Overview of The Child Health and Mortality Prevention Surveillance Network (CHAMPS)

Presentation for PDVAC

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CHAMPS

Child Health and Mortality Prevention Surveillance

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Source: You et al, Lancet 2015; 386: 2275-2286
Verbal Autopsy Remains a Primary Means to Determine Cause of Death in High Mortality Areas

Source: Epidemiologic Reviews, Oxford University Press, 2010

Countries where verbal autopsy is used
Causes of deaths among children under 5 years, 2013

- Neonatal (0-27 days)
  - Prematurity: 15%
  - Neonatal sepsis: 7%
  - Congenital anomalies: 4%
  - Neonatal tetanus: 1%
  - Other: 4%

- Postneonatal, 1-59 months
  - Prematurity: 9%
  - Injuries: 5%
  - HIV/AIDS: 2%
  - Malaria: 7%
  - Measles: 2%
  - Diarrhoea: 2%
  - Other group 1 conditions: 10%
  - Congenital anomalies and other non-communicable diseases: 7%

- Pneumonia: 13%
- Intrapartum-related complications, including birth asphyxia: 11%

Challenges with Global Surveillance and Cause of Death Data

CHALLENGE 1: INCOMPLETE

CHALLENGE 2: POOR QUALITY

CHALLENGE 3: DELAYED

These challenges prevent us from truly understanding what is killing children under five years of age.
CHAMPS Background

Proposal and funding: Bill & Melinda Gates Foundation
Scope: 20-25 sites over a 20-25 year time frame
Geographic focus: South Asia and Sub-Saharan Africa

Initial focus: Tracking the most-preventable causes of mortality among children under five years of age
CHAMPS Program Objectives

1. Track definitive causes of child mortality in sites throughout Sub-Saharan Africa and South Asia

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

3. Enable sites to able to provide additional services and surveillance infrastructure to prevent mortality
CHAMPS Site Minimum Qualifications

- Location in Sub-Saharan Africa or South Asia
- Under-five mortality rate greater than 50 per 1,000
- Surveillance feasibility
- Catchment population of at least 100,000 people
  - Birth cohort of at least 3,000
  - At least 12,000 under-five children
- Potential for acceptance of project activities
- Willingness to share:
  - Data
  - Specimens
  - Common protocol
Six CHAMPS surveillance sites have been established, two under way

<table>
<thead>
<tr>
<th>Site</th>
<th>Under 5 Mortality Rate</th>
</tr>
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<tbody>
<tr>
<td>Soweto, South Africa</td>
<td>59/1000</td>
</tr>
<tr>
<td>Manhiça, Mozambique</td>
<td>76/1000</td>
</tr>
<tr>
<td>Bamako, Mali</td>
<td>59/1000</td>
</tr>
<tr>
<td>Kisumu, Kenya</td>
<td>79/1000</td>
</tr>
<tr>
<td>Baliakandi, Bangladesh</td>
<td>50/1000</td>
</tr>
<tr>
<td>Harar/Kersa, Ethiopia</td>
<td>95/1000</td>
</tr>
<tr>
<td>Makeni, Sierra Leone</td>
<td>120/1000</td>
</tr>
<tr>
<td>India</td>
<td>TBD</td>
</tr>
</tbody>
</table>
**CHAMPS Methods: From Assessment, to Analysis, to Action**

**Social Behavioral Science**
- Understand acceptability of proposed processes

**Mortality, Pregnancy, Demographic Surveillance**
- Identify deaths for MITS and collection of additional data

**Specimen Collection**
- Collect tissue and non-tissue specimens for further laboratory analysis

**Clinical Data Verbal Autopsy**
- Gather other information around terminal state to improve context for DeCoDe panel

**Microbiology, Real-Time PCR Analysis**
- Identify pathogens in specimens that may have caused death

**Local & Central Histopath Analysis**
- Analyze tissues to understand pathogens associated with cellular changes; compare central and site findings

**DeCoDe Panel**
- Review all findings and assign cause of death

**Data to Action**
- Help inform a range of policies and public health actions to reduce child mortality
## CHAMPS Social Behavioral Sciences: Formative Research

<table>
<thead>
<tr>
<th>Method</th>
<th>Target Groups or Areas of Research</th>
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</table>
| Key informant in-depth interviews | - National level  
- Community level  
  - Formal leaders  
  - Informal leaders                                                                                           |
| Semi-structured interviews    | - Pregnant women  
- Next of kin of children with severe illness  
- Health care providers  
- Next of kin of deceased children who have accepted or refused MITS                                                |
| Focus group discussions       | - Parents of young children  
- Mothers or mothers-in-law of pregnant women                                                                     |
| Observations                  | - Procedures  
- Rituals, customs and traditions around death and the consent process                                              |
Community Engagement Workshops in Bamako, Mali reveal strong support for understanding causes of child mortality

Examples of community tensions, alignment with CHAMPS Objectives:

• 80% agreed that MITS was acceptable with parental permission
• 82% of participants agreed they would not allow their child to undergo MITS if the procedure interfered with religious practices

• 98% said that pregnancy surveillance was acceptable

• 68% attended a traditional healer at least once in past year

Some factors to consider when a child dies:

• Time for prayer
• Offer of compassion to family (condolences)
• Burial rituals
CHAMPS has launched Mortality Surveillance in 4 sites

**HEALTH FACILITY**

Study staff

**COMMUNITY**

Informants

**Evaluate eligibility:** any stillbirth or child death <60 months, residence in CHAMPS catchment area during surveillance period

**Goal:** Notify CHAMPS surveillance team to enable completion of MITS within 24 hours of death

Within 2-4 weeks of child’s death, conduct caregiver interview (verbal autopsy), collect clinical information on child, mother
CHAMPS has field tested and improved the recently released WHO 2016 Verbal Autopsy instruments.
CHAMPS has created Minimally Invasive Tissue Sampling SOP and Specimen Collection Kits

- Abdominal approach - spleen / kidney
- Placenta (P), umbilical cord (U) if stillbirth or death immediately following birth
- Skin lesion if present and lymph node if palpable
CHAMPS has developed innovative techniques to detect multiple pathogens simultaneously: TaqMan Array Cards

- CDC team designed 5 new TaqMan Array Cards (TAC)
- Real-time PCR with TAC will detect over 100 pathogens from diverse specimen types
- >50 newly designed assays
- First TAC designs with multiplex assays

- **Respiratory**
  - NP/OP swabs
  - Lung tissue
- **Neonatal**
  - Blood
  - CSF
- **Blood/CSF Tier 1**
  - Blood
  - CSF
- **Blood/CSF Tier 2**
  - Blood
  - CSF
- **Diarrheal**
  - Stool
Local Pathology Lab: 4 sites in histology

H & E stain

Telepathology
## Local Diagnostic Laboratory Capacity Strengthened

### Laboratory Processes Done In Country

<table>
<thead>
<tr>
<th>Process</th>
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<tbody>
<tr>
<td>Culturing of blood and cerebrospinal fluid (CSF)</td>
</tr>
<tr>
<td>HIV DNA polymerase chain reaction (PCR)</td>
</tr>
<tr>
<td>GeneXpert tuberculosis PCR</td>
</tr>
<tr>
<td>Malaria testing (smears and rapid diagnostic tests)</td>
</tr>
<tr>
<td>Blood, lung, CSF, stool, nasopharyngeal (NP) and/or oropharyngeal (OP)</td>
</tr>
<tr>
<td>swabs analyzed on TAC cards</td>
</tr>
<tr>
<td>Remaining specimen and nucleic acid frozen and archived locally</td>
</tr>
<tr>
<td>(and portions sent to central repository for archiving)</td>
</tr>
</tbody>
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Determination of Cause of Death (DeCoDe) Panel

Demographic
- DOB, DOD, Sex, Date/Time of MITS procedure, Gestational age (if applicable), Birth weight

Verbal Autopsy
- Summary of VA
- Raw data (answers to all of the questions)

Maternal Abstraction
- Raw data

Clinical Abstraction
- Raw data

Clinical Postmortem Diagnostic Results
- HIV
- TB
- Malaria

MITS Collection Data
- Measurements (interpretation)
- Photographs (interpretation)

Molecular ID Diagnostic Results
- TAC results with assay interpretation (supplied centrally)

Pathology Results
- Site pathology report (standardized)
- CPL pathology report (with relevant photomicrographs)
- Whole slide images available upon request

*Panel assigns underlying and immediate causes of death according to ICD10.
**INTERNATIONAL CAUSE OF DEATH CERTIFICATION**

- **Cause of Death (i.e. Primary CoD):** Causal chain of events (disease or injury) that directly led to death.
- **Underlying Cause of Death:** Initiating event in the causal sequence that occurred most remote from time of death.
- **Immediate Cause of Death (i.e. Direct CoD):** Final event in the causal sequence that occurred closest to time of death.

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**INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH**

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Approximate interval between onset and death</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Disease or condition directly leading to death*</td>
<td></td>
</tr>
<tr>
<td>(a) due to (or as a consequence of)</td>
<td></td>
</tr>
<tr>
<td>Antecedent causes</td>
<td></td>
</tr>
<tr>
<td>Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last</td>
<td></td>
</tr>
<tr>
<td>(b) due to (or as a consequence of)</td>
<td></td>
</tr>
<tr>
<td>(c) due to (or as a consequence of)</td>
<td></td>
</tr>
<tr>
<td>(d) due to (or as a consequence of)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td></td>
</tr>
<tr>
<td>Other significant conditions contributing to the death, but not related to the disease or condition causing it</td>
<td></td>
</tr>
</tbody>
</table>

*This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury, or complication that caused death.
Using CHAMPS Data: Possible Examples of Data to Action

Local
- Reporting pertinent results to families
- Family HIV testing and referral to care
- Reporting aggregate findings to communities
- Investigating possible outbreaks
- Presenting findings during hospital mortality reviews
- Implementing strategies to reduce nosocomial infections

National
- Incorporating CHAMPS surveillance findings in national child mortality reviews
- Including pediatric deaths in epidemiologic surveillance bulletins
- Analyzing CHAMPS data to inform national vaccination policies

International
- Incorporating CHAMPS surveillance findings in international child mortality analyses
- Setting international priorities for achieving U5M targets
- Planning efforts for vaccine development
Obrigado! Asante! Zikomo! Dhonnebad! Merci! Thank you!

- Bill & Melinda Gates Foundation
- Colleagues and institutions in CHAMPS sites:
  - **South Africa**: University of Witswatersrand
  - **Mozambique**: CISM, Insitituto Nacional de Saude
  - **Mali**: Center for Vaccine Development, Mali; University of Maryland, Baltimore
  - **Kenya**: CDC-Kenya, KEMRI, Henry Jackson Foundation
  - **Bangladesh**: Icddr,b; Institute for Epidemiology and Disease Control Research
  - **Ethiopia**: London School of Tropical Medicine and Hygiene; Haramaya University
  - **Sierra Leone**: Ministry of Health and Sanitation; CDC-Sierra Leone
  - University of Barcelona, ISGlobal team
  - CHAMPS program office team members
  - Countless others