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ORIGINAL ARTICLE

Intensified TB case finding in Swaziland: whom do you find in the household in a high TB/HIV burden setting?

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Abstract

Objectives: Active Case Finding (ACF) strategies in communities increases TB and HIV case detection, yet the direct impact of these strategies on the TB and HIV epidemics remains unknown. Leveraging TB REACH funding, Baylor College of Medicine Children's Foundation-Swaziland (BCMCF-SD) implemented a community-based ACF program to extend health interventions to a representative population of Swaziland. **Methods:** BCMCF-SD screened household contacts of index cases (ICs) initiating TB treatment in 7 health facilities. Contacts reported to have a positive TB screen were referred to a health facility for sputum submission. Home visits were conducted to reach contacts with presumptive TB who did not visit a health facility. We describe the population reached through household ACF from May 2013-December 2015, according to age, gender, reported HIV-status, and number of additional TB cases. **Results:** 3,342 ICs were linked to 876 households yielding 5,337 contacts. Of these contacts, 2,635 (49%) provided sputum for TB investigation, with 88% (2,324/2,635) of sputum specimens collected during a home visit. Our program identified 2% (45/2,635) additional bacteriologically confirmed TB cases. HIV-positivity was reported for 9% (464/5,336) of contacts while 55% (2,946/5,336) were reported to have an unknown HIV-status. Males and adolescents were more likely to report an HIV unknown status ($p < 0.01$). **Conclusion:** Although effective at finding additional TB cases, household-based ACF strategies may be limited in identifying bacteriologically confirmed cases among children, adolescents and elders in this setting. Our model of ACF provides an ideal opportunity to reduce the TB burden by extending services to hard-to-reach populations.

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INTRODUCTION

Swaziland is a small, land-locked, middle-income country in Sub-Saharan Africa situated at the epicenter of the Tuberculosis (TB) and Human Immunodeficiency Virus (HIV) pandemics. In 2015, TB incidence was 565/100,000 with TB case notification rates of 60%. HIV prevalence sat at 29% with TB/HIV co-infection rates of 72%¹⁻³. These overlapping and synergistic epidemics demand coordinated TB and HIV control efforts achieved through integration of TB/HIV care at all levels of the health system.

Early initiation of anti-TB treatment remains key for TB control and is dependent on effective case detection. Active TB case finding (ACF) in communities, through household contact and source case investigations, increases TB case notification compared to passive TB case finding that relies upon diseased individuals presenting to the health systems. ACF strategies have good potential to increase pediatric and adolescent TB case finding through tailored strategies adapted to unique setting^{4,5}.

Such strategies range from population-wide screening to targeted case-finding in high-risk groups such as people living with HIV (PLHIV) and contacts of known TB cases⁶⁻⁸. Contact investigations evaluate contacts of an infectious adult or adolescent for TB or LTBI and often focus on household contacts. Source case investigations evaluate all contacts of a child with TB to identify an infectious adult or adolescent and may have lower yield than contact investigation^{4,5}.

Despite the growing body of evidence substantiating that household proximity to a bacteriologically confirmed adult TB case is an important predictor of a positive TB screen in children, there is very little published data on ACF interventions targeting childhood TB in TB high-burden, resource-limited settings⁹⁻¹¹.

Today global TB control efforts are framed within the Sustainable Development Goal 3 (SDG3) and are driven by The Global Plan to End TB 2016-2020 and UNAIDS' 90-90-90 goals^{12,13}. In Swaziland ACF strategies are supported by national policies and guidelines, however implementation has been limited presumably due to resource constraints¹⁴.

Our analysis aims to garner relevant information on what population is accessed through a standardized TB ACF initiative and highlight opportunities for synergistic public health control efforts. Further, we believe that this strategy may be adapted to similar settings to help achieve TB control targets.

METHODS

Baylor College of Medicine Children's Foundation - Swaziland (BCMCF-SD) plays a pivotal role in the provision of health services targeting children and adolescents affected by TB and HIV^{15,16}. TB/HIV services are integrated in a family-centered, primary health model of care. In 2013, BCMCF-SD and the BCM Global TB program received funding from the

TB REACH Wave 3 initiative to increase TB case detection via active and community-based ACF in collaboration with the Swazi National TB Control Program (NTCP). The program, aptly named "Butimba" (meaning "The Royal Hunt" in siSwati), prioritized TB diagnosis and prevention in children (< 15 years of age) living in a TB/HIV high burden setting from May 2013 to November 2015⁹.

TB contacts investigation and management were consistent with the NTCP protocols. Leveraging existing structures and using standardized tools, including a project-specific family mapping tool ([Annex 1](#)), household contacts of TB index cases (ICs) were identified and screened for TB symptoms, including persisting cough, weight loss, and night sweats.

If a contact reported TB symptoms, the Butimba team made efforts to collect a sputum sample either in the health facility or during routine programmatic home visits. Sputum was collected by expectoration, gastric or nasopharyngeal aspiration. Sputum samples were tested for TB using smear microscopy, GeneXpert MTB/RIF (GXP), and/or culture (BACTEC MGIT, Becton-Dickinson). Treatment for active TB disease followed national guidelines ([fig. 1](#)).

RESULTS

From May 2013 to December 2015 a total of 3,342 ICs were linked to 876 households yielding 5,337 TB contacts. Of these contacts, 49% (2,635/5,337) provided sputum for TB investigation; 88% (2,324/2,635) did so during the home visit. A total of 87 new TB cases were identified amongst contacts, resulting in the diagnosis of 2% (45/2,635) additional bacteriologically confirmed TB cases ([fig. 2](#)).

A total of 2,453 (46%) of screened individuals were < 15 years. Our ACF strategy showed capacity to reach a representative Swazi demography based on age groups and gender distribution. Of note, our program was more likely to capture sputum positive TB disease in individuals between the ages of 20-50 years ($p < 0.05$). While there was no statistical significance, women made up 61% of sputum positive TB cases. Known HIV infection was reported by 9%(464/5,336) of contacts while 55%(2,946/5,336) reported an unknown HIV-status. Males and adolescents (10-19 years) were more likely to report an unknown HIV status ($p < 0.01$).

DISCUSSION

Although Swaziland has experienced a steady decline in TB incidence and case notification² that is attributed to decentralization of antiretroviral therapy, integration of TB and HIV services, improved access to TB diagnosis and increased IPT coverage among PLHIV^{9,17}; Children, adolescents and HIV co-infected individuals carry a disproportionate burden of TB infection and disease resulting in worse disease outcomes³.

Increasing TB notification rates is key to eliminating the global burden of TB¹³ and growing evidence supports the use

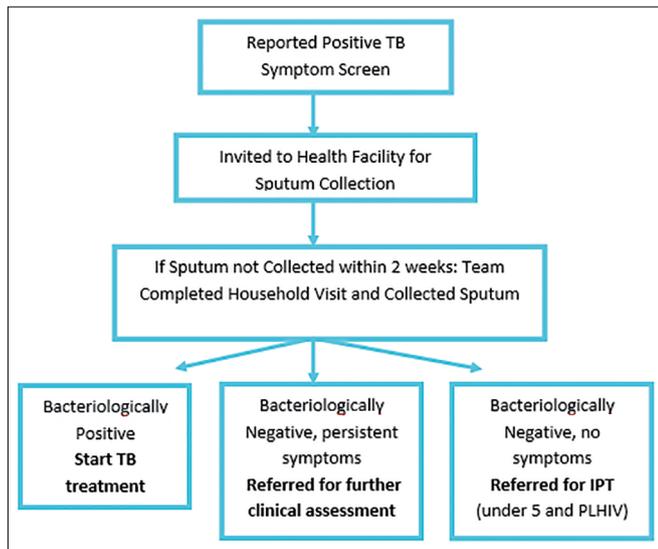


Figure 1. Screening of TB contacts and further management in the Butimba project. Abbreviations: Bacteriologically positive, positive by either smear, Gene Xpert, or culture; Bacteriologically negative, negative by smear, Gene Xpert or culture; PLHIV, people living with HIV; IPT, Isoniazid Preventive Therapy.

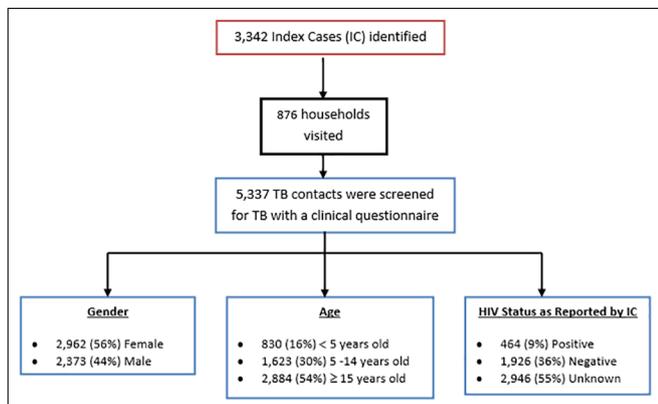


Figure 2. Screening of TB contacts.

of ACF strategies that include household TB contact tracing. However limited evidence on how to adapt these strategies to unique local contexts threatens successful programmatic implementation by the national TB programs.

Butimba was designed to investigate novel methods to further decrease the gaps in Swaziland’s TB case notifications. In this TB high burden, resource-limited setting, health services are decentralized to primary health settings and pivot around nurse-led medical care.

Our work leveraged existing resources and simplified medical protocols to increase TB case notification and provided facility-based health care workers opportunities to increase their capacity to obtain sputum samples for TB investigation. Butimba’s facility- and community-based model of ACF proved to be an ideal opportunity to reach a representative population of Swaziland and to extend health interventions to hard-to-

reach populations such as men, adolescents and elders.

Most countries traditionally notify twice as many TB cases in men as in women and admittedly struggle with significant gaps in child TB detection. Disparity in gender notifications has been attributed to socioeconomic and cultural factors leading to barriers in accessing health care and debated influence of biological mechanisms^{18,19}.

In contrast, our program captured an equal distribution of microbiologically confirmed TB in males and females aged 20-50 years. Furthermore, our program demonstrated an estimated child TB incidence of 1,390 per 100,000 child contacts screened. Collectively, our findings suggest that our ACF program can be implemented in TB high burden settings to narrow the unacceptably large case detection gaps that are up to 40% in all cases and approach 70% in both children and women³.

Males of any age and adolescents (10-19 years) more likely to self-report an unknown HIV status compared to women and other age groups. We demonstrated a 1.43 fold increased chance of detecting an additional TB case in households known to be HIV-affected, highlighting a potential impact of integrated TB/HIV case finding and the need to improve HIV case detection among males and adolescents⁹.

Although this information is potentially important, as males and adolescents are key populations that must be reached if Swaziland is to achieve the global UNAIDS 90-90-90 targets, a limitation of our methods is discrimination between truly unknown HIV status or reluctance to disclose status it at the time of the health intervention cannot be ascertained. Nevertheless, these results are consistent with other similar data emerging from Swaziland and highlight a potential opportunity to improve stigma reduction in these populations²⁰.

Though we provide promising evidence of high yield ACF interventions in resource limited setting, our program encountered limitations. Among contacts that met criteria for sputum evaluation, 22% did not provide sputum for evaluation. Although consistent with similar experiences, incomplete sputum evaluation lowers the potential impact of any contact tracing program⁹.

We found a notable gap of bacteriologically confirmed TB cases in the elder population above 50 years of age. This age group plays an important role in socializing and educating children and adolescents in the Swazi society, potentially playing a role in TB transmission within households and society. This age group may benefit from more targeted TB investigations to improve TB control.

CONCLUSIONS

The Butimba program demonstrated the feasibility of increased TB case detection in a TB high burden setting via ACF, especially in women, children and adolescents. Our ACF model effectively meets the need to integrate TB and HIV case finding,

while improving health access and equity for children and adolescents and decreasing the overall TB and HIV burdens in the Swazi context. Our model provides a reproducible, sustainable intervention to guide policy and program implementation to successfully achieve SDG 3 in resource limited settings.

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Annex 1

Verbal Consent obtained for home visit: YES NO

Death in home in past 24 months: YES NO

If yes, cause: TB HIV Other illness Accident

Other

Does anyone who lives on the homestead work in the mines? YES NO

Please list all living in the household that are:

Under 5 Years Old																											
Name and Surname	DOB (DD/MM/AAAA)	Sex		Relation to IC			Sleep Location compared to IC				TB Screen Questions			TB Screen		HIV Status		On TB Tx		Referred to Clinic		Sputum Collected		Contact Number	Update at IC's Completion ATT		
		M	F	Parent/Caregiver	Child	Other	Same bed	Same room	Same house	Different house	Cough	Fever	Poor weight gain	P	N	R	NR	?	S	N	S	N	S			N	Date

