakanabo-Diallo S, Kazienga A, Valea I, Sorgho H, Valá A, Augusto O, Ruperez M, Menendez C, Ouma P, Desai M, Ter Kuile F, Stergachis A. **Assessment of the safety of antimalarial drug use during early pregnancy (ASAP): protocol for a multicenter prospective cohort study in Burkina Faso, Kenya and Mozambique**. Reprod Health. 2015;12(1):112.
50. Titchmarsh L, Zeh C, Verpoort T, Allain JP, Lee H. **Leukodepletion as a point-of-care method for monitoring HIV-1 viral load in whole blood**. J Clin Microbiol. 2015;53(4):1080-6.
51. White MT, Verity R, Griffin JT, Asante KP, Owusu-Agyei S, Greenwood B, Drakeley C, Gesase S, Lusingu J, Ansong D, Adjei S, Agbenyega T, Ogutu B, Otieno L, Otieno W, Agnandji ST, Lell B, Kremsner P, Hoffman I, Martinson F, Kamthunzu P, Tinto H, Valea I, Sorgho H, Oneko M, Otieno K, Hamel MJ, Salim N, Mtoro A, Abdulla S, Aide P, Sacarlal J, Aponte JJ, Njuguna P, Marsh K, Bejon P, Riley EM, Ghani AC. **Immunogenicity of the RTS,S/AS01 malaria vaccine and implications for duration of vaccine efficacy: secondary analysis of data from a phase 3 randomised controlled trial**. Lancet Infect Dis. 2015;15(12):1450-8.
52. Wong JM, Cosmas L, Nyachieo D, Williamson JM, Olack B, Okoth G, Njuguna H, Feikin DR, Burke H, Montgomery JM, Breiman RF. **Increased rates of respiratory and diarrheal illnesses in HIV-negative people living with HIV-infected individuals in a densely populated urban slum.** J Infect Dis. 2015;212:745-53. Epub 2015.
53. Worrell CM, Bartoces M, Karanja DM, Ochola EA, Matete DO, Mwinzi PN, Montgomery SP, Secor WE. **Cost analysis of tests for the detection of schistosoma mansoni infection in children in Western Kenya**. Am J Trop Med Hyg. 2015;92(6):1233-9.

For more information please contact
Centers for Disease Control and Prevention—Kenya
P.O Box 606-00621, Village Market
Nairobi, Kenya
Telephone: +254-2-867000
Web: www.cdc.gov/countries/Kenya
Publication date: May 2016

CS 265128-A