



CHAMPS



Child Health and Mortality Prevention Surveillance

Year 5
Annual
Report

A letter from our Executive Director



Child Health and Mortality Prevention Surveillance (CHAMPS) envisions a world where evidence-based interventions offer every child an equal chance to thrive.

More than 5 million children under the age of five died in 2019 alone. Most of these deaths were preventable, yet their precise causes are often unknown because of gaps in clinical evaluation, disease surveillance, and diagnostic testing. This is especially true in low-resource countries, where mortality rates are highest. Using innovative approaches, Child Health and Mortality Prevention Surveillance (CHAMPS) works to close this information gap by gathering and sharing the scientific evidence needed to save young lives.

This report summarizes the CHAMPS network's notable achievements from our fifth year (July 2019 through June 2020), including key accomplishments linked to each of our main objectives. Early in 2020, the COVID-19 pandemic presented public health professionals and researchers around the world with new and unforeseeable challenges. Social distancing mandates, institutional restrictions, and limitations on international shipping and travel temporarily slowed work at CHAMPS sites and forced us to adapt to the new landscape. I'm proud to report that CHAMPS teams are contributing their skills and resources to local pandemic responses while making significant progress toward our overall objectives.

Now in our sixth year, CHAMPS is producing results that better define causes of child mortality, disseminating those results to public health leaders, and building capacity and programs in the places where we work. Looking forward, we are expanding the push to make data and findings available through a range of channels and partnerships, expanding our network with enrollment and data collection in new sites, continuing our emphasis on scientific innovation, and ensuring that data are not only collected, but used to drive lifesaving interventions. We hope you enjoy this report and invite you to visit our website at CHAMPShealth.org for the latest news.

A handwritten signature in black ink, appearing to read 'Cynthia G. Whitney'.

Cynthia G. Whitney MD MPH
Principle Investigator and Executive Director
Child Health and Mortality Prevention Surveillance (CHAMPS)
Emory Global Health Institute

CHAMPS works to save children's lives by collecting, analyzing and sharing accurate, timely data about the causes of child mortality in the regions where it is highest.

CHAMPS objectives



Find and track the definitive causes of child mortality.



Generate, disseminate and encourage the use of high-quality data to reduce the rate of child mortality around the world.



Leverage the CHAMPS network to conduct research studies and public health activities.

Where we work

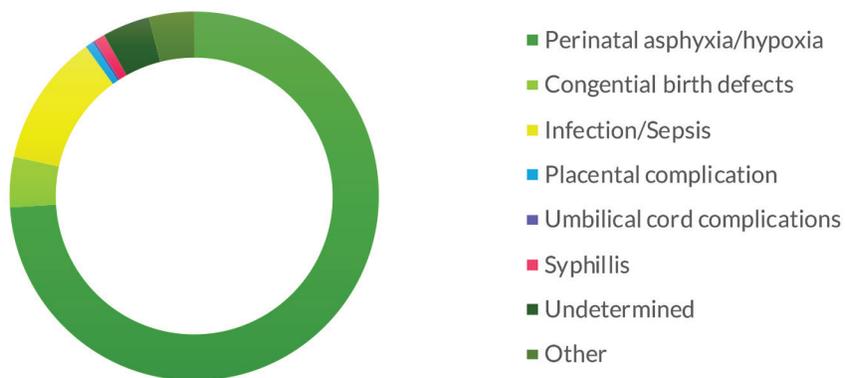


Understanding causes of child mortality where we work

CHAMPS is working to create a world where all children are able to thrive. To understand why a child dies, CHAMPS gathers clinical data, conducts verbal autopsies, performs laboratory tests for key pathogens, and examines tissue samples using polymerase chain reaction (PCR) and pathology techniques; this information is then reviewed by a panel of local experts who determine the specific causes of stillbirth or death in children under five. We then share the data and findings with scientists, policy makers and leaders of national public health institutions working to reduce child mortality.

Among stillbirths enrolled and evaluated through CHAMPS, intrauterine hypoxia is the leading fetal cause of death. Preterm birth complications, birth asphyxia and neonatal sepsis are leading causes for neonates. Among infants and children, malnutrition and infections are most commonly identified. CHAMPS scientists are finding, however, that **a majority of the deaths (53%) have more than one cause in the chain of events leading to a child's death.** Looking at how different diseases and conditions occur together and contribute to child mortality may help improve how prevention programs are designed.

Causes of Stillbirth (n=432)

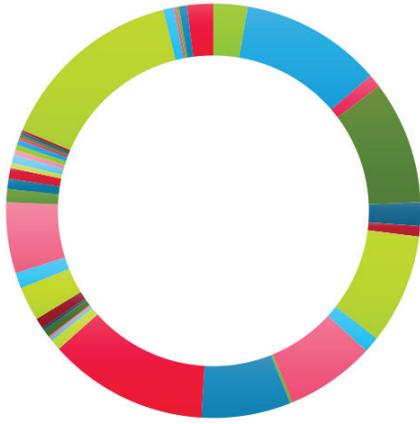


Neonatal Causes of Death (n=709)

- | | |
|---|--------------------------------|
| ■ Perinatal asphyxia/hypoxia | ■ Syphilis |
| ■ Neonatal preterm birth complication | ■ Diarrheal diseases |
| ■ Neonatal sepsis | ■ HIV |
| ■ Congenital birth defects | ■ Measles |
| ■ Congenital infection | ■ Other infections |
| ■ Neonatal aspiration syndromes | ■ Liver disease |
| ■ Other neonatal disorders | ■ Umbilical cord complications |
| ■ Neonatal encephalopathy | ■ Maternal hypertension |
| ■ Lower respiratory infections | ■ Cesarean delivery |
| ■ Meningitis/encephalopathy | ■ Placental complications |
| ■ Chorioamnionitis and membrane complications | ■ Maternal Infection |
| ■ Obstructed labor and fetal malpresentation | ■ Injury |
| ■ Undetermined | ■ Other |



Infant/Child Causes of Death (n=489)



- Sepsis
- Congenital infection
- Other infections
- Lower respiratory infections
- Neonatal preterm birth complications
- Diarrheal diseases
- Tuberculosis
- Upper respiratory infections
- HIV exposure
- Other respiratory disease
- Injury
- Poisoning
- Paralytic ileus and intestinal obstruction
- Heart diseases
- Epilepsy
- Anemias
- Motor neuron disease
- Other neonatal disorders
- Neonatal encephalopathy
- Undetermined
- Congenital birth defects
- Malaria
- Sudden Infant Death Syndrome
- Meningitis/encephalitis
- Syphilis
- HIV
- Rabies
- Measles
- Liver disease
- Cancer
- Other neurological disorders
- Other endocrine, metabolic, blood and immune disorders
- Sickle cell disorders
- Other skin and subcutaneous diseases
- Diabetes
- Other immunodeficiencies
- Malnutrition
- Perinatal asphyxia/hypoxia
- Other

Year 5, by the numbers

Conducted



666

Minimally Invasive
Tissue Sampling
(MITS) procedures

Enrolled



1,543

CHAMPS cases

Reached



1,234

Community members
with outreach
activities

DeCoDed



688

CHAMPS-enrolled
deaths

Standardizing and improving the quality of our data collection

CHAMPS strives to ensure data quality and consistency, using state-of-the-art methods to carry out our work. During our fifth year, we continued to work toward standardizing and improving data collection and quality assurance across the network by upgrading data capture forms, increasing data quality checks, establishing systems for internal monitoring, providing new equipment and refining our Demographic Surveillance System (DSS) methods.

Our Social-behavioral Science (SBS) teams conducted 32 rapid qualitative assessments designed to improve network operations and local community health. Assessments covered topics such as: death notifications, reasons for refusal and consent to participate in CHAMPS, antenatal care, maternal and child health (MCH), and identification of site-specific gatekeepers. Findings from this work helped inform improvements in surveillance activities (Box 1).



Refining Demographic Surveillance

Demographic surveillance systems (DSS) are used to monitor populations and their health over time within a geographically defined area. These systems track births, deaths, migrations, and socioeconomic and health circumstances in places where this information may not otherwise be reliably collected. DSS plays an important role in CHAMPS work as it provides us with key information to better understand the characteristics of the populations in which we work. It also provides critical data on levels of child mortality, trends and general causes of child death, and individual, household, and community factors associated with mortality.

In Year 5 we began revamping DSS at each of our sites to standardize and improve the quality of data collected. In Ethiopia and Bangladesh, catchment areas were expanded to increase enrollment. Across all sites, DSS catchment included approximately 137,845 children under 5 years of age and 25,117 live births.

Box 1: Improving MITS consent in Bangladesh

In 2019, CHAMPS's SBS team in Bangladesh conducted a rapid assessment to better understand why some families agree to participate in Minimally-Invasive Tissue Sampling, or MITS, while others decline. The SBS team approached decision makers from 14 families (six consented to MITS, five refused and three unable to reach) for interviews.

Some families reported that they declined to participate because they were unfamiliar with the MITS team and therefore did not trust them when approached for consent. Team members then adjusted their approach to ensure introductory and follow-up meetings with families upon arrival to health facilities, rather than waiting until after a child's death. The assessment also indicated that MITS teams should provide more time for families to grieve and process their loss before approaching with the request to participate in MITS. By implementing these and other rapport- and trust-building recommendations, MITS consent rates improved at the site.

Implementing pregnancy surveillance

According to the World Health Organization, 47% of deaths among children under 5 years of age in 2019 occurred in the neonatal period. In CHAMPS, 38% of our enrolled deaths through Year 5 were stillbirths and 33% were neonates. Pregnancy surveillance, which allows for better data collection of health indicators during pregnancy and delivery, is key to better understanding the causes of poor pregnancy outcomes that account for this large proportion of child mortality.



In Year 5, CHAMPS developed a standardized pregnancy surveillance platform to identify and track pregnancies and pregnancy outcomes in CHAMPS catchment



Pregnancy surveillance ground activities began in Ethiopia following rapid assessment of surveillance and ultrasound implementation.

areas. The platform is designed to leverage current surveillance programs for use in early pregnancy detection, antenatal care follow-up and timely detection of pregnancy outcomes. It also links to child mortality surveillance and cause of death determination.

CHAMPS pregnancy surveillance collects data from consented women at three time points: during the prenatal period, within 48 hours of delivery, and 42 days following delivery.

Improving methods for assessing nutrition

Assessing nutritional status of CHAMPS cases requires accurate measurements, but the skills and tools needed to take measurements are not available in many places. CHAMPS provided training and equipment for measuring height, weight and mid-upper arm circumference to all seven network sites to improve post-mortem anthropometric measurements. We also pilot-tested use of a novel three-dimensional computerized measurement system, but found that traditional methods were in general more accurate in our settings.



Measuring mid-upper arm circumference during a community screening event

Increasing our pathology capacity

CHAMPS continued to build expertise in pathology in Year 5. The CHAMPS Central Pathology Laboratory (CPL) in the U.S. Centers for Diseases Control and Prevention (CDC) continued to conduct telepathology training sessions for pathologists and teams at each site. In addition, they hosted an in-person, intensive two-week training for pathologists from Bangladesh, Ethiopia, Mozambique, and Sierra Leone.



Microbiology training in Quelimane Central Hospital, Mozambique

CHAMPS's Central Biorepository makes well-characterized specimens available to researchers who need them; more than 4,600 specimens are currently available in our biorepository, with specimens from CHAMPS sites in South Africa and Kenya added in the last year. To increase our capacity for telepathology, CHAMPS upgraded our slide repository storage network. We also began building a specimen inventory management system, a searchable table of all physical specimens that exist within the CHAMPS network.



CHAMPS team in Sierra Leone reviews pathology slides.

Ensuring the best diagnostic methods

CHAMPS created a new TaqMan Array Card (TAC) to perform serotyping on specimens containing *Streptococcus pneumoniae*, a critical step to understanding which deaths may have been vaccine preventable. We also distributed testing kits for sickle cell trait and disease in Kenya, Mali, Mozambique, Ethiopia and Sierra Leone for routine screening.

In collaboration with Emory Eye Center in Kisumu, Kenya, we launched a pilot study to assess whether eye specimens would help determine cause of death. The study aims to collect fundus photographs, intraocular and extraocular fluid, and conjunctival impression cytology from 75 deaths that undergo MITS. By the end of Year 5, the team had collected specimens and photos from 62 deaths.

Building trust through community engagement

CHAMPS SBS activities allow community members to engage directly with CHAMPS's mission and help our teams better understand the culture and context of the places where we work. Talking to community members and leaders about their perceptions of child death, their experiences with the healthcare system, and their willingness to participate in CHAMPS activities is vital to our success. Communication builds mutual understanding and trust, both prerequisites for doing the difficult work of determining why a child has died.

In Year 5 alone, we reached 44,060 community members through 992 outreach events across all seven CHAMPS sites. These included regular meetings with community stakeholders, advisory boards and associations, community feedback sessions, religious meetings, and health promotion events.

CHAMPS team members work to increase program visibility and acceptance of MITS through community meetings.



Community members in Ethiopia listen to CHAMPS messaging on Radio Fana.

Using Theatre for Development in Ethiopia

In Kersa and Harar, Ethiopia, CHAMPS uses participatory community theater to deliver information about child and maternal health, help explain our work and share CHAMPS results. Actors are recruited from the same communities where they perform and help adapt scripts to ensure that the show addresses community needs in an authentic, engaging way. These performances have increased community acceptance of CHAMPS.

Radio program and listening groups

SBS teams in Ethiopia and Sierra Leone use radio programs to raise awareness about CHAMPS program activities and answer frequently asked questions. These radio programs also include information designed to improve maternal and child health and prevent disease. In Ethiopia, the team has aired more than 50 radio episodes, one of which included interviews with family members who had consented to MITS. Radio programs in Sierra Leone are led by community stakeholders and allow individuals to call in with questions.

Generating and sharing data to save lives

CHAMPS's comprehensive, cutting-edge methods generate data that allow scientists and public health leaders to understand, with confidence, why children die in high-mortality areas. CHAMPS aims to ensure that these data are available quickly to anyone to use, with the goal of improving public health practice, advancing scientific understanding, and saving lives.

From sharing data locally...

We share our findings with communities, public health officials and families, giving parents the answers they need, and informing immediate public health action. Across the network, family follow-up plays a large role in CHAMPS work. In many cases, understanding why their child died helps families with the emotional healing process. In instances where CHAMPS has identified a preventable cause of death, follow-up meetings with families can provide information that may prevent future illness and death.

In response to the COVID-19 pandemic, family follow-up efforts adapted to national shutdowns and in-country restrictions, resulting in follow-up being conducted over the phone. Despite these challenges, our sites were able to provide information and counseling to more than 1,200 families who had lost children.



CHAMPS teams deliver cause of death results to families in Mozambique.



...to globally

In Year 5, we increased the amount of data shared within and outside the network. The CHAMPS data team fulfilled 28 standard data requests, created a code repository in [GitHub](#) to publicly share analytic code, and advertised dataset access through an open-source web application called [Dataverse](#).

We also provided custom data sets for analysis to scientists in network sites and at the Bill & Melinda Gates Foundation, RSV GOLD, Flu GOLD, PathAI, Telethon Kids Institute, the WHO verbal autopsy working group and the Institute for Health Metrics and Evaluation (IHME).

CHAMPS analyzed and shared findings with the scientific community, including presentations at Gates Foundation-hosted meetings of global experts on malaria in December 2019 and *Klebsiella pneumoniae* in June 2020. CHAMPS findings of *K. pneumoniae* as a top pathogen in neonatal sepsis and in deaths among children one-to-59 months of age may influence scientific views about the scope of disease caused by this organism.

Sharing CHAMPS findings

Across the network, teams developed more than 30 abstracts for international and national conferences, including 20 that were presented at the 2019 ASTMH Annual Meeting. Of these, 16 were led by scientists based at CHAMPS sites. Twenty-nine abstracts (26 site-led) and two symposia were also submitted for presentation to the 2020 ASTMH Annual Meeting.

In October 2019 we published a [13-manuscript supplement](#) in *Clinical Infectious Diseases* describing an overview of CHAMPS foundational methods and processes, including mortality surveillance, DSS, SBS, DeCoDe and results from South Africa's Sentinel Epidemiology and Etiology data (SEED) pilot studies. CHAMPS also published initial findings in the July 2020 edition of *Lancet Global Health*, where we shared DeCoDe results from 933 cases across five sites from 2016-2018.



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Manuscripts

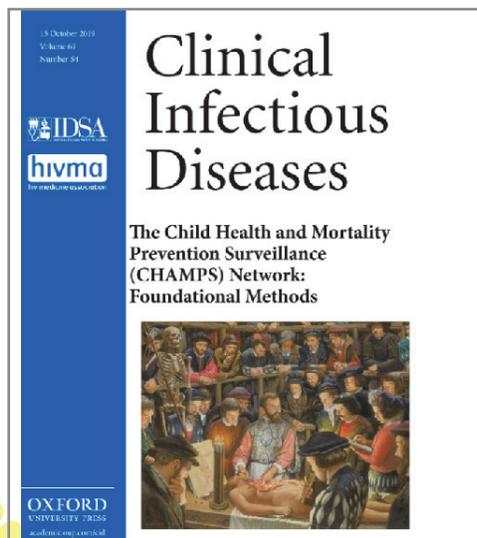


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Scientific Abstracts



CHAMPS team members from South Africa and Mozambique present findings at ASTMH, November, 2019.



Transforming data into action

CHAMPS differs from many research efforts because our scientists engage directly with public health and clinical leaders, share CHAMPS findings, and improve the ability of local, national and global leaders to respond to public health problems as they occur and over the longer term.

We continually work to facilitate the use of CHAMPS data for action at the individual, family, community and public health systems levels. This year we engaged in data to action (D2A) projects in Bangladesh, Ethiopia, Kenya and Mozambique, and have compiled site-led case studies to highlight D2A successes, challenges, and lessons learned. Topics ranged from community perceptions on child malnutrition to improving antibiotic prescribing practices and accuracy of hospital death notification.

How CHAMPS informs everyday medical practice



A testimonial from Dr. Magdalene N. Kuria, pediatrician and child health specialist, Kisumu county

Since CHAMPS began and I started taking part in DeCoDe meetings I have noticed a shift in the way I personally approached critically ill children. I am training my team to be more aggressive in their management of common conditions like malaria. Seeing the number of children who could have been saved if cerebral malaria was diagnosed in time has raised my speed of response to the convulsing child with malaria. I have made a number of observations regarding preventive measures as a result of examining CHAMPS data:

- Sepsis not responding to conventional antibiotics causes many mortalities. From my experience in CHAMPS, gram negative septicemia is high on my list with Klebsiella as a well-known culprit of child mortality. I no longer wait long before going to second line or even third line antibiotics when conventional antibiotics fail.
- A large number of still births and early neonatal deaths have been shown to be totally preventable. Monitoring labor and delivery and proper documentation of the actual status of the fetus are some actions I would like taken during labor and delivery
- I have developed a high index of suspicion as far as malnutrition is concerned. CHAMPS data has suggested that we seem to be missing malnutrition in many sick patients because anthropometric measurements are not being taken when the child is still alive. Many who are diagnosed are not fully managed and end up lost to follow-up.
- In many patients with severe pneumonia, oxygen therapy is sub-optimal. I would like to involve hospital administration and the procurement teams to supply nasal prongs and oxygen masks, and it would be great if the doctors would prescribe oxygen like the drug it is. Proper dosing and monitoring are sadly missing

These and many other observations have greatly impacted my medical practice thanks to CHAMPS.

Responding to COVID-19

The resources CHAMPS has invested in local communities in past years allowed the network to quickly pivot to support urgent, community-centered responses to the COVID-19 pandemic. We were able to use our existing mortality surveillance and community engagement structures to lead and assist with hospital and community-based COVID surveillance and contact tracing. At six sites, CHAMPS enhanced COVID-19 testing capacity by sharing our laboratory equipment, staff and infrastructure. In Kenya, Ethiopia and Sierra Leone, CHAMPS labs were designated as national testing hubs for their respective districts.

Across the network, CHAMPS site teams supported local and national prevention efforts by developing and disseminating community education materials, holding community workshops on containment efforts, and training health professionals in the use of personal protective equipment (PPE). In Sierra Leone, 70% of CHAMPS radio programs were diverted in March 2020 to support the district COVID-19 response.

“The CHAMPS-DHMT partnership in Bombali has been excellent, both in terms of research implementation and support to the health system in general. District health leaders told us that Bombali had one of the most effective COVID-19 responses in the country because of technical support from CHAMPS.”



CHAMPS SBS team members from Sierra Leone assist in sharing COVID-19 sensitization messages with the community.



Dr. Amara Jambai
Deputy Minister for Health II, Ministry of Health and Sanitation, CHAMPS Sierra Leone Site Co-Director

“Shortly after the start of the pandemic, the CVD-Mali CHAMPS team transitioned to COVID-19 response activities to support the Ministry of Health, assisting with COVID surveillance at the facility level, enrolling healthcare workers and monitoring the effects of COVID on health service access and utilization. CVD-Mali staff are currently carrying out a community-based sero-survey in Bamako, as well as enrolling COVID pregnant women cohorts to track possible adverse effects; they are following women through the postpartum period and their infants up to six months of age. CHAMPS has greatly contributed to this effort by helping to identify participants.”



Dr. Samba Sow
Director, Center for Vaccine Development-Mali, CHAMPS Mali Site Co-Director

Responding to COVID-19

“2020 has been an extraordinarily challenging year for the Mozambican CHAMPS site. Although we struggled against restrictions imposed by COVID-19, we were also able to contribute to national efforts by offering laboratory and testing support that reduced time for feedback of results, allowed for prompt contact tracing, and improved time to follow-up for positive patients requiring medical care.”



Dr. Inacio Mandomando
Research Scientist & Coordinator of Diarrheal Disease
Research Area, Manhica Health Center; CHAMPS
Mozambique Site Co-Director

“COVID-19 has limited regular movement across the country and, therefore, many regular CHAMPS activities. To help with pandemic response while continuing to do our work, we’ve led community education efforts, trained health professionals on COVID case management, and conducted COVID-19 testing in our labs.”

CHAMPS team members, Ethiopia



Microbiology team members in Ethiopia help organize COVID-19 testing in serum samples of pregnant women attending ANC.

“Since the beginning of the pandemic, the CHAMPS lab staff has worked with the government to combat COVID-19. We’ve tested more than 60,000 specimens for COVID-19 in the Virology Laboratory of icddr,b and performed full genome sequencing of SARS-COV-2 to identify novel variants. Our staff contributed to the development of the national laboratory manual for molecular diagnosis of SARS-CoV-2 from Clinical Specimens and an online course on COVID-19 testing, which can be used by any lab staff from every corner of the country free of cost.”



Dr. Shams El Arifeen
Senior Director and Senior Scientist, International Centre for Diarrhoeal Disease
Research (icddr,b); CHAMPS Bangladesh Site Co-Director

Dr. Mustafizur Rahman
Senior Scientist and head of virology lab, icddr,b

Looking forward

Year 5's accomplishments have strengthened the CHAMPS network and key partnerships, putting CHAMPS in position to produce more high-quality data, share results, and build capacity across our sites.

The pregnancy surveillance platform was completed in Year 5 and is ready for use by CHAMPS sites in Year 6. CHAMPS sites in Ethiopia, Bangladesh and Kenya will be the first to implement standardized pregnancy surveillance and data collection, followed by Kenya, Mozambique, South Africa, and Sierra Leone.

In Year 6, CHAMPS plans to add a new site in India, bringing the total number of CHAMPS sites to eight, and will begin the selection process for ninth site. Our sites continue to assist with the local COVID-19 response while safely restarting CHAMPS enrollment.

CHAMPS will also focus more resources on disseminating our data and findings. Year 6 will include a focus on communicating and disseminating results, with the launch of a new website, creation of scientific abstracts, and completion of the next set of manuscripts on CHAMPS findings.



CHAMPS's work would not be possible without generous funding and collaboration from the Bill & Melinda Gates Foundation.

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Technical and Implementing Partners

United States

Emory Global Health Institute
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Task Force for Global Health, Public Health Informatics Institute
International Association of National Public Health Institutes (IANPHI)

Bangladesh

International Centre for Diarrheal Disease Research, Bangladesh (icddr,b)
Institute of Epidemiology, Disease Control and Research (IEDCR)
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Mali

Center for Vaccine Development (CVD)-Mali
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Mozambique

Manhiça Health Research Centre (CISM)
National Institute of Health (INS)
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Sierra Leone

Ministry of Health and Sanitation
Crown Agents
ICAP (Columbia University)
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South Africa

University of the Witwatersrand
National Institute for Communicable Diseases

From our program office at Emory Global Health Institute, CHAMPS brings together a global network whose partners understand that maximizing the life-saving impact of our work requires collaboration and data-sharing across teams, disciplines, organizations and borders.

Every individual and organization in the CHAMPS network plays a key role in reducing child mortality.