Child Health and Mortality Prevention Surveillance: An Introduction to Using CHAMPS Data

31 August 2021
CHAMPS Network – Overarching Objectives

Track definitive causes of child mortality in sites throughout Sub-Saharan Africa and South Asia
  - Using Minimally-Invasive Tissue Sampling (MITS)

Produce and disseminate high-quality data to inform policy and public health action

Enable sites to leverage CHAMPS investments to prevent mortality
  - Data-to-Action
CHAMPS Surveillance Sites

- Kisumu, Kenya
- Manhiça, Mozambique
- Soweto, South Africa
- Harar/Kersa, Ethiopia
- Baliakandi/Faridpur, Bangladesh
- Raibareli District, India
- Makeni, Sierra Leone
- Bamako, Mali

**Active sites**

**Launching soon**
Overview of CHAMPS Data Collection
CHAMPS Aims to Deepen Understanding of Causes and Contributors to Under-5 Deaths
CHAMPS determines causes of death in children under 5 using **Minimally Invasive Tissue Sampling (MITS)**, diagnostic testing, clinical records, and verbal autopsy.

Under-5 deaths, stillbirths detected within 24 hours
Parental consent for MITS

Verbal autopsy interviews
Clinical records abstraction

Photographs
Physical measurements

- Blood
- CSF
- NP/OP swab
- Stool
- Liver
- Lung
- Heart
- Brain
- Bone Marrow
- Placenta (when available)
Diagnostic Testing for MITS

<table>
<thead>
<tr>
<th>Culture</th>
<th>HIV, TB, malaria testing</th>
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<tbody>
<tr>
<td>TaqMan Array Cards</td>
<td>Pathology</td>
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</tbody>
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CHAMPS Aims to Deepen Understanding of Causes and Contributors to Under-5 Deaths

- Community Engagement
- Surveillance
- Cause of Death Determination
- Case Enrollment
CHAMPS Determination of Cause of Death (DeCoDe)

DeCoDe Panel

Demographic Data
Verbal Autopsy
Clinical Abstraction
Available medical records
Maternal Abstraction

MITS Collection Data
- Anthropometrics
- Photographs

Other Diagnostics
- Blood and CSF culture
- HIV (PCR)
- TB (GeneXpert)
- Malaria blood smears and RDT

Molecular Diagnostics
- TAC Results

Pathology Results
- Site pathology report
- CDC Central Pathology Laboratory: special stains, immunohistochemistry
- Whole slide images

Cause of Death Assignment
ICD-10 and ICD-PM
**Cause of death assignment following ICD-10 and ICD-PM: importance of causal chain**

### FRAME A: Medical data: Part 1 and 2

<table>
<thead>
<tr>
<th>Part 1</th>
<th>Part 2</th>
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<tr>
<td><img src="image.png" alt="Diagram" /></td>
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<tr>
<th>a</th>
<th>b-c</th>
<th>d</th>
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<tbody>
<tr>
<td><strong>Immediate cause of death</strong></td>
<td><strong>Morbid causes of death</strong></td>
<td><strong>Underlying cause of death</strong></td>
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<tr>
<td>“the disease or complication which directly preceded or directly led to death”</td>
<td>“disease or injury that initiated the train of events leading directly to death, or circumstances of accident or violence which produced the fatal injury”</td>
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**Significant contributor**

**Other conditions that contribute to death**
CHAMPS DeCoDe Standardizations

• Adhere to WHO ICD-10 and ICD-PM guidelines for determining and classifying perinatal and child deaths

• Standardized training provided

• Developed diagnosis standards for interpretation of complete CHAMPS data

• External quality assurance process
CHAMPS DeCoDe Diagnosis Standards (DS)

• Provide guidance to:
  o Standardize interpretation of CHAMPS specific data elements across DeCoDe panels
  o To assign individual diagnoses

• Not an exhaustive list but will be continuously adapted as CHAMPS data informs definitions
**CHAMPS DeCoDe Diagnosis Standards (DS)**

**Bacterial sepsis of the newborn (ND)**

ICD-10 Codes: P36.0 (due to streptococcus, Group B), P36.1 (due to other and unspecified streptococci), P36.2 (due to *Staphylococcus aureus*), P36.3 (due to other and unspecified staphylococci), P36.4 (due to *Escherichia coli*), P36.5 (due to anaerobes), P36.8 (other bacterial sepsis), P36.9 (unspecified)

This DS should be used for sepsis in neonates <28 days old. The Sepsis DS in Section IV should be used for older infants and children.

**Level 1**

- Strong pathological evidence of pyogenic infection in 2 or more tissues with isolation of an organism by culture or immunohistochemical (IHC) evidence of an organism from one or more tissues

OR

- Infection suggested by one of the following laboratory findings:
  - Isolation of a pathogen by culture from a normally sterile body site and judged by panelists not to reflect postmortem contamination
  - Detection of a pathogen by PCR (TAC) in 2 or more tissues
  - Immunohistochemical (IHC) evidence of a pathogen in 2 or more tissues
  - Histological evidence of pyogenic infection in 2 or more tissues
  - Metabolic acidosis (Base excess <10 mmol/L)

PLUS THREE or more of the following clinical signs or clinical laboratory findings (if available) documented in the medical record:

- Temperature >38°C or <35°C
- Tachycardia or new episodes of bradycardia
- Altered mental status, abnormally sleepy, difficult to wake, lethargic or reduced or no spontaneous movement, irritable, or agitated
- Absent or weak cry, weak suck, or difficulty in feeding
- New or increased episodes of apnea, tachypnea, or increased requirement for ventilator support (if available)
- Mottled, pale, cyanotic, delayed capillary refill, diminished pulses, cool extremities or hypotension
- Elevated C-reactive Protein (CRP)
- Increased White Blood Cell (WBC) count for age (based on Table 14.1 in the Harriet Lane Handbook)

**Level 2**

One of the following:

- Moderate pathological evidence of sepsis in 2 or more tissues with isolation or detection of an organism consistent with the infection from one or more tissues
- Isolation of an organism by culture in 2 or more tissues
- Isolation of an organism by culture from one tissue and detection of the organism by PCR in one or more different tissues
- No Level 1 laboratory tests available AND THREE or more clinical signs of sepsis as above documented in the medical record
- One or more of the laboratory findings outlined for Level 1 diagnosis of sepsis above AND THREE or more clinical signs of sepsis above reported by verbal autopsy

**Level 3**

Cases that meet the Level 1 or Level 2 clinical criteria of sepsis above, with suspected infection and symptoms not more likely attributable to another condition, but without sufficient laboratory findings for Level 1 or Level 2 diagnosis. OR cases with laboratory evidence of sepsis that is not attributable to peri-mortem overgrowth or contamination but that does not meet criteria for Level 1 or Level 2 diagnosis above.

(Simonson 2014) (Vergagno 2015) (Shane 2014) (Wynn 2010)
CHAMPS Aims to Deepen Understanding of Causes and Contributors to Under-5 Deaths

Case Enrollment

Cause of Death Determination

Community Engagement

Surveillance

Case Enrollment
CHAMPS Case Example 1

- **Female, Stillbirth**
  - 35 week estimated gestation age (by LMP)
  - Weight 3.8 kg

- **Mother- 20 y/o HIV positive on ART (Dx’ d prior to pregnancy)**
  - Twin pregnancy
  - 4 ANC visits

- Post-mortem HIV, malaria and TB testing negative
- Other twin born alive, APGAR 7/8, weight 2000g.
- Condition felt to result in stillbirth: Obstructed labor

- TAC was positive for *Treponema pallidum*
Case 1 - Immunohistochemistry Results

Liver

Lung

Brain
Case 1 - Placenta Pathology

Mother and twin tested and treated
Where and How to Access CHAMPS Data
Aggregate data in real-time

The Power of Data

CHAMPS' precise, accurate, real-time data explains why children under five are dying.

HTTPS://CHAMPSHEALTH.ORG/DATA
Data Access

• Standard dataset requests from website

Four Levels of Data Access

CHAMPS data can be used for a variety of research and evaluation purposes. For that reason, we offer four levels of data, the first of which — Summarized Data — is accessible here on our site. To access additional levels of data, a request form must be filled out.

Level 1: Summarized Data
Level 2: De-Identified Data
Level 3: Limited Data
Level 4: Potentially Identifiable Data

De-identified data can be downloaded as a curated standard data set after registration and electronic acceptance of a Data Transfer Agreement (DTA).

Standard data set includes:

- Case demographics (including MTS measurements), verbal autopsy, DeCoDe results, TAC results, and lab results
- Additional curated standard datasets in development
- Data transformations performed to de-identify this dataset: Case identifiers replaced with surrogates; dates shifted; narrative/summary fields removed

To view documentation for the de-identified dataset prior to downloading, obtain descriptive metadata or the citation for the dataset, please visit the CHAMPS Dataverse and scroll to the bottom of the page.

To access the CHAMPS R package, visit our GitHub Portal. The package provides utilities to read and transform L2 a data into convenient formats, functions to compute several statistics of interest, and some utilities for presenting these statistics in various formats such as plots and HTML tables.

Register and Request Data
Data Access

- Dataverse houses dataset descriptions and dictionaries (https://dataverse.unc.edu/dataverse/champs)
CHAMPS Code Repository

champs

R package that provides utilities to read and transform CHAMPS L2 study data into convenient formats, as well as functions to compute several statistics of interest. Also includes some utilities for presenting these statistics in various formats such as plots and HTML tables.

Installation

You can install this package using the `remotes` package's `install_github()` function.

If you don't already have the `remotes` package, you can install it with:

```r
install.packages("remotes")
```

Then you can install the `champs` package with:

```r
remotes::install_github("EGHI-CHAMPS/champs-L2-statistics")
```
Public R Code

champs

This website documents the “champs” R package. This package provides utilities to read and transform CHAMPS L2 study data into convenient formats, functions to compute several statistics of interest, and some utilities for presenting these statistics in various formats such as plots and HTML tables.

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```
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```

Documentation

There are several documents that will help you get acquainted with CHAMPS data and how to use the functionality of this package to analyze it. These can be accessed using the “Articles” menu at the top of this website.

- CHAMPS Introduction
- Downloading CHAMPS data
Public R code

• Automate set of standards data requests:
  • Proportion of Condition X in Causal chain by age, site
  • Proportion of TAC detected vs. all cases by age, site
  • Proportions of infectious condition in causal chain vs. TAC-detected by age, site
  • Top pathogens in causal chain by age, site; per syndrome
  • Postmortem interval by specimen type and site, DeCoDe result...
  • Cases with condition in causal chain by age, site by location of death or length of hospitalization
  • Tabulate syndrome combinations for specified etiology
  • All above as plots, tables, heat maps

• Extensive documentation for code
Additional Data Available Upon Request

- Pathology findings
- Pathology slide images
- Clinical data abstractions (child and maternal)
- Case photos (requires IRB/ethical approval)

- Biorepository (tissue and non-tissue specimens)
CHAMPS Network Acknowledges All of the Families, Communities and BMGF

South Africa  Mozambique  Kenya  Mali  Bangladesh  Ethiopia  Sierra Leone