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Gaps in the child tuberculosis care cascade in 32 rural communities in Uganda and Kenya☆

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ABSTRACT

Background: Reducing tuberculosis (TB) deaths among children requires a better understanding of the gaps in the care cascade from TB diagnosis to treatment completion. We sought to assess the child TB care cascade in 32 rural communities in Uganda and Kenya using programmatic data.

Methods: This is a retrospective cohort study of 160,851 children (ages < 15 years) living in 12 rural communities in Kenya and 22 in Uganda. We reviewed national TB registries from health centers in and adjacent to the 32 communities, and we included all child TB cases recorded from January 1, 2013 to June 30, 2016. To calculate the first step of the child TB care cascade, the number of children with active TB, we divided the number of reported child TB diagnoses by the 2015 World Health Organization (WHO) child TB case detection ratio for Africa of 27%. The remaining components of the Child TB Care Cascade were ascertained directly from the TB registries and included: diagnosed with TB, started on TB treatment, and completed TB treatment.

Results: In two and a half years, a total of 42 TB cases were reported among children living in 32 rural communities in Uganda and Kenya. 40% of the children were co-infected with HIV. Using the WHO child TB case detection ratio, we calculated that 155 children in this cohort had TB during the study period. Of those 155 children, 42 were diagnosed and linked to TB care, 42 were started on treatment, and 31 completed treatment. Among the 42 children who started TB treatment, reasons for treatment non-completion were loss to follow up (7%), death (5%), and un-recorded reasons (5%). Overall, 20% (31/155) of children completed the child TB care cascade.

Conclusion: In 32 rural communities in Uganda and Kenya, we estimate that 80% of children with TB fell off the care cascade. Reducing morbidity and mortality from child TB requires strengthening of the child TB care cascade from diagnosis through treatment completion.

1. Introduction

The World Health Organization (WHO) estimates that among children worldwide there were one million incident cases of tuberculosis (TB) and at least 210,000 TB deaths in 2015 [1]. Despite the high burden of TB in children, it is estimated that at least two thirds of cases in sub-Saharan Africa go un-diagnosed or un-reported [2]. Even when a child is diagnosed with TB, treatment outcomes are often poor [3]. To

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reduce child TB deaths it is essential to strengthen the links in child TB care from diagnosis through treatment completion.

The "Cascades of Care" framework is used widely in the HIV/AIDS field to assess the quality of HIV care throughout the care continuum [4]. This framework can be adapted for Child TB Care to describe the sequential steps from TB diagnosis through linkage to TB care, treatment initiation, and treatment completion. The care cascades model defines one common outcome that all patients should achieve; for the TB care cascade, that goal is the completion of TB treatment and achieve a cure. To date there are no published studies that assess the child TB care cascade in its entirety. The few studies that report on components in the Child TB Care Cascade in sub Saharan Africa suggest stark gaps in components of the cascade including failure to diagnose TB [5–9] or complete treatment, [8–11] especially in children under the age of five [5,8,9,12,13]. Applying the Childhood TB Care Cascade framework to local data in the public domain can help identify where children "fall off" the cascade and measure the efficacy of interventions to increase the number of children who are cured of TB.

Our primary objective was to describe the Child TB Care Cascade in 32 rural communities in Uganda and Kenya from 2013 to 2016 using local programmatic data from Uganda and Kenya national TB registers. We also sought to identify subpopulations of children that may be under diagnosed (i.e. children under five and children with smear negative disease) by applying the metrics of child TB diagnosis described by Seddon et al. [14] These metrics can be applied to data from local health centers, and deviations from the expected proportions can provide a snapshot of under- or over-diagnosis at the primary health care center level.

2. Methods

2.1. Study design and participants

This is a retrospective observational cohort study of children ages 0–15 years of age who were enumerated in a census from 2012 to 2013 from 32 rural communities in Kenya and Uganda (12 communities in Nyaanza province, Kenya, 10 in Eastern Uganda, 10 in Western Uganda). We reviewed the national TB registers in each of the 32 communities to assess the number of reported TB cases, the TB case characteristics, and to estimate the TB care cascade. We included cases diagnosed between January 1, 2013 to June 30, 2016 to allow for full documentation of 6 months of TB treatment by the time of database closure on May 5, 2017.

2.2. Setting

This study is set in 32 rural communities in Uganda and Kenya that were participating in the SEARCH HIV "test and treat" cluster-randomized trial (NCT 01864503). The SEARCH trial design and community selection have been previously described [15].

In these 32 rural communities, TB is primarily evaluated, diagnosed, and treated in government-sponsored primary health centers. The Kenyan and Ugandan national TB programs generally rely on passive case finding. Patients present to primary health centers for evaluation and, if diagnosed with TB, are referred to the National TB Program where they are recorded in the TB treatment registry and offered treatment. Primary health centers have access to sputum microscopy on site. None of the primary health centers have access to mycobacterium tuberculosis (MTB) culture or onsite radiographic service. Isoniazid preventive therapy and active case finding are not widely implemented in the 32 communities. Children with HIV receive HIV care at government-sponsored primary health centers and receive TB screening at each clinical visit per national Ministry of Health protocols.

2.3. Variables and Definitions

2.3.1. Reported cases of child TB

We retrospectively reviewed national TB treatment registries from health centers within and adjacent to the 32 study communities. We defined a child TB case as a case if it was (a) documented in the national TB registry as new, relapsed, or lost to follow up; (b) recorded in the registry when the child was less than 15 years of age; and (c) matched to a child enumerated in the SEARCH baseline census. TB cases from the national TB registry were linked to SEARCH census by matching name, sex, date of birth, and residence. We excluded cases from children classified as "lost to follow up" and "relapsed" if they were already included as a new case within our study period. The same methods were used to define adult TB cases.

2.3.2. TB contact

We defined a child as having an adult TB contact if the child's household identification number from the SEARCH study matched the household identification number of an adult TB case from the national TB registry.

2.3.3. Child TB case characteristics

National TB treatment registries include date, name, residence, sex, type of tuberculosis (pulmonary or extrapulmonary), initial and follow up smear results, treatment start date, and final treatment outcome. We classified the site of TB disease as pulmonary if the sputum acid-fast bacilli (AFB) smear was positive, even if concomitant extra-pulmonary disease was present. Standard definitions of the Ugandan and Kenyan National TB Program (NTP) were used to define TB treatment outcomes: completed treatment, incomplete treatment- not taking anti-TB drugs for two months or more after starting treatment, transferred out. If a treatment outcome was not documented in the registry, then we classified the outcome as treatment not completed.

2.3.4. HIV status

HIV status, CD4 count, and HIV viral load were obtained during the ongoing community-wide SEARCH trial, which at baseline achieved testing coverage in 89% adults [15] and 81% children [16] via a hybrid mobile and community based HIV testing strategy. For this analysis, we used the CD4 and viral load collected during the SEARCH trial's baseline year in 2013–2014. We used the HIV status documented in the TB registry for two children, as they were both missing a baseline HIV test from the SEARCH trial. A child was defined as likely HIV-exposed uninfected (HEU) if the child was HIV negative and the child's mother had a positive HIV antibody test result during the baseline year of the SEARCH study, 2013–2014. As part of the SEARCH study, we were able to link all children under the age of 12 to the de-identified identification number of their birth mothers. This identifier was then linked to the mother's HIV status. A mother's HIV status was missing if the mother was deceased at the time of the study, the mother did not live within the child's household, or the mother declined HIV testing.

2.4. Assessing the child TB care cascade

The components of the Childhood TB Care cascade were adapted from the HIV care cascade [4], and the measures of the cascade included:

(1) **Children with active TB:** the estimated number of children with active TB disease was defined as the number of child TB cases reported in the study population divided by the case detection rate (CDR) for Africa. We used the 2015 WHO child TB case detection ratio (CDR) for Africa of 27%, as the CDR for child TB has not yet been established for rural areas of East Africa. [17]. The 2015 WHO Global TB Report reports that in Africa there were an estimated 330,000 cases of child TB, 90,523 of which were reported