Cause-specific under-five mortality in Sub-Saharan Africa and South Asia: Adjustment for selection bias in the CHAMPS network

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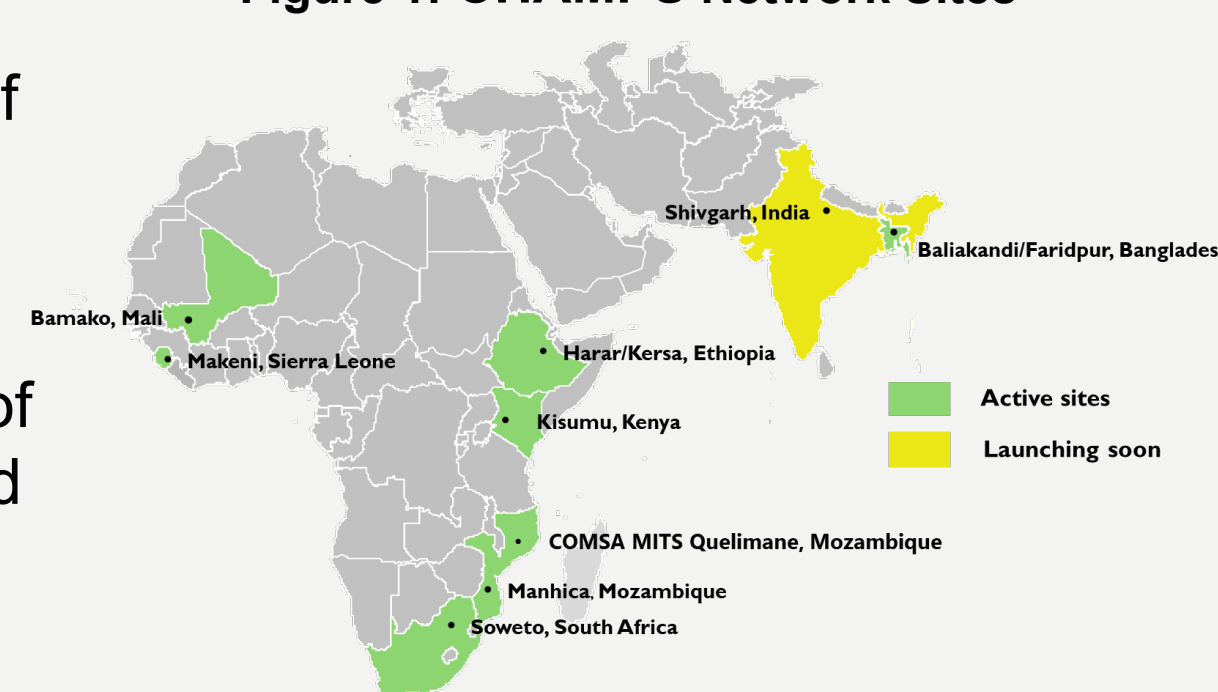
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Background

Despite reductions in the global rate of stillbirths and under-five (U5) mortality, substantial geographic disparities persist. The Child Health and Mortality Prevention Surveillance (CHAMPS) network (Figure 1) aims to improve the understanding of the causes of stillbirth and U5 mortality by collecting standardized, population-based data from high-mortality sites.

Through the collection of comprehensive cause of death data – including minimally invasive tissue sampling (MITS, a needle-based postmortem sampling technique) of key organs and body fluids; histopathology, laboratory, clinical records abstraction; and verbal autopsy – determination of cause of death (DeCoDe) panels, composed of local experts, ascertain the causal chain of mortality, including the underlying cause, and other antecedent, immediate, and maternal causes of death.

Figure 1: CHAMPS Network Sites

Active sites
Launching soon

Shivgarh, India
Baliakandi/Faridpur, Bangladesh
Bamako, Mali
Makeni, Sierra Leone
Harar/Kersa, Ethiopia
Kisumu, Kenya
COMSA MITS Quelimane, Mozambique
Manhica, Mozambique
Soweto, South Africa

Methods

Not all enrolled cases are eligible or consent for MITS; some families only consent to collection of antemortem clinical and verbal autopsy data. Using only cases consented for MITS to calculate mortality fractions (proportion of deaths attributed to a specific cause of death) may be biased due to selection bias, in that cases enrolled in CHAMPS and consented for MITS may not be representative of the underlying cause of death distribution.

The work presented estimates adjusted cause-specific mortality fractions for the top five causes of death anywhere in the causal chain in each age group (stillbirths, neonates, infants and children) and site from 2017 to 2019; selection probabilities were estimated based on subgroup membership of all CHAMPS cases. Subgrouping variables identified *a priori* included season and location of death, maternal education, caretaker's religion, sex of child, and verbal autopsy cause of death; those statistically significantly associated with MITS conducted were selected for adjustment.

Results

a. Bangladesh -- Baliakandi and Faridpur (2017-2019)

b. Ethiopia – Harar and Kersa (2019)

c. Kenya – Manyatta and Siaya (2017-2019)

d. Mali – Bamako (2017-2019)

e. Mozambique – Manhica and Quelimane (2017-2019)

f. Sierra Leone – Makeni (2018-2019)

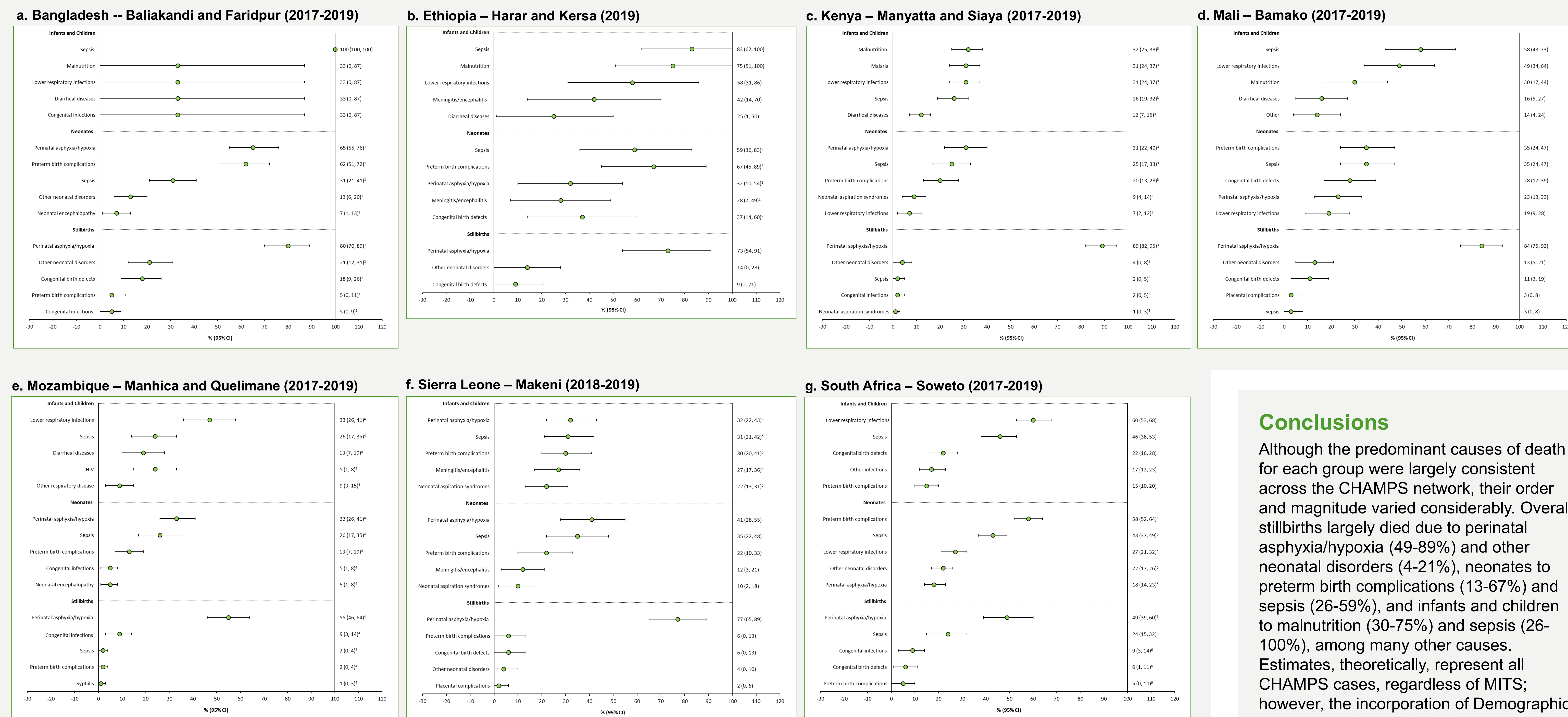### g. South Africa – Soweto (2017-2019)

Figure 2. Adjusted cause-specific mortality fractions for the top five causes of death in the causal chain by age group and for each site in the CHAMPS network.

a. Bangladesh (MITS=155, non-MITS=595); b. Ethiopia (MITS=42, non-MITS=74); c. Kenya (MITS=386, non-MITS=166); d. Mali (MITS=170, non-MITS=761); e. Mozambique (MITS=379, non-MITS=435); f. Sierra Leone (MITS=176, non-MITS=238); South Africa (MITS=604, non-MITS=87). [1]Adjusted for location of death and maternal religion. [2]Adjusted for location and season of death. [3]Adjusted for location and season of death. [4]Adjusted for location of death, season of death, and maternal religion. [5]Adjusted for location and season of death. [6]Adjusted for location of death, season of death, and maternal religion.

Conclusions

Although the predominant causes of death for each group were largely consistent across the CHAMPS network, their order and magnitude varied considerably. Overall, stillbirths largely died due to perinatal asphyxia/hypoxia (49-89%) and other neonatal disorders (4-21%), neonates to preterm birth complications (13-67%) and sepsis (26-59%), and infants and children to malnutrition (30-75%) and sepsis (26-100%), among many other causes. Estimates, theoretically, represent all CHAMPS cases, regardless of MITS; however, the incorporation of Demographic Surveillance System (DSS) data is required to extrapolate farther into the catchment areas. Future work should use Bayesian credible intervals for their better coverage properties, particularly for sparse data.

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