Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____	_____
Abigail Hooper	Date

The Role of an NIH Fogarty Program in Facilitating Career Development for Female TB Researchers in Addis Ababa, Ethiopia

By

Abigail Hooper
MPH

Hubert Department of Global Health

_____

Cari Jo Clark, ScD, MPH
Committee Chair

The Role of an NIH Fogarty Program in Facilitating Career Development for Female TB Researchers in Addis Ababa, Ethiopia

By

Abigail Hooper
BSc
Corban University
2020

Thesis Committee Chair: Cari Jo Clark, ScD, MPH

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Global Health
2023

Abstract

The Role of an NIH Fogarty Program in Facilitating Career Development for Female TB Researchers in Addis Ababa, Ethiopia

By Abigail Hooper

Background: Ethiopia is one of twelve countries on World Health Organization high burden country lists for both TB and HIV-associated TB. Despite evidence that increasing the number of female researchers yields better science and economic benefits, there is a lack of female TB researchers in Ethiopia. Little research has been undertaken to investigate facilitators of career development for female TB researchers in Ethiopia. This research sought to investigate the role of an NIH Fogarty program on facilitating career development for female researchers.

Methods: We conducted a sequential mixed-method cross-sectional study of an NIH Fogarty program in Ethiopia. We collected ten survey responses and conducted nine in-depth interviews with current and graduated female trainees of the program and conducted three key informant interviews. Descriptive statistics of central tendency and variable distribution were used to analyze the survey data, and thematic analysis was used to analyze the qualitative data.

Results: Trainees were supported via facilitated mentorship, capacity building through coursework, and increased time to work on research outputs due to the protected time stipend. These activities facilitated career development for female trainees as measured by grant submissions and publications, which increased on average since trainees started the program. A major barrier to career development was a lack of time resulting from living in two worlds: professional and home. Female mentorship was identified by participants as more holistic, spanning work-life balance and support of non-professional goals, and the all-female cohort encouraged more women to apply as perceived male advantage was eliminated.

Conclusions: This research supports the use of dedicated all-female training opportunities and female mentorship as qualitative facilitators for career development. Addressing barriers to career development for female TB researchers will reduce attrition from the field and quantitatively increase the number of women in TB research in the long-term.

The Role of an NIH Fogarty Program in Facilitating Career Development for Female TB Researchers in Addis Ababa, Ethiopia

By

Abigail Hooper
BSc
Corban University
2020

Thesis Committee Chair: Cari Jo Clark, ScD, MPH

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Global Health
2023

Acknowledgements

I would like to acknowledge and thank the participants in this research for their honesty in sharing their experiences and for sharing their valuable time with me to participate in interviews and complete the survey. I am inspired by their contributions to the field of TB research and their drive to better themselves as researchers. I aspire to be more like them in my own research career.

I'm thankful for Dr. Yimtu Woldeamanuel, for her support, advice, and expertise as a female researcher and her own gender research experience in Ethiopia. I am exceedingly grateful for her time and contributions to this research.

I am grateful for the support and guidance from Dr. Cari Jo Clark as my thesis advisor. She was an inspiration as a qualitative researcher when I was the most discouraged in the process of writing this. Thank you to all my professors at Emory for providing the education necessary to complete this, with a special thanks to Dr. Matthew Freeman, Dr. Karen Andes, and Dr. Monique Hennink for igniting a passion for evaluation and qualitative research.

Thank you to Drs. Henry Blumberg, Russell Kempker, Kidist Bobosha, Dawn Comeau, and the rest of the EETB-RTP team for supporting me as a REAL student, through my APE, and in my thesis. I am proud to have been a part of such a wonderful team and look forward to continuing to see the work you do in Ethiopia and the Republic of Georgia. A massive thank you to Alison Hoover for her mentorship and supervision these past two years. I would not be the public health professional I am today without the experience gained in working with her and learning from her example. She also was a great sounding board and editor.

Thank you to my church community and specifically my family group for encouraging and praying for me throughout my MPH and thesis work. Thank you to my husband Jake Hooper. Thank you for your constant support and encouragement in the highs of lows of my MPH, and in the stress of completing this thesis specifically. I could not have done any of this without you. I love you.

Finally, all glory be to God.
"Praise Him from whom all blessings flow" -Thomas Ken

Table of Contents

Chapter 1: Introduction

Introduction and rationale

Tuberculosis (TB) is responsible for around 1.6 million deaths around the world each year, making it the second leading cause of death from an infectious disease behind COVID-19 and the thirteenth leading cause of death overall (World Health Organization, 2021). Ethiopia is one of twelve countries on both of the World Health Organization (WHO) high burden countries lists for TB and HIV-associated TB (WHO, 2021). In addition to a high TB disease burden, there is an extreme shortage of physician-scientists and well-trained and skilled researchers in Ethiopia and Sub-Saharan Africa (SSA) as a whole (Adefuye et al., 2018). This results in a low capacity to identify and address the root issues in a local context, as well as a reliance on the Western world for research and medical progress (Adefuye et al., 2018; Castro Torres & Alburez-Gutierrez, 2022; Kramer et al., 2015; Izugbara et al., 2017). Contextually and culturally relevant research solutions are imperative in achieving the WHO End TB strategy targets (Charani et al., 2021; Murdoch et al., 2021).

Contextually and culturally relevant research necessitates a skilled local research workforce. In addition to the existing researcher shortage, there is a scarcity of female researchers. According to the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics (UIS), less than 30% of researchers globally are women (UNESCO, 2018). In Ethiopia, just 13.3% of the nation's researchers are women (UNESCO, 2016). Studies have shown that globally, women publish less, are paid less, are awarded fewer grants, are promoted less, and are more likely to leave the field earlier than similarly qualified men (Evans & Bucy, 2010; Nimmesgern, 2016; Sax et al., 2002). The lack of female progress in

scientific careers is shaped by multiple intersecting factors resulting in a leaky pipeline of women dropping out of the system at various career and educational levels (Liani, 2021). Gender equality initiatives that focus on increasing the number of female staff and students simply push more women through this leaking pipe system. Molla and Cuthbert (2014) emphasize the need to address the qualitative indicators of women's experiences in higher education and STEM careers.

Beyond addressing gender equity in scientific fields, research shows that a gender diverse workforce correlates with increased profits (Hunt et al., 2018; Papageorgiou, 2018). In addition to profits, gender diversity in research teams leads to better science, expands perspectives, questions, and areas of research which may help facilitate discoveries in research (Nielsen et al., 2017). In a group setting, collective intelligence is in part determined by how many women are in a group because they help facilitate equal distribution of talking among a group within a conversation (Woolley et al., 2010).

Despite the proven benefits of a gender diverse research workforce, there are barriers along the pathway to becoming a female researcher in SSA starting in childhood with the gender stereotypes that girls are exposed to at a young age, (American Association of University Women, n.d.; Ayentimi & Abadi, 2022), continuing throughout their higher education as women are more vulnerable to attrition and at risk of sexual harassment (Eshetu et al., 2018; Melak & Singh, 2021), and all throughout their career as they work to achieve work-life balance in the face of institutional and other barriers (Liani, 2021; Liani et al., 2021a, 2021b; Sougou et al., 2022). Time is additionally a crucial resource to advance in a scientific career and the inequitable gender division of labor in the home, in conjunction with the sociocultural pressures to have a family and to establish a career in the same period, disadvantage women in comparison

to their male colleagues (Liani et al., 2021a). Researchers in Ethiopian institutions need publications and academic leadership experience to get promotions, and the sociocultural norms and gender stereotypes in Ethiopia prevent women from advancing in their scientific career as they are time poor and unable to complete the research outputs needed for promotions (Tassew et al., 2021).

The Ethiopia-Emory Tuberculosis Research Training Program (EETB-RTP) is a National Institute of Health Fogarty International Center-funded program designed to strengthen TB research capacity in Ethiopia. The program is a competitive two-year fellowship for early to mid-career TB researchers. Program fellows take long-distances class through Emory University, are paired with an Ethiopian and International mentor, and provided with a protected time stipend and a small research budget. One of the goals of the EETB-RTP is to build human resource capacity and enhance the research infrastructure for TB-related research in Ethiopia through the provision of didactic and mentored research training to early career researchers in Ethiopia. An additional goal of the program is to increase diversity in TB research in Ethiopia with a focus on increasing the number of female researchers. Prior to 2021, the percent of women enrolled in the program was low (23.3%). A Women in Research Subcommittee was convened and recommended an all-women cohort of trainees to increase the percentage of female trainees. Based on their recommendations, the 2021 request for applications was only open for female researchers. Ultimately, six new female early career TB researchers were accepted into the program, bringing the percent of female participants up to 36% of the trainees.

The prevalence and disease burden of TB globally and within Ethiopia, as well as the unique factors that make TB eradication difficult, emphasize the need for more TB researchers and increased TB research infrastructure. The lack of women in research careers, specifically in

senior roles in Ethiopia, highlights the need for programs and opportunities designed to help female researchers with their career development. Additionally, studies show grants and publications are key to career advancement for female researchers in Ethiopia (Tassew et al., 2021). The goal of the EETB-RTP is to help early-career TB researchers advance to independent researcher status with a specific focus on capacity development in the areas of grants and publications. To our knowledge, no research had been undertaken on the efficacy of Fogarty programs on their ability to meet the unique career development needs of their female trainees. To meet goal five of the Sustainable Development Goals (SDG), which is to achieve gender equality and empower all women and girls (United Nations, n.d.), it is imperative we understand the barriers to and facilitators of career development for female researchers in SSA. By conducting this research, we sought to increase the understanding of barriers to and facilitators of career development for female TB researchers in Ethiopia, as well as evaluate the EETB-RTP's role in addressing those barriers and providing facilitators. This research is relevant to the EETB-RTP and other programs and institutions regarding the implementation of programming, training, and development opportunities aimed to qualitatively address the lack of female representation within TB research in Ethiopia and beyond.

Problem statement

Given the low prevalence of female researchers in Ethiopia, steps must be taken to aid early career female researchers progress in their career. The Fogarty International Center funded Ethiopia-Emory TB Research Training Program is one such mechanism for helping early career TB researchers progress to independent researcher status. Despite knowledge that women have unique needs in career development, there is very little research on what exactly those needs are.

Given this gap, it is imperative research is conducted to better understand how the Fogarty EETB-RTP meets, or doesn't meet, the career development needs of its female trainees.

Purpose statement

The aims of this research are:

1. To better understand the barriers to and facilitators of career development for female TB researchers in Ethiopia
2. To evaluate the role of the EETB-RTP in advancing career development by the following metrics:
    a) Publications
    b) Grants (received as co-investigator or primary investigator)
    c) Promotions

Research Question

- What are the barriers and facilitators of career advancement for early- to mid-career female TB researchers in Addis Ababa Ethiopia?
- How is the EETB-RTP addressing the barriers to and facilitators of career advancement for their own female trainees?

Significance statement

The National Institutes of Health has expressed an increased interest in gender research and evaluations. This research comes at a key time to meet this interest and to fill a gap in the literature as there are no published gender disaggregated evaluations of Fogarty programs. By conducting this research, we seek to increase the understanding of barriers to and facilitators of career development for female TB researchers in Ethiopia, as well as evaluate the EETB-RTP's role in addressing those barriers and providing facilitators. This research will hold key findings

relevant to other programs and institutions on the implementation of programming or training and development opportunities to qualitatively address the lack of female representation within TB research in Ethiopia and beyond.

Chapter 2: Literature Review

Introduction

This literature review will highlight the need for a more robust tuberculosis (TB) research infrastructure in Ethiopia with an emphasis on the need to increase the number and capacity of female TB researchers specifically. The TB sources are trusted global health information sources such as the World Health Organization (WHO). The research studies have been selected for their methodology, alignment with the proposed research objectives and variables, and topical overlap across the various dimensions of this research (geography, population, career development for women in general vs in science, etc.).

Tuberculosis

Tuberculosis (TB) is responsible for around 1.6 million deaths around the world each year, making it the second leading cause of death from an infectious disease and the thirteenth leading cause of death overall (World Health Organization, 2021). TB is a disease in humans caused by *Mycobacterium tuberculosis* (MT) and is spread through the air from person-to-person (CDCTB, 2022). TB usually affects the lungs, making it a pulmonary disease, but it can affect many other organ systems including the respiratory system, lymphoreticular system, and skin (Adigun & Singh, 2022). While TB is a major contributor to mortality worldwide, its prevalence is disproportionately concentrated in a few countries. In 2020, the 30 WHO high-burden countries for TB accounted for 87% of the global incident cases of TB (World Health Organization, 2023d). Until 2021, Ethiopia was one of 14 countries on all three World Health Organization (WHO) High-Burden Country lists for TB, multi-drug resistant (MDR)-TB, and TB/HIV. In 2021, Ethiopia transitioned off the MDR-TB list, but remained on the other two (World Health Organization, 2023d).

In 2014, the World Health Assembly adopted the WHO's End TB Strategy which aims to address the Sustainable Development Goals of ending the global TB epidemic. The End TB Strategy has the goals of reducing TB incidence by 80% and TB deaths by 90% by 2030 (World Health Organization, 2023c). There are a few factors that contribute to the difficulty in accomplishing the goals of the End TB strategy, latent tuberculosis infection (LTBI) being one of them. LTBI is the time between infection with MT and developing active disease (*Chapter 2: Transmission and Pathogenesis of Tuberculosis*, n.d.). An estimated quarter of the world's population has been infected with MT (LTBI), but the majority of those with normal immune systems will not develop TB disease or will clear the infection before it progresses to a diseased state (WHO, 2021). Without treatment, about 5% of people with LTBI will develop active TB, and an additional 5% will develop active disease later in life (*Chapter 2: Transmission and Pathogenesis of Tuberculosis*, n.d.) We currently lack effective treatment options for LTBI as only 50% of those who opt to initiate treatment actually complete their treatment regimen, and there is a poor understanding of who will develop active disease (Blumberg & Ernst, 2016). The emergence and increase of multidrug resistant (MDR) and extensively drug resistant TB have posed as additional problems for eradicating TB. The WHO estimates there were 450,000 incident cases of MDR or rifampin-resistant TB, which is a 3.1% increase from 2020 (World Health Organization, 2023a). Due to challenges with effective screening measures, the global prevalence of XDR is difficult to estimate (World Health Organization, 2018) and treating drug resistant TB is more costly and requires longer treatment regimens (CDC Morbidity and mortality weekly report, 2006). Despite the challenge drug resistance poses for TB treatment, there are new drugs and treatment regimens are being investigated including the bedaquiline-

pretomanid-linezolid (BPaL) regimen which has a 90% efficacy in cases of highly drug-resistant TB (Conradie et al., 2022) (**Appendix A** for more TB information).

Impact of the COVID-19 Pandemic

Despite some of these potentially promising advances in TB treatment, TB screening and care have been disrupted by the COVID-19 pandemic (Chilot et al., 2021; Dara et al., 2021; Pan American Health Organization, 2022). In 2021, for the first time in many years, the trend of decreasing TB prevalence reversed with a 4.5% increase in the number of people who fell ill with TB and the burden of drug-resistant TB increased by 3% (Pan American Health Organization, 2022). A WHO report for the European Region from January to June 2020 found TB notifications, as reported through national disease surveillance systems, in 29 member states had decreased by 35.5% during Q2 of 2020 compared to 2019, which was six times more than the average annual decrease of 5.1% during 2015-2019, indicating this was not due to a decrease in TB cases, but rather a failure to capture TB notifications (Dara et al., 2021). It was also found that there was a 33.5% decrease in the number of patients enrolled in treatment for MDR/RR-TB (Dara et al., 2021). A study conducted in Ethiopia showed the COVID-19 pandemic had a significant negative effect on clinical care and treatment for patients who had TB by affecting their follow-up and medication refill appointments (Chilot et al., 2021). In addition to these findings, TB treatment facilities were closed due to a lack of or redirected resources to focus on COVID-19, and patients stopped coming to treatment appointments for fear of contracting COVID-19, financial pressures, or a lack of transportation due to the pandemic (Chilot et al., 2021; Manyazewal et al., 2020). COVID-19 has threatened to disrupt the progress made in combatting TB and achieving the 2030 Sustainable Development Goal 3.3 of ending the TB

epidemic with the End TB strategy (Dara et al., 2021; Manyazewal et al., 2020; World Health Organization, 2023b).

History and status of TB in Ethiopia

The 2020 milestone for the End TB Strategy is a 20% reduction in incidence rate and a 25% reduction in mortality rate (World Health Organization, 2023b). Ethiopia is one of only seven high burden TB countries to have achieved the 2020 milestone (Haileamlak, 2021). Despite this progress, tuberculosis remains a major public health problem in Ethiopia today. According to the World Bank, the incidence of TB was 119 per 100,000 people in 2020 with a 73% case detection rate for TB in all forms and a treatment success rate of 86% , which is the lowest treatment success rate of recent years in Ethiopia. (World Bank, 2023a, 2023c, 2023d). In 2021, the mortality rate for TB in Ethiopia was 16 cases per 100,000 people (Knoema, 2021). A 2016 study of the TB burden in Ethiopia, which had not been comprehensively evaluated for 25 years, estimated that there were 151,602 prevalent TB cases in 2016 (Deribew et al., 2018). The TB burden in Ethiopia, as evidenced by the high mortality and prevalence rates in the country, demands a concerted research focus in Ethiopia.

Need for culturally and contextually driven solutions

TB diagnosis and treatment are affected by cultural and contextual environments, requiring a local approach to TB research (Castro Torres & Alburez-Gutierrez, 2022; Charani et al., 2021; Murdoch et al., 2021). Murdoch et al. (2021) identified several contextual factors that are specific to South Africa, such as high HIV prevalence, large socioeconomic inequity, and the colonial and apartheid past, that are impossible to separate from TB care and policy. The interaction of these different contextual factors in South Africa across the scope of TB care affects the ability of South Africa to effectively combat TB (Murdoch et al., 2021). The

generation of knowledge and evidence regarding unique sociocultural factors is needed to address the gaps in culture and current practice (Charani et al., 2021) and is imperative to achieve TB elimination. The need for contextually relevant research results in the need to sever the reliance on research conducted in the global North and the belief in its universality across context and culture (Castro Torres & Alburez-Gutierrez, 2022). This indicates the need for TB research to be conducted in Ethiopia.

Barriers to culturally and contextually driven solutions in Ethiopia

Contextually and culturally relevant research conducted in the countries where it is needed necessitates adequate research infrastructure and an equipped research workforce. Kokwaro and Kariuki (2001) outline four problems in medical research in Africa that contribute to the lack of researchers: infrastructural, institutional, financial, and educational. The lack of proper laboratories and equipment, along with the lack of reliable internet and power make research difficult. In many African countries, medical schools and research institutions do not have well-developed structures for career advancement and in many places, remuneration is poor for researchers and physician-scientists (Kokwaro & Kariuki, 2001). And the biomedical curriculum in many schools is often lacking recent advances in the field. These inter-related issues, as well as political instability, socioeconomics, and the impact of colonialism contribute to brain drain from Africa (Dei & Asgharzadeh, 2002; Kokwaro & Kariuki, 2001; Maharaj, 2014).

This brain drain contributes to the shortage of physician-scientists and well-trained and skilled researchers in Ethiopia and Sub-Saharan Africa (SSA) as a whole (Adefuye et al., 2018). According to the World Bank, in 2017, there were 91 researchers in R&D in Ethiopia per million people, compared to the 2018 world average of 1,592 per million people and the 2015 LMIC

average of 714 per million people (2023b). A survey by the Ethiopian Ministry of Science and Technology found only 15% of all university staff in Ethiopia had a Ph.D. (Tamrat, 2018). While 77% of participants indicated they worked in research, 30% of participants had not published any articles and 60% had fewer than ten articles in the study period (Tamrat, 2018). Reasons suggested for this included, working conditions, poor remuneration, and limited research job opportunities (Tamrat, 2018).

Lack of Women in STEM

In addition to the lack of well-trained and skilled researchers in general, it is well documented that women are under-represented in STEM fields (American Association of University Women, n.d.). According to the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics, less than 30% of researchers globally are women (UNESCO, 2016). In Ethiopia, just 13.3% of the nation's researchers are women (UNESCO, 2016). According to UNICEF, only 18% of females pursue a STEM field compared to 35% of males (*Reimagining-Girls-Education-through-Stem-2020.Pdf*, n.d.). Studies have shown that globally, women publish less, are paid less, are awarded fewer grants, are promoted less, and are more likely to leave the field earlier than similarly qualified men (Evans & Bucy, 2010; Nimmesgern, 2016; Sax et al., 2002). Additionally, there is a lack of research in SSA investigating the causes of this disparity in representation (Liani et al., 2021a).

Why do We Need Women in STEM?

It is critical to address the gender gap in STEM fields and research because data shows that gender diversity in research leads to better science (Nielsen et al., 2017). Wooley et al. (2010) found that collective intelligence, or the "*c* factor," is correlated with the proportion of females in the group, average social sensitivity, and equal distribution of turn-taking in a

conversation. Gender plays an important role as women tend to have higher social perceptibility and help facilitate more equal conversation participation, thereby increasing the "c factor" (Woolley et al., 2010). Women additionally are better at identifying peers' expertise, and are less likely to be influenced by irrelevant factors and focus on education qualifications when evaluating peers (Joshi, 2014). Gender diversity in research additionally expands perspectives, questions, and areas of research explored, which may help facilitate new discoveries in research (Nielsen et al., 2017). In addition to the above benefits of more equitable representation of women in science and the workforce in general, addressing gender disparity gap in the labor force will result in economic benefit (Hunt et al., 2018), by as much as a 10-80% increase in GDP, dependent on the existing prevalence of women in the labor force (Papageorgiou, 2018). Despite all the benefits of greater gender diversity in research, there are many barriers contributing to the lack of women in STEM.

Causes of the Lack of Women in STEM

The barriers along the path to a career in STEM research for women begins in childhood, with gender stereotypes that girls are exposed to at a young age, (American Association of University Women, n.d.; Ayentimi & Abadi, 2022), continues throughout their higher education as women are more vulnerable to attrition (Eshetu et al., 2018; Melak & Singh, 2021), and all throughout their career as they work to achieve work-life balance in the face of institutional and other barriers (Liani, 2021; Liani et al., 2021a, 2021c; Sougou et al., 2022). Millicent Liani (2021) notes the lack of female progress in scientific careers is shaped by multiple intersecting factors that result in a leaky pipeline of women dropping out of the system at various career and educational levels.

The intersecting factors preventing women from pursuing STEM fields include institutional barriers, dispositional barriers (personal choices) and situational barriers (cultural) (Ayentimi & Abadi, 2022). A study in Ghana identified four social norms that influenced women's pursuit of a career in academia and their agency: the perceptions of an age limit to marry, of men caring for women and the family, and the notion of limited marriage prospects for highly educated women, as well as the desire for early childbearing (Ayentimi & Abadi, 2022). Traditional gender norms were the main barrier to women pursuing an academic career because they contributed both to personal barriers as women internalized the gender norms, and because institutions and the larger culture also shared the belief of these gender norms (Ayentimi & Abadi, 2022).

Some of the institutional level factors resulting in a lack of women in STEM include: sexual harassment and violence, minimal career advancement opportunities, and an environment of discrimination with overt and covert hostility towards their participation in higher education (Molla & Cuthbert, 2014). Molla and Cuthbert (2014) argue that gender equality initiatives often focus on increasing the number of female staff or students rather than addressing the qualitative indicators of women's experiences in higher education, and that psychosocial factors must be addressed to prevent attrition (Molla & Cuthbert, 2014).

Barriers to Career Development in SSA

There are additional, but similar, barriers related to women's career advancement once they are established in a scientific career in SSA. Liani et al. (2021) found that time was a crucial resource to advance in a scientific career, and that the the inequitable gender division of labor in the home, in conjunction with the sociocultural pressures to have a family and to establish a career in the same period, disadvantage women in comparison to their male colleagues. This

contributes to women feeling as if they are navigating two lives, personal and career, and the fear of continued poor work-life balance can lead early-career and junior researchers to question staying in their scientific careers (Liani et al., 2021a). Women felt their personal life was more fragile and if dropped would lead to irreparable damage, while their career could be dropped and picked back up again at a later date (Liani et al., 2021a). In West Africa, female researchers have an inability to equitably balance work-life responsibilities as socio-cultural pressures cause them to prioritize family responsibilities (Sougou et al., 2022). Additionally, gender-insensitive organizational and institutional culture and policy leads to the relegation of women to lower roles, and explicit discrimination of unmarried women from leadership roles (Sougou et al., 2022).

There is also a a lack of female role models and mentors in SSA (Liani et al., 2021c) and research shows that 60% of women in STEM were inspired by role models, compared to 46% of men (Buchholz, 2022). The presence of and interaction with female role models in science will help draw more women to STEM fields by increasing expectations of success (González-Pérez et al., 2020). Additionally, female mentors who can guide female researchers in areas outside of scientific inquiry such as childrearing, pregnancy, and work-life balance is a crucial need of female scientists in early career stages (Liani et al., 2021c).

Career Development Needs: Ethiopia

Additionally, researchers in Ethiopian institutions need publications and academic leadership experience to get promotions (Tassew et al., 2021). The sociocultural norms and gender stereotypes in Ethiopia prevent women from advancing in their scientific career as they are time poor and unable to complete the research outputs needed for promotions (Tassew et al., 2021). Strategies recommended for boosting women's research capacity included dedicated

female grant cells, mentorship, and establishing special conducive situations such as daycare (Tassew et al., 2021). Women who experience micro-managing and sexual harassment, and whose experiences were rooted in social norms that favor men over women, were less likely to rise to a position in leadership (Muktar et al., 2022). Women in Ethiopia who had strong familial and peer support systems, and who had received organizational support in the forms of affirmative action, development, training, and recognition, tended to rise to leadership positions (Muktar et al., 2022).

Role of D43 Programs

This need for training and development opportunities is where the Fogarty International Center (FIC) plays a role. The mission of the FIC is "advancing the mission of the National Institutes of Health (NIH) by supporting and facilitating global health research conducted by U.S. and international investigators, building partnerships between health research institutions in the U.S. and abroad, and training the next generation of scientists to address global health needs" (Fogarty International Center, n.d.). One funding mechanism of the FIC is the D43 International Research Training Grant which is designed to support and strengthen global health research and collaboration (National Institutes of Health, n.d.). In 2013, Dr. Henry Blumberg started a D43 TB Research Training Program (RTP) in Ethiopia that provided mentored and didactic research training to early-career TB researchers with the goal of helping them transition to independent researcher status. In the second five-year funding cycle of the program, a specific aim of the program, the Ethiopia-Emory TB Research Training Program (EETB-RTP), was to increase diversity in TB researchers with a particular emphasis on increasing female researchers. But as discussed by Molla and Cuthburt (2014), simply increasing the number of females participating

in the EETB-RTP does nothing if the program is not designed to meet the qualitative needs of those additional female trainees.

Fogarty Evaluations

There have been several evaluations of Fogarty programs conducted in the past few years. One evaluation briefly touched on career development as a quantitative metric measured by the obtainment of postdoctoral degrees, promotions, and research activities related to mentoring (Kempker et al., 2018). None of the results were sex-disaggregated and they were focused on the impact of the program rather than understanding how the program facilitated career development. A different impact evaluation on Fogarty programs in Kenya and Uganda looked at the impact of all Fogarty programs in those countries on public health policy and program development (Bennett et al., 2013). The study in India had the goal of systematically measuring the impact of a 5-year Fogarty program on institutional capacity building in addition to individual capacity building, and found that the program had a significant impact on individual research capacity, and a marginal improvement in institutional scientific outputs (Dhumal et al., 2020). None of these results are sex-disaggregated and there was no consideration of gender playing a role in individual researcher's success within the program.

Need Statement

The prevalence and disease burden of TB globally and within Ethiopia, as well as the unique factors that make TB eradication difficult, emphasize the need for more TB researchers and increased TB research infrastructure. The lack of women in research careers, specifically in senior roles in Ethiopia, highlights the need for programs and opportunities designed to help female researchers with their career development. Additionally, studies show grants and publications are key to career advancement for female researchers in Ethiopia (Tassew et al.,

2021). The goal of the EETB-RTP is to help early-career TB researchers advance to independent researcher status with a specific focus on capacity development in the areas of grants and publications. To our knowledge, no research had been undertaken on the efficacy of Fogarty programs on their ability to meet the unique career development needs of their female trainees. To meet goal five of the SDGs, which is to achieve gender equality and empower all women and girls (United Nations, n.d.), it is imperative we understand the barriers to and facilitators of career development for female researchers in SSA. By conducting this research, we sought to increase the understanding of barriers to and facilitators of career development for female TB researchers in Ethiopia, as well as evaluated the EETB-RTP's role in addressing those barriers and providing facilitators. This research holds key findings relevant to other programs and institutions on the implementation of programming or training and development opportunities to qualitatively address the lack of female representation within TB research in Ethiopia and beyond.

Chapter 3: Methods

The purpose of this research is to identify barriers and facilitators to career development for female TB researchers in Ethiopia and to evaluate the role of the EETB-RTP in advancing career development for its female trainees via publications, grants, and promotions. This is a sequential mixed-method cross-sectional study with three components: a quantitative survey, in-depth interviews, and key informant interviews.

Study sample and recruitment

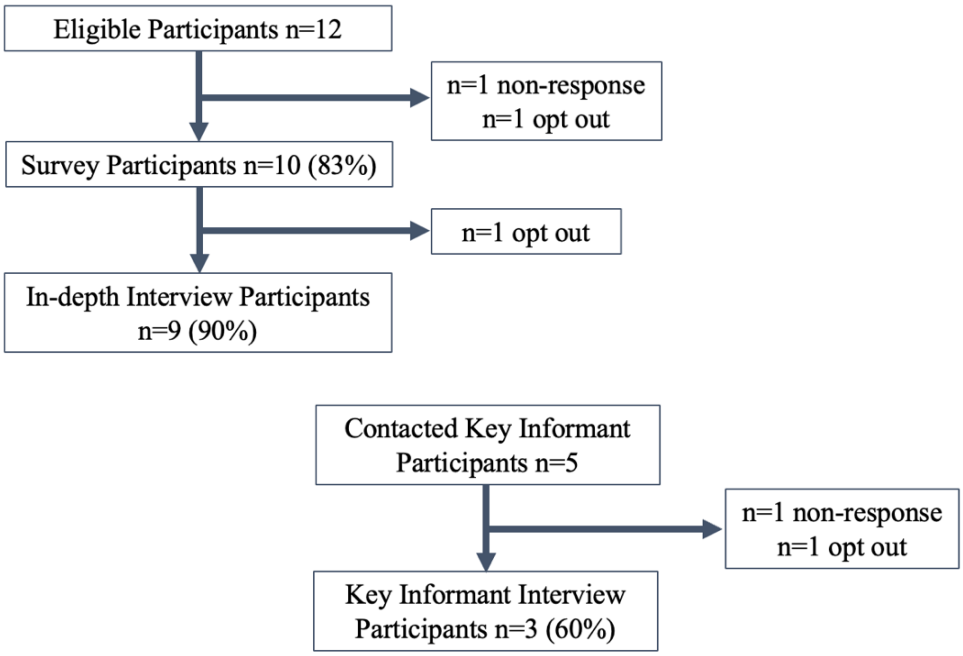
The study population for the survey and in-depth interviews was adult female graduates and active trainees of the EETB-RTP. All trainees of the EETB-RTP, and thus this study population, must live in Ethiopia and be early- to mid-career researcher (have a doctoral degree and a rank no higher than Assistant Professor at Addis Ababa University (AAU), or Scientist at Armauer Hansen Research Institute (AHRI), or the Ethiopian Public Health Institute (EPHI), and a minimum of five years of experience) with an interest in TB. Trainees must additionally enroll in either a predoctoral (enrolled in a Ph.D. program or plan to enroll in a Ph.D. program within two years of applying to the EETB-RTP) or postdoctoral (have an MD or Ph.D. degree) tract when applying to the program. Key informant participants were purposively selected senior female researchers in Ethiopia with ties to the EETB-RTP program through mentorship, program management, or participation in the EETB-RTP Women in Research Subcommittee. As the secondary aim of this research is to evaluate the role of the EETB-RTP in advancing the career development of its female trainees, all key informants had to be familiar with the format and function of the EETB-RTP.

Active and graduated female trainees of the EETB-RTP were identified from program records, and all active and graduated female trainees met the eligibility criteria. Recruitment was

conducted to maximize diversity across institutions, marital status, and co-ed vs all-women cohorts. Potential participants were recruited via email to participate in an electronic quantitative survey covering the topics of publications, grants, publications, mentorship, research stipends, and other programmatic elements of the EETB-RTP. An initial recruitment email was deployed with a link to the survey and information on the study. The initial email was followed by weekly reminders to non-respondents with an opt-out of the research and recruitment emails option available to potential participants. The survey was open for one month. Of twelve eligible participants, ten completed the survey (83%). One potential participant declined to participate in the research, and the other did not respond to any recruitment efforts (Figure 1).

Recruitment for the in-depth interviews with active and graduated female trainees of the EETB-RTP, and with Ethiopian female researchers associated with the EETB-RTP for the key informant interviews occurred via email. Interviews were held over Zoom Pro and audio recordings created during the interviews were transcribed and de-identified by the PI. All interviews were conducted without cameras to reduce the Wi-Fi bandwidth requirement of the interview given the unreliable Wi-Fi connection for most of the participants. One key informant interview took place in person, as the participant was in Atlanta for unrelated business. Of eleven eligible participants (n-1 those eligible for the survey due to the opt-out), nine elected to participate in an in-depth interview (82%), and of the 5 participants contacted for a key informant interview 3 elected to participate (60%) (Figure 1).

Figure 1



Data

The survey was 34-38 questions long, depending on how questions were answered, and electronic consent was collected at the beginning of the survey. Questions were a mix of multiple choice, Likert and rating scales, and short answers. The survey was developed and pre-tested in partnership with Ethiopian co-authors and partners. The purpose of the survey was to evaluate the role of the EETB-RTP in facilitating career development for female trainees. Questions covered the topics of mentorship, EETB-RTP coursework, resources, stipend support, grants, and the 2021 all-women request for application (RFA). Descriptive statistics of central tendency and distribution were used to analyze the survey data and the results were used to adapt existing baseline key informant interview guides and in-depth interview guides.

The interview guides, both in-depth and key informant, were developed in collaboration with Ethiopian co-investigators and pre-tested prior to implementation. Each interview guide was designed to last about an hour and had questions around key thematic areas of program

evaluation with possible probes. Key thematic areas for the in-depth interviews were mentorship, work-life balance, coursework, stipend support, grants, and publications and the all-female cohort. Key thematic areas for the key informant interviews were the research experience for women in Ethiopia, mentoring, and the EETB-RTP program. All the data collection tools can be found in **Appendix B**. All interviews were conducted in English and the interviewer (PI) used active listening and inductive probes throughout each of the interviews.

Analysis

Descriptive statistics of central tendency and variable distribution were used to analyze the survey data. The interviews were transcribed, deidentified, and imported into MaxQDA (VERBI Software, 2021), a qualitative analysis software package. The qualitative data was analyzed using thematic analysis, which is a qualitative analysis method used to identify patterns and themes in the data. A deductive codebook was developed by the primary investigator (PI), with critical review by two co-authors, to identify key areas of programmatic evaluation interest. All the interviews were reviewed and memo'ed to note possible inductive themes. After the memo process was completed, inductive codes were defined, added to the codebook, and iteratively refined.

Ethical Considerations

This analysis was determined to be IRB-exempt under the criteria for exemption 45 CFR 46.104(d)(2). Prior to data collection, all portions of the study were reviewed by Emory University's Institutional Review Board (STUDY00004470) and Armauer Hansen Research Institute and ALERT Ethics Research Committee in Addis Ababa Ethiopia, and this research was determined to meet the criteria for exemption.

Limitations

Limitations of the study include data quality of the in-depth interviews due to unstable internet connection to support the Zoom call. One interview had to be completed in two parts on different days due to the participant's poor internet connection. Knowing internet connection might hinder data quality, all interviews were conducted without visual on Zoom Pro to reduce the bandwidth burden on the participant's Wi-Fi connection. An additional limitation is that participants may have felt uncomfortable sharing negative experiences with and perceptions of the EETB-RTP for fear of it jeopardizing their relationship and funding from the program (for active trainees). To reduce this limitation, program leadership only had access to deidentified data, and all participants were informed of this and reminded of it at the beginning of the interview. Additionally, as the analysis was performed by a sole coder, there is no inter-rater reliability.

Chapter 4: Results

Participants

The median age for the survey sample (n=10 survey) at the start of the program was 34 and most (90%) were early-career level. There was good representation from all three EETB-RTP partner institutions, AHRI, AAU, and EPHI. Most of the participants (60%) were in the all-female cohort, which contains 50% of all female trainees enrolled in the program (Table 1). Of the interview participants (n=9), most were married with kids (78%), several were clinicians (44%), and many were from the 2021 all-female cohort (56%). Key informants represented two of the three EETB-RTP partner institutions; there were no eligible candidates for key informant interviews from the third partner institution.

Table 1	**Median**	**Range**
Age at Start of Program	34	28-43
Career Level	**Percent**	**Count**
early	90.0%	9
Highest Degree at Start		
MSc	40.0%	4
MBA	10.0%	1
MD	40.0%	4
PhD	10.0%	1
Job Title		
Researcher	10.0%	1
Researcher/PhD student	20.0%	2
PhD student	20.0%	2
Assistant Prof	20.0%	2
Legal Affairs Acting Director/Researcher	10.0%	1
Postdoc	10.0%	1
Advisor	10.0%	1
Institution		
AHRI/ALERT Hospital	60.0%	6
EPHI	20.0%	2
AAU	20.0%	2

Cohort		
Co-ed	40.0%	4
All-women	60.0%	6

Figure 2: EETB-RTP Facilitators of Career Development

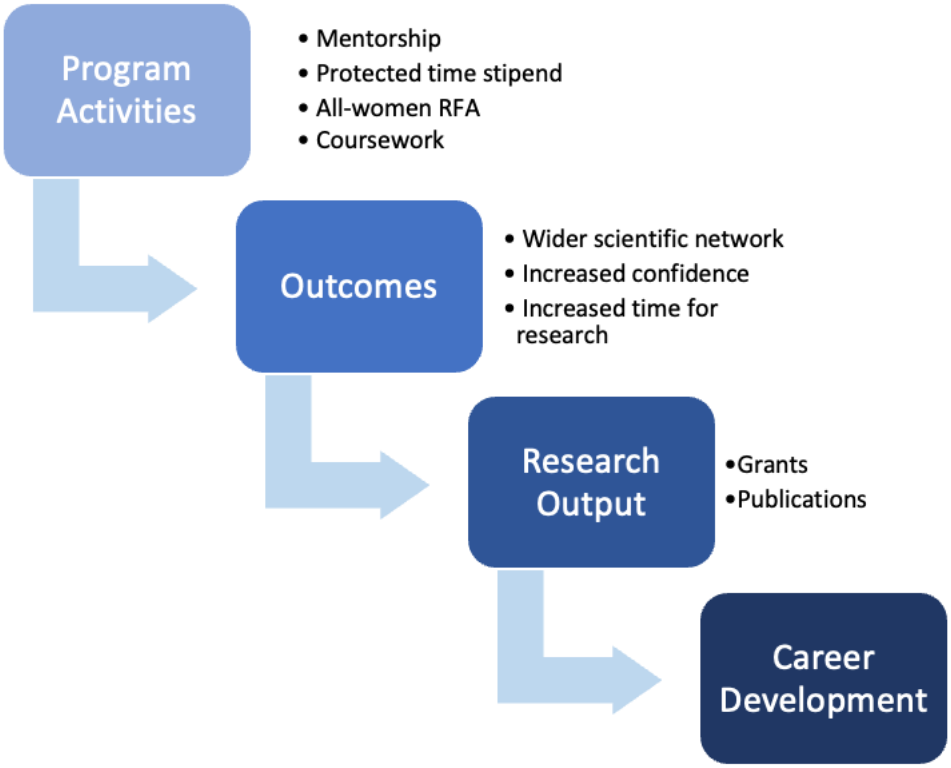


Figure 2: The program activities that participants identified as facilitators of career development included mentorship, the protected time stipend, the all-women RFA, and coursework. The outcomes that resulted from the interaction of those activities with each other were a wider scientific network, increased confidence, and increased time for research. The interaction of the outcomes led to increased research outputs as measured by grants and publications which are widely accepted measures of career development; the long-term goal of the EETB-RTP.

Living in Two Worlds

As women were bore the primary responsibility of childrearing and home life, their professional and familial responsibilities were viewed as two separate and often competing lives. Married participants described themselves as both a wife and mother and as a researcher, with one participant describing these roles as differing vocations: “I am a mother. I am a wife. I do have another vocation at home in addition to that I have here in the lab” (IDI 001). Participants found that their familial responsibilities were often unpredictable: family was no longer available to assist with school pick-up, sick children, the hired help no showed, or their kids had urgent and last-minute school-related needs. This unpredictability in their personal life affected their ability to increase their professional responsibilities, and to fully engage in their current professional and fellowship responsibilities. Unmarried participants reported fewer barriers to a good work-life balance with one participant stating that because she did not have a child, she was not busy with other activities and was able to focus on herself and her career interests.

> *“Mmm, well my, the most important barrier would be especially from the personnel side, lots of things are unexpected. So, you, you wouldn't want to take over a huge responsibility where you know, something- uh life is unpredictable. So, you need to have some room to change in your career life. So, that's to handle any unplanned events which can happen in your personal life. So, ... because you cannot control people around you- you can control your your schedule, you can control your, your emotions, you can control your work schedule, but you cannot control your family, you cannot control your personal life. And that can ultimately affect you. So, you want to make yourself ready to handle any unexpected events.”* ***(IDI 008)***

The overlap of these two worlds, home, and work, was seen as a barrier to participants; the inability to separate their two worlds led to long hours, a lack of sleep, and a negative effect on their emotional wellbeing. By keeping the two worlds separate, participants were better able to balance their different responsibilities.

> *"Women are consumed by a lot of responsibilities, for example, if I have to do something at home or at at in the office, then I may also carry over some assignments in my mind from home. And the same way when I go back home, I may have some carryover task that I will take from office to to home. Because probably I may be late working I had a late evening yesterday. And so, I had to have to recover and be active and get engaged in what I have to- have planned for today. And the same is true, like from work to home also. So, that adjustment it really uhm it affects your emotions, your physiology, your whatever- you know- your your time is is, is needed, then that's consumed by a lot of responsibilities"* ***(KII 002)***

According to key informants, the sociocultural context in Ethiopia places the majority of the responsibilities of child-rearing on females. Men were generally encouraged to work and financially provide for the family, while women were expected to care for the family and household. Participants reported a cultural shift in the younger generations, that resulted in more men being active participants in the home and in raising children. This was perceived as being due to globalization, as the exchange is not only of materials and goods, but also of culture and ideas. This cultural shift was not uniform across trainees' and key informants' experiences. Participants reported differing levels of spousal support in childrearing and had different experiences with their own father's level of participation in their own growing up. Spousal support was a key facilitator of achieving work-life balance, as well as career development. A

career in research and further education in science, often resulted in a need to travel for months or weeks at a time. Participants shared their husbands support in childrearing is what made it possible to travel for work, research, or education, “if I didn't have his support, I wouldn't have done it [education abroad]. You cannot leave your children to somebody who doesn't think that it's his job” (KII 001).

Two trainees in the all-female cohort were pregnant and gave birth while enrolled as active trainees in the EETB-RTP. Engagement in an active research project at work, or through the EETB-RTP, was reported as difficult to maintain while on maternity leave by those participants. Key informants shared that some women, depending on their role and responsibility in a project may be asked to work a few hours a day while on maternity leave to keep their work moving forward, but that women have the right to decline the request to work part time, “[It’s] optional, that will be fully based on your willingness and uhm interest. If you say I cannot do this, that's your right” (KII 003). As there was no maternity leave policy for the EETB-RTP the trainees were still expected to complete their research project on the two-and-a-half-year timeline as their peers (the all-women cohort received a 6-month extension of the two year programming and support due to research delays caused by COVID-19). Conducting EETB-RTP research while on maternity leave was viewed as stressful and difficult, specifically because trainees had to rely on others who were unreliable in providing promised research deliverables in a timely manner.

> *“You are always use a laptop and a baby at the same time so *laugh*... even if you are not doing a lot [research], it would, it would uh stress you the- out the fact that you're, you're not doing as you're expected to do... And people are not reliable. You have to push everyone they are- they don't deliver the time they promised you... And that is really,*

really difficult. It's it's almost impossible to do research while you are on maternity leave." ***(IDI 008)***

All female cohort

The all-female request for applications (RFA) in 2021 and the subsequent all-female cohort was seen as beneficial for two key reasons by participants. One was that it increased the number of females able to enter the program per cohort. With limited spots available in each cohort, a dedicated female cohort quantitatively addressed the need to increase to number of women. Key informants talked about the perceived lack of opportunities for women in Ethiopia compared to their male counterparts and noted the importance of providing more opportunities for just women. Nearly all participants, across co-ed and all-female cohorts and key informant interviews, appreciated the opportunity the all-female RFA provided for themselves and or their peers.

"What women actually lack, in this kind of environment is opportunity. Men can grab a lot of opportunity through their networks or so many different ways, the fact that they are male, it gives them a lot of opportunities. So, uhhm I would say this [all-female cohort] is one of the many things that I would think uh to give opportunity for women, academics, or researchers." ***(KII 002)***

The second perceived benefit of the all-female RFA was that it created a more level playing field for successfully applying to the EETB-RTP. Many participants felt males were advantaged in applying to the EETB-RTP and other similar programs. Male counterparts were considered more senior and better able to win grants and fellowship training because they were able to solely focus on their career development, instead of working to balance familial and professional responsibilities. The desire for a more level playing field did not equate with a

desire for the elimination of competition though. Women felt competition within funding and training opportunities was important, and that competition remained in all-female opportunities, but male advantage was eliminated. This perception was seen across members of the all-women cohort, co-ed cohort, and key informants.

> *"Males have better experience than me here. Those male uh applicants are more senior rather than me. So, the chances of winning were very minimal during that time [co-ed cohort RFA]."* ***(IDI 001, all-female cohort)***
>
> *"The gender balance always is skewed towards men. Always. Everywhere. In leadership, in research. So, having that cohort would definitely encourage female researchers, you know, to upgrade their knowledge, and it will contribute towards gender equity."* ***(IDI 009, co-ed cohort)***
>
> *"Because if you compete if we provide an equal opportunity for men and female, to be honest, there's like 60 or 70% chance of for the male, to win that grants as they only focus only on their course or on their career development. So, but if you make it only for a female, I think they all are on the same situations they all are on the same capacity. So, they will be confident that there is a high chance of getting this grant win."* ***(KII 003)***

The benefits of an all-women cohort were seen by most to be in the application period and not the proceeding fellowship education. Most participants of the all-female cohort did not see a difference between their previous experiences in co-ed education and their educational experience in the all-female cohort. A possible post-application benefit of the all-female cohort was increased intra-cohort peer-mentoring. Several participants of the all-female cohort noted peer mentoring as a benefit of their experience in the all-female cohort, and one participant of a

co-ed cohort felt she would have established better and longer-lasting relationships within her cohort if she had been in the all-female cohort as opposed to a co-ed cohort.

Analysis of the percent of female applicants for each RFA period showed a drastic increase in the number of females applying for the all-female cohort compared to previous years. The high number of women applying for the all-female cohort in 2020 indicates that there is interest and desire among female TB researchers in Ethiopia, and that the all-women cohort facilitated their decision to apply. Nearly five times the number of women applied in 2020, compared to 2019 (Table 2). The number of women who applied for the co-ed cohort in 2022 was nearly double that of the previous co-ed cohort in 2019. This could be due to the word-of-mouth recommendations made by trainees to fellow peers. Several women said the program was recommended to them by peers and colleagues who had previously been in the EETB-RTP, and several also noted they were encouraging their friends and peers to apply for the co-ed RFA released in 2022, with a programmatic start in 2023.

> *"I've been making my friends [to the EETB-RTP] to apply last year... Yeah of course if nearly I recommend for any- everyone I know in the lab, and in the school, everywhere."*
>
> ***(IDI 006, all-female cohort)***

Table 2

	Cohort Type	Total Applications Received	Females Applied n (%)
2013	Co-ed	21	2 (10%)
2015	Co-ed	27	2 (7%)
2019	Co-ed	30	5 (17%)
2020	All-Female	24	24 (100%)
2022	Co-ed	24	9 (38%)

As part of increasing the number of females in research, the EETB-RTP is also increasing the pool of available female mentors. Several former trainees have mentored or are currently mentoring active trainees in the program, including previous female trainees. This contributes to the sustainability of the program and increases the number of eligible female mentors. As formal and informal mentoring relationships are common in Ethiopia, women outside of the EETB-RTP are also likely to benefit from the increase of mid-career and senior-level female researchers and role models.

EETB-RTP Mentoring

Only 50% of survey participants had a mentor prior to enrollment in the program, and all currently had a mentor. Most (70%) had a female mentor currently and the remaining had never had a female mentor. Most participants (66%) who had never had a female mentor did not have a female role model at their institution. Participants rated the quality of mentorship (1=lowest possible quality of mentorship and 10= highest possible quality of mentorship) and satisfaction (1=lowest possible satisfaction and 10= highest possible satisfaction) with their Ethiopian and international mentors provided by the EETB-RTP very highly with a median of 9 and 9.5 respectively (Table 3).

Table 3	**%**	**n**
Had a Mentor Prior to Program	50.0%	5
Has a Mentor Currently	100.0%	10
Has a Female Mentor Currently	70.0%	7
Works at the Same Institution as Female Mentor	42.9%	3
Has Never Had a Female Mentor	30.0%	3
Has Never Had a Female Role Model at Their Institution ***Of those who have never had a female mentor***	66.6%	2
Mentor Meeting Frequency Ethiopian Mentor		
Weekly	10.00%	1

Monthly	50.00%	5
Every Few Months	30%	3
Every Six Months	0%	0
As needed	10%	1
Mentor Meeting Frequency International Mentor		
Weekly	0%	0
Monthly	20%	2
Every Few Months	50%	5
Every Six Months	20%	2
As needed	10%	1
Scale rating where 1=lowest quality/satisfaction, and 10=highest quality/satisfaction		
	Median	**Range**
Quality of Mentorship	9	4-10
Satisfaction with Ethiopian Mentor(s)	9	4-10
Satisfaction with International Mentor(s)	9.5	6-10

Mentorship was seen as invaluable to career development for early career researchers. Participants viewed early mentorship as providing a good foundation at the beginning of their research career. One participant, who had not had a mentor prior to the program, wished she had experienced mentorship earlier in her career because of how helpful her mentors' practical experience sharing had been for her. Because of the conviction that she would have done better in her career with earlier mentorship, she encourages all her junior colleagues to seek out mentorship within their first or second year at her institution.

A good mentor, as defined by participants, was someone who expressed interest in their mentee, was available, provided timely critical feedback, and facilitated other relationships that benefitted mentees' careers and research. Regular meetings and feedback on their work built confidence as mentees were able to get feedback and encouragement on their progress and get recommendations for next steps.

Participants liked the international and Ethiopian mentorship team model used by the EETB-RTP. They specifically liked having a national mentor who was easily accessible for in-person meetings. The ease of accessibility of the national mentor was supported by the survey data which showed participants met with their Ethiopian mentor more frequently than their international mentor; sixty percent of participants met with their Ethiopian mentor weekly or monthly, while only 20% met with their international mentors monthly (Table 4). In addition to being more easily accessible, participants appreciated the sociocultural understanding their Ethiopian mentors had. Participants liked having an international mentor because of the increased exposure they provided to different expertise and experience.

> *"I think that [the international and local mentor team model] is perfect. Because, I mean, the local mentor would understand, you know, the local situations and ... I had access to my national mentor, anytime I needed to, even physically because she was you know close by. That was good. But still, having the international mentor is very, very important. The mix of national and international mentor, I think it makes the mentorship program more more fruitful, because you can tap into the different expertise in even international mentors. So, I think that works perfectly."* ***(IDI 009)***

Barriers to excellent mentoring relationships were focused in two areas. The first was a lack of clear short-term deadlines. While there are large programmatic deadlines within the EETB-RTP, such as the expectation trainees complete their research project within the two years of the fellowship, trainees wished their mentors would have set short-term deadlines or created a timeframe for deliverables to be completed and then held them accountable to those deadlines. Trainees felt they would have performed better in their research projects if their mentors had set and enforced deadlines.

"...kind of having some sort of timeframe for deliverables or things like if someone enforced that, like if your mentor, enforces that. I think that that could be very much helpful I think." ***(IDI 006)***

The other barrier to excellent mentoring relationships was specific to international mentoring relationships. Due to the nature of the relationship, in-person meetings are not as easily available between trainees and their international mentor. Participants still valued their virtual mentoring relationships, and the barrier was not the virtual relationship itself, but the mechanics by which the long-distance relationship was limited: poor network connection and the limited overlap of the "workday" between Ethiopia and the United States, where majority of the international mentors reside. Many of the interviews for this research experienced interruptions due to network connectivity issues and some participants reported limited WIFI connection as a barrier to meetings with their international mentoring.

Additionally, Ethiopia is seven to eight hours ahead of Atlanta, Georgia, USA (majority of US mentors are associated with Emory University in Atlanta, Georgia) depending on Daylight Savings. Most United States to Ethiopia meetings occur between 8:00-10:00AM Eastern Standard Time, which is late afternoon East Africa Time (exact time is dependent on Daylight Savings). While these meetings occur before 5:00PM in Ethiopia, which is considered the end of the typical workday in the US, many participants reported the late afternoon was their transition time from work to personal life. The transition time consisted of navigating transportation, traffic, and the need to pick-up kids from school. The overlap of the start of the workday in the US with this transition time in Ethiopia was a barrier to meeting with international mentors.

*"It's always about time. *laugh* Because you know, our time gap, our time difference affects our routine. Like, what the program focuses on protected work time, right? But*

usually the courses, lectures, meetings, and so on, are in between work and personal time. So, it's, it's a peak traffic time. So now, it's uh uh like uh 4- 4:30 4:50, right now, our meeting. So, it's a peak traffic times where you pick your kids, it's where you go out from work, uh go home drive, and so on. So, it is not, it's not a work time, it's generally general, transition time from work to personal-to-personal life. Yeah, especially if you are a female, then you have to, you have to pick up kids from school, you have to, uh they have homeworks, where you have to do shopping on your way back home, and so on. Or you have to stay in the office. Initially, that's what I used to do. I used to stay in the office after work hours, and then and then drive at the end of our courses. But with that, then the traffic would be so much that you'd reach from probably probably eight or nine. And uh would be very difficult uh to get up because you work, you have to leave from home to go to work at least 6:30. You have to leave from home. 6:30. So, uh uh I want the kids to sleep early. If I'm very late, then that's a problem. So, it's always arranging uhm meeting times and attending the course in a proper in a proper uh work environment is a bit difficult due to the time difference yeah." ***(IDI 008)***

Holistic Mentoring

A common theme across transcripts was that female mentors tended to provide more holistic mentoring spanning work-life balance and support of non-professional goals, whereas male mentors reportedly focused on the subject matter alone. One participant expressed she would not be comfortable discussing the personal life circumstances she had shared with her female mentors with a male mentor, if she had one. Female mentors were seen as sympathetic and understanding of the challenges female trainees faced as they themselves had similar experiences.

"But one thing that I could say about female mentors is that they're more understanding to your your needs than male mentors. I'm not saying about our feminine issues, but in, general life perspective. Because professional wise, both both female and male mentors, could could have equivalents or qualities. But when it comes to your personal life, uhm female mentors tend to be more understanding and more supportive than men, male mentors." ***(IDI 002)***

*"Female mentors are far more better than male mentors. *laugh* Because they give you the tricks all the tricks which made their life easier. As opposed to male mentors which they focus on the subject matter only...So, the soft touch, uhh definitely female mentors are better."* ***(IDI 008)***

Of the three participants who stated they did not see any difference between male and female mentors, two were unmarried and did not have children. As majority of the participants who stated female mentors were more holistic focused on female mentor's abilities to speak to the lived experience of work-life balance, it could be that the holistic approach to mentoring is less important for female researchers with fewer familial responsibilities.

Participants across in-depth and key informant interviews described positive male mentoring experiences as "human in a way that we had a relationship" (KII 001) and emphasized the accessibility and support that their male mentor(s) provided. Key informants provided insights on how male mentors of female mentees could develop a more holistic approach to mentoring. Per key informants, Ethiopian women tend to be less likely to initiate contact with mentors than their male peers, and so mentors of Ethiopian women should initiate contact with mentees in the early stages of the relationship to build rapport and comfortability in the

relationship. They should focus on relationship building and keep in mind the work-life balance of female mentees will differ from male mentees. One of the key informant interviewees emphasized the importance of mentoring teams; that no one mentor can provide all a mentee needs. She recommended that male mentors who feel unable to provide more holistic mentoring to reach out to another mentor to help fill that gap in a female mentee's mentoring needs.

> *"[W]hen the first uhm meeting, or when you start building that an intimate relationship, you have to really understand people... So, I think building that relationship and helping them [female mentees] to be open. And understanding that uhh they might have other other problems, other challenges, other than that which are faced with male mentees is very important."* ***(KII 001)***

At the end of the survey, participants were asked "How can we better support female trainees of the EETB-RTP?" Five of the eight total responses for that question were about mentoring, with three of those specifically emphasizing female mentoring or peer mentorship opportunities that addressed "how to balance work and personal life."

Time as a Resource

Time was a valuable resource for participants and effective time management was an important facilitator of work-life balance. A lack of time was frequently cited as a barrier to writing manuscripts and applying to grants. As grants and publications are facilitators of career advancement, the lack of time to write was thus a barrier to advancing in their career. As women lacked the time to accomplish all their tasks, they reported using their sleep time, their annual leave, their lunch breaks, and other personal time to accomplish all that they needed to do between their professional and personal responsibilities.

> *"Usually, I work overnight at home or some activities that have not been completed here at work. After I complete my home activity, my home tasks and uhm after my family time, I use my sleep time for some of the activities."* ***(IDI 001)***

The lack of time was stressful and closely associated with the differing responsibilities the two lives required. Men were perceived as having more time than women to devote to research and career development as they did not have the same sociocultural expectations to fulfill familial responsibilities. The protected time stipend provided by the EETB-RTP was seen as a facilitator of increased time. Many participants reported the need to work a second job in the private sector to supplement their low government salary prior to the program. When they received the protected time stipend, they no longer needed to work those extra hours to provide for themselves or for their family. Without the need to work a second job, trainees had the "required time" to focus on their research.

> *"I used to work in a particularly private clinics, as a lab, okay, after work time to get more money so that you can cover your expenses and things like that... you don't have to look for overtime works, overtime as a part time jobs because stipend money, you can use that money to erase your financial limitations. So, I think uh particularly in terms of saving your time to focus on writing or reading time. That is very much helpful in that regard."* ***(IDI 006)***

Increased Scientific Network and Exposure

Key informants emphasized the importance of the role of the EETB-RTP in facilitating increased networking opportunities and exposure to other scientific professionals. Networking and exposure were closely associated ideas throughout the transcripts. Exposure was used to describe interactions with several different elements such as people, education, cultures, work in

international labs, and conferences, whereas networking was specific to people only. Participants viewed in-country conferences and the international and national mentor team model as excellent facilitators of networking opportunities and exposure. Participants from the all-women cohort did not comment on the role of the in-country conference on networking and exposure as they had not attended an in-country conference at the time of the interviews due to COVID-19. Networking and increased exposure were viewed as facilitators of team science, increased access to opportunities, grant ideas, and increased confidence.

> *"...specifically for a woman, researcher, or for women, uh we need to expand their networking... Networking, exposure. We have to expose them. Give them an opportunity to present their works, to communicate so that they can build- I have lived this such kinds of experience and exposure builds confidence"* ***(KII 003)***

Confidence Building

Throughout the interviews, a key outcome of programmatic activities was that of the EETB-RTP facilitating confidence building for its trainees. Key informants described women in Ethiopia as more shy, less assertive, and less confident in approaching mentors with questions or asking for help than their male peers. As seen in the recruitment process of the all-female cohort, participants felt less confident in their ability to successfully apply to a co-ed cohort because they felt their male peers would be more successful. This lack of confidence was seen as a barrier by trainees. As early career researchers who had little to no experience applying for grants and writing manuscripts for publication, they doubted the quality of their research and their written work, and they doubted their ability to get grant funding. The fear of asking for help from peers and mentors also hindered their ability to effectively conduct their research work.

> *"[I]n my work, I'm afraid to communicate someone but uh this makes me to not to do more on my research work. So, once I engaged on this, if I once I once I got when I got this opportunity I I become competent on my work to also to express to have a meeting with other researcher, so it is a good opportunity for me."* ***(IDI 005)***

Coursework and mentorship were considered confidence builders by the trainees. Trainees reported increased confidence in applying for grants, writing manuscripts, and conducting data analysis because of the classes provided by the EETB-RTP: the Scientific and Grant Writing Class, and the Biostatistics and Data Managements classes specifically. Participants not only felt more confident about their ability to write a grant, but they were more confident in their ability to successfully get grant funding. The availability of mentors, as well as their support and criticism, also facilitated confidence building for the trainees. The ability to regularly meet with their mentors' helped trainees feel confident in each step of their research. Confidence was also facilitated by regular feedback and constructive criticism of their work.

> *"Their [the mentors'] attitude, their willingness to help at any point, their availability, uh and their kind words in encouragement throughout the process, their constant criticism, uhm really uhm uh, they didn't held back when they comment on some of the things that I have done, which was very helpful, even though I put the best of the best that I have. But they were really out there and taking the time to criticize whatever I did, which was really uhm build up my my my confidence, and their loyalty to my growth is very inter-, very interesting and very- I'm really grateful to that.* ***(IDI 002)***

Grants and Publications: Facilitated by Coursework and Mentorship

Key areas of focus for the EETB-RTP include increasing individual capacity for writing publications and grants applications. For many of the participants, to be eligible for a promotion,

they must publish a first author manuscript, or several manuscripts at a second author or co-author level. Because publications were more closely associated with immediate promotion, and because trainees associated greater likelihood of success in grant applications with more publications, trainees tended to prioritize publishing their existing research work before thinking about applying for grants.

> *"The thing I didn't apply for a number of grants right now is, as my focus is just to finish what I started, so, uh that's why I think I have to have at least some output published output from the things I am doing now."* ***(IDI 006)***

Beyond needing to publish for career advancement, many participants had a personal desire to publish that was rooted in their desire to conduct meaningful and relevant research. If their research was meaningful and relevant than it was worth publishing and needed to be communicated with a wider audience because otherwise it failed to help anyone. The programming of the EETB-RTP was seen as a facilitator of publishing research. The courses and mentorship, including peer mentorship, were the most frequent programmatic facilitators discussed. In addition to facilitating the publishing of current research, two women reported increased confidence and ability to publish their pre-existing research.

> *"It's [the EETB] uh very helpful. I got energy of publishing my second paper because of the program because uh the paper that I have submitted very recently was my MSc research work, but uh I just keep it closed. I, I I it was not, I didn't try to even repair the manuscript. But after joining the program, and uh learning the uh different processes, just, I have submitted it."* ***(IDI 001)***

On average, participants had more publications since starting the program than they had prior to enrollment in the program (Table 4). Only two participants had no publications since

starting the program, one of whom had no publications prior to starting the EETB-RTP. Both trainees without publications were in the 2021 all-female cohort, and thus had less time to publish compared to trainees from previous cohorts. Graduated trainees had a higher median with nine publications since starting the program compared to active trainees with only 4. This difference is likely due to the graduated trainees having had more time to publish compared to active trainees. There was also an increase in the median number of grants applied to as a PI since starting the program compared to prior to enrollment in the EETB-RTP. Sixty percent of participants reported they were currently working a grant, averaging more than one active grant application (Table 4).

As early career researchers, participants had less experience with grant applications than they did with publishing their research. Most participants viewed grants as the necessary mechanism by which their research would be funded and did not have the same personal motivation to get grant funding as they did for publishing. The grant writing class was seen as a major facilitator of perceived greater success in grant applications. The grant writing class is taught in two sections. The first semester is didactic learning, and the second is an independent study with the instructor during which the trainees work independently with the instructor to prepare a grant application for submission. Respondents had high agreement (median=9.0; where 1=strongly disagree, and 10=strongly agree) with the statement that the Scientific and Grant Writing course had increased their capacity to apply for and receive grants (Table 4). The lack of knowledge, experience, and confidence were reported as barriers to applying for grants. The didactic content of the first semester addressed the lack of knowledge, and the applied experience in the independent study semester resulted in improved confidence in trainees' ability to successfully apply for grants.

Interviewer

So, in the past, what have been some of the barriers for applying to grants?

Participant

The knowledge- how to apply, where to apply.

Interviewer

And you feel like the class helped answer those questions?

Participant

Yes, yes. Definitely. I am uh receiving a grant alerts uh notifications every time after the class. So, I'm looking, I'm trying from time to time so it's very helpful. ***(IDI 001)***

Table 4	**Median**	**Range**
Publications		
Number of Publications Prior to Starting EETB-RTP	2.5	0-14
Graduated Trainees	1	1-4
Active Trainees	3	0-14
Number of Publications Since Starting EETB-RTP	5.0	0-23
Graduated Trainees	9	2-23
Active Trainees	4	0-8
Grants		
Grants applied to as a PI prior to enrollment in the EETB-RTP	0.5	0-4
Grants received as a PI prior to enrollment in the EETB-RTP	0.0	0-3
Grants applied to as a PI since enrollment in the EETB-RTP	1.5	0-3
Grants received as a PI since enrollment in the EETB-RTP	0.0	0-1
Number of Grants currently being drafted	1.5	1-2

Currently drafting a grant application	60%	
Scale rating agreement where 1=strongly disagree, and 10=strongly agree		
The Scientific and Grant Writing course has increased my capacity to apply for and receive grants.	9.0	5-10

Chapter 5: Discussion

This research contributes to the contextual and cultural understanding of barriers to and facilitators of career advancement for female researchers in Ethiopia through the mechanism of an NIH Fogarty research training program. To our knowledge, this is the first research investigating the program's ability to support the unique career development needs of its female trainees, and one of few studies investigating facilitators of career development for female researchers in Ethiopia.

Our findings suggest that dedicated all-female RFAs and cohorts are facilitators of gender equity in research training programs in Ethiopia, as more women felt empowered to apply and more were able to benefit from the training. The all-female RFA also addressed barriers for women by creating a level-playing field by eliminating perceived male advantage in the application process. Female mentorship was an additional facilitator that helped early-career female researchers manage the dual responsibilities of their two lives: professional and familial. Consistent with other literature on research training programs (Cross et al., 2019), facilitators of excellent mentoring relationships included interest, availability, timely critical feedback, and networking. Peer and pod mentoring experiences were valued by female participants (Biehle et al., 2021; DeCastro et al., 2013) and most participants desired female mentorship (DeCastro et al., 2013) and more intersectional mentorship that addressed work-life balance (Harrison et al., 2022).

Once enrolled in the program, the EETB-RTP programmatic activities-- mentorship, the protected time stipend, the all-female RFA, and coursework—resulted in the outcomes of increased time and confidence, and a wider scientific network. These activities and outcomes facilitated a qualitative and synergistic effect that led to increased productivity in grants and

publications, which are well-established contributors to career development--the long-term goal of the EETB-RTP. The protected time stipend increased the time available to participants by reducing financial pressures that resulted in trainees needing to take second jobs. By not working multiple jobs, participants had more time to focus on writing. This is supported in literature as researchers in LMICs tend to rely on day-to-day or hourly income, which limits the time they are able to devote to research compared to counterparts in high income countries (HICs) (Hodson et al., 2023), but there is not any research on how the utilization and perspectives on protected time differ in LMICs compared to HIC where protected time is a given in academic and research institutions.

A key challenge recognized by female researchers in the sample was the larger domestic responsibilities they had compared to male peers (Jolly et al., 2014; Schoonbroodt, 2018). The inequitable division of labor in the home (Liani et al., 2021a) and in childrearing resulted in a lack of time to work on research, and research outputs such as grants and manuscripts, compared to male colleagues. This finding is similar to literature on women's double burden all over the world; in LMICs and in HICs. While training programs may not be able to directly overcome this challenge, programs need to address the unique needs their female trainees have regarding this double burden and consider the impacts it will have on programmatic impact measurements.

Grants and publications are widely considered important metrics of career advancement in a research career in the literature (Bavdekar & Tullu, 2016; Bloch et al., 2014; Tassew et al., 2021), and deemed crucial by participants. Publications were directly tied to promotions as several participants noted a need for a first author publication, or several co-author publications to get promotion; the wider literature emphasizes first or senior author publications in advancing a research career (Mbuagbaw et al., 2020). Trainees were more focused publications than on

grants at this early stage in their research career partially because a successful grant application was seen as less likely than a successful journal submission. Previous literature supports the trainees' perception and suggests that there is a funding bias against junior researchers (Azoulay et al., 2015; Shuchman, 2018). Despite the difficulty in obtaining funding, participants viewed grants as the necessary mechanism by which their research would be supported and by which more manuscripts would come from and stated that the program facilitated grant submissions. The coursework, specifically the grant writing course, provided participants with the necessary knowledge to find and apply for grants and gave them increased confidence in their ability to obtain grant funding. As success in grant funding necessitates grant applications, it is a good sign that the majority of participants were actively preparing more than one grant submission on average. More time is needed to assess the long-term effects of this program on obtaining grant funding as many of the participants had not graduated from the program at the time of data collection, and as key informants shared that women need more time to accomplish research outputs given their time spent living in two worlds.

Limitations

Limitations of this research include the self-reporting of data and possible reporting bias by participants. Additionally, participants of the all-female cohort had not graduated at the time of data collection. Thus, it is difficult to assess the post-programmatic impact of the facilitators of grants and publications for those participants. As this research had a narrow scope of a single D43 program in Ethiopia, and given the qualitative nature of this research, these results cannot be universally applied to female researchers everywhere. But many of the results of this study align with pre-existing literature which supports the validity of these findings in other contexts.

Further research is necessary to investigate the role of other Fogarty and similar research training programs in facilitating career advancement for female researchers.

Implications

The implications of these study findings include the partnering of female trainees, especially those with children, with at least one female mentor to help them achieve better work-life balance. Improved work-life balance will help female researchers stay in the field (Liani et al., 2021b) making female mentorship a qualitative facilitator that addresses the leaky pipeline of women in STEM. Additionally, training for all mentors needs to be expanded to include more holistic mentoring approaches. A holistic approach should focus on relational mentoring and remind male mentors to factor in the dual responsibilities, professional and familial, that female mentees bear. When one-on-one female mentoring is not possible, programs should consider program-facilitated peer and pod mentoring groups for the discussion of work-life balance. As peer and pod mentoring were valued by participants, research training programs should prioritize and encourage more peer and pod mentoring opportunities within and across cohorts.

For research training programs looking to increase the number of women participating, occasional and repeated all-female cohorts should be implemented, especially in contexts where the dual responsibilities of home and professional life place women at a time disadvantage compared to their male peers. This research provides evidence that not only do all-female cohorts increase the number of women able to access the training opportunity, but they also increase the number of female applicants as all-female RFAs are seen as more accessible.

Future Directions

Future directions for this research are the inclusion of Ethiopian male and international mentors to compare their experiences mentoring women with those of the key informant

mentors. Additionally, other research on Fogarty research training programs needs to be publishing sex-disaggregated data. SDG 17.18 specifically targets data disaggregation (Sustainable Development Solutions Network, n.d.), but there remains a lack of sex-disaggregated data in published research and program data (Hawkes et al., 2022; Sugimoto et al., 2019). Without sex-disaggregated data, we limit our ability to identify and address gender inequity (Hawkes et al., 2022).

Conclusion

There is a need to identify and implement qualitative facilitators of career development opportunities for female TB researchers in Ethiopia. This research supports the use of dedicated all-female training opportunities and female mentorship as qualitative facilitators for career development. Addressing barriers to career development for female researchers will reduce attrition from the field and quantitatively increase the number of women in research in the long-term.

Appendix A: TB Information

Latent TB Infection

A person with MT in their body, but who does not have tuberculosis disease, has latent tuberculosis infection (LTBI). A person with LTBI is not infective and has no signs or symptoms of infection. LTBI can be detected two to eight weeks after initial infection with MT by an interferon-gamma release assay (IGRA) or with a tuberculin skin test (TST) (*Chapter 2: Transmission and Pathogenesis of Tuberculosis*, n.d.). An estimated 10.6 million people fell ill with TB in 2021 and an estimated quarter of the world's population has been infected with MT (LTBI). The majority of those with normal immune systems will not develop TB disease or will clear the infection before it progresses to a diseased state (WHO, 2021). Progression from LTBI to TB disease can occur within weeks or take years (*Chapter 2: Transmission and Pathogenesis of Tuberculosis*, n.d.). People infected with LTBI have a 5-10% lifetime risk of developing TB. Without treatment, about 5% of people with LTBI will develop active TB, and an additional 5% will develop active disease later in life (*Chapter 2: Transmission and Pathogenesis of Tuberculosis*, n.d.) There are various factors, immune suppression, HIV diagnosis, age, socioeconomic status, smoking, etc., that increase the risk of LTBI developing into active TB disease (World Health Organization, 2021).

Antibiotic Resistance

An additional complication of TB is the increase in the prevalence of drug resistance. The 1990s saw the emergence of multidrug-resistant (MDR) TB. MDR is defined by resistance to at least isoniazid and rifampin, which are the first-choice drugs in treating TB. Resistance to these drugs necessitates treatment with second-line drugs (SLDs) which are more expensive, more toxic to the patient, and less effective in treating TB (CDC Morbidity and mortality weekly

report, 2006). Then reports started coming in about TB cases that were resistant to nearly all SLDs which would be known as extensively drug-resistant (XDR) TB which is defined by resistance to "isoniazid, rifampin, a fluoroquinolone, and a second-line injectable (amikacin, capreomycin, and kanamycin) OR by an organism that is resistant to isoniazid, rifampin, a fluoroquinolone, and bedaquiline or linezolid" (Langer & Starks, 2022). This is a recent change to the definition from the WHO In 2021, the WHO estimates there were 450, 000 incident cases of MDR/rifampin-resistant (RR) TB, which is a 3.1% increase from 2020 (World Health Organization, 2023a). By the end of 2016, 123 WHO Member States had reported cases of XDR-TB (World Health Organization, 2018). As many low- and middle-income countries (LMICs) lack the diagnostic ability to test for XDR-TB, there are no reliable global estimates as to the prevalence of XDR-TB, but estimates from countries with reliable data through 2016 suggest 6.2% of all MDR-TB cases are XDR-TB (World Health Organization, 2018).

Treatment Options

Despite the challenge drug resistance poses for TB treatment, there are multiple treatment options for TB and even a vaccine. The Bacillus Calmette-Guérin' (BCG) vaccine, named after the two French scientists who developed it, is 70-80% effective against severe forms of TB, such as TB meningitis (Oxford Vaccination Group, 2022). But there is debate over the efficacy of the vaccine in preventing TB overall, especially in adolescents and adults (Martinez et al., 2022). Research published in the Lancet in 2022 found that the protective effects of the BCG vaccine (when administered in infancy) waned at about five years old (Martinez et al., 2022). The results indicate that the current BCG vaccine, while important in protecting children who are at high risk for TB, is not enough to slow the TB epidemic as it is not as effective in adults, meaning new vaccines are needed (Martinez et al., 2022). As far as treatment options, given the rise of drug-

resistant TB, there are new drugs in development and new treatment regimens being investigated. One such treatment regimen that shows promise is the bedaquiline-pretomanid-linezolid (BPaL) regimen with a 90% efficacy in cases of highly drug-resistant TB (Conradie et al., 2022).

Appendix B: Data Collection Tools

Key Informant Interview Guide

Warm Up Questions

1. How did you end up in TB research?
    a. **When did you begin your career in research?**
    b. **What has helped you the most with achieving your TB research career goals?**
    c. **How common is your experience with that in Ethiopia?**
    d. **What has been challenging in your journey to get to where you are now in your career?**

2. What role do you think the EETB-RTP plays in preparing people to become independent researchers?

Key Questions

I want to spend some time talking about the broader context of women in research in Ethiopia and then we will move into some more program specific questions.

3. What are some of the challenges that female TB researchers in Ethiopia face?
    a. **How are these challenges unique to women? Or not?**
    b. **Is there anything unique about TB research compared to other research in regard to these challenges?**

4. What changes in career development opportunities for female TB researchers have you seen in Ethiopia over the course of your career?
    a. **What do you think has contributed to that change?**
    b. **What do you think still needs to be accomplished right now?**

5. What are the most important things for a female early-career TB researcher to do to progress in her career in Ethiopia these days?
    a. **What are barriers to career development for female researchers?**
    b. **What are facilitators of career development for female researchers?**

6. What does a good balance of work and life responsibilities look like for a TB researcher?
    a. **How is it different for a female researcher?**
    b. **What are some of the barriers to having a good work-life balance for women?**
    c. **What are facilitators of work-life balance for women?**
    d. **How can the EETB-RTP better aid female researchers in maintaining a good work-life balance?**

7. What are maternity leave policies like in Ethiopia?
    a. **What is the typical maternity leave experience for women in Ethiopia?**
    b. **What about in the case of clinical research? Grants? Clinical service? Professorship?**
    c. **What would an ideal maternity leave experience look like for female researchers in Ethiopia?**

Mentoring

Thank you for your answers. Now I would like to talk more about the role of mentoring in research, specifically for women in Ethiopia.

8. What are cultural norms in Ethiopia that influence mentoring relationships?
    a. **How can we do a better job understanding cultural differences that may impact mentoring?**
    b. **How does gender play a role in mentoring relationships? Female mentees with male mentors? With female mentors?**
    c. **What advice do you have for people mentoring women?**
    d. **How does the mentor training meet the needs of female trainees? What could the mentoring training improve on to better meet the needs of female trainees?**
    e. **In your mentoring experience, what are the differences between male and female mentees?**

EETB

Thank you for sharing that information about mentoring with me. I would like to transition to some general questions about EETB.

9. How is the EETB-RTP meeting its goal of helping early-career female TB researchers become independent researchers?
    a. **What is the most beneficial thing the program does to help female TB researchers?**
    b. **How can the EETB-RTP better support female researchers with their career development?**

10. How have the semester-long courses benefited female trainees as they work to become independent researchers?
    a. **What would you change about the semester-long courses to better support and or benefit its female trainees?**

11. How have you seen the short courses and mini sessions benefit female trainees as they work to become independent researchers? As a reminder some of the short courses include the English Language and Presentation skills, Implementation Science, Team Science, Responsible Conduct of Research, and Mentorship Training
    a. **What would you change about the short courses to better benefit female trainees?**
    b. **What course or content is missing from the current EETB-RTP short courses that would better benefit female trainees?**

12. What is the role of the EETB-RTP research stipend on career development opportunities for female trainees?

   a. **How would you change the stipend support to better support the needs of female trainees?**

13. What have been the benefits of the EETB Women in Research Subcommittee?
    a. **For the program, for trainees, for you?**
    b. **Has the committee met the goals it set when it was created?**
    c. **How could the committee better meet the needs of female trainees?**
    d. **What are your long-term goals for the Women in Research Subcommittee?**
    e. **Why did you recommend an all-women cohort?**

14. How has the all-women RFA been successful in meeting the goals of the Women in Research Subcommittee?
    a. **What still needs to be accomplished?**
    b. **Would you recommend repeating the all-women cohort in the future? Why or why not?**
    c. **What are the benefits on an all-women cohort compared to a co-ed cohort?**

Closing Questions

15. What part of the EETB-RTP programming would you like to see replicated in other training and education programs to better prepare female TB researchers to become independent researchers?

16. What advice do you have for program leadership about how to better support female researchers?

17. How can the EETB-RTP better support female TB researchers in Ethiopia?

In-depth Interview Guide

Warm up Questions

1. How did you become interested in TB research?
    a. **What people helped you develop that interest?**

2. What is your dream job in research?
    a. **How has the EETB-RTP prepared you for your dream job? What part of the EETB-RTP has been the most helpful in preparing you for your dream job?**

3. What did you hope to gain from the program when you were applying?
    a. **What sparked your interest in applying to the program? How did you hear about the program?**

Key Questions

Now we are going to spend some time discussing grants and publications and your experience in those areas.

4. Can you tell me about your experience publishing scientific manuscripts?
    a. **How is the process different for you from your male colleagues?**
    b. **How do publications affect your career as a female researcher?**
    c. **What are the barriers and facilitators of publishing for you?**
    d. **Is it a priority for you to publish personally? Where do you need to make sacrifices in order to publish?**
    e. **How has the EETB-RTP impacted or changed your experience with the publishing process?**

5. Can you tell me about your experience with preparing and submitting grants?
    a. **How has the EETB-RTP impacted or changed your experience with the grant process?**
    - **What have been the barriers and facilitators of:**
    b. **applying for grants?**
    c. **finding grants?**
    d. **receiving grants?**
    e. **How do grants affect your career?**
    f. **Is it a priority for you to get grant funding?**

6. ***[For current trainees***]: What do you know about the Advanced In-Country Research Training Grant provided by the EETB-RTP?
    a. **Do you plan to apply for the advanced in-country grant when you finish the program?**

[For previous trainees]: Why have you not applied for the Advanced In-Country Research Training Grant provided by the EETB-RTP?

- **a. How aware of the grant opportunity were you?**
- **b. What were the barriers to applying?**

Research Stipend

Thank you for all your answers so far. We really appreciate your willingness to share. The next few questions are about the research stipend provided by the EETB-RTP.

7. What has been the role of the research stipend from the EETB-RTP on your Fogarty fellowship responsibilities?
   - **a. How has it affected your career and institutional responsibilities outside of the Fogarty fellowship?**
   - **b. Do you feel the EETB-RTP research stipend is sufficient in helping you protect your time for conducting the Fogarty research project and for completing research training?**
   - **c. How would you change the research stipend to better aid you in your Fogarty research and research training?**
   - **d. How would you change the research stipend to better aid you in your career and responsibilities outside of the Fogarty fellowship?**

Courses

Thanks for your honesty in sharing with me. Now I want to talk about the semester long and short courses.

8. What have been the benefits of the semester-long courses provided by the EETB-RTP for your research career? To be specific, the grant writing, biostatistics, and epidemiology courses.
   - **a. What course has been the most beneficial and why?**
   - **b. How has the content from these courses contributed to your research?**

9. What have been the benefits of the short courses provided by the EETB-RTP, such as the English Language and Presentation skills, Implementation Science, Team Science, Responsible Conduct of Research, and Mentor Training, for your research career?
   - **a. What short course that you attended has been the most beneficial and why?**

Mentoring

Now we are going to transition to talk about your mentoring relationships and mentoring in general.

10. What was your relationship like with your mentors from the EETB-RTP?
    - **a. What was it like with your international mentor? How did they support you?**
    - **b. What was it like with your Ethiopian mentor? How did they support you?**
    - **c. How have your mentors impacted your career?**

   d. **What are your thoughts on the international and local mentor team model the EETB-RTP uses?**

11. In your experience, what are the differences between male and female mentorship?
    a. **As a woman, are there advantages or disadvantages to having a female mentor?**

12. What is your perception of the female representation within the EETB-RTP?
    a. **How does the female representation in the EETB-RTP differ from your current institution? From your previous experiences research?**
    b. **What is your perception of the female representation for program staff vs trainees?**

All-women RFA

These next few questions are going to be about the all-women RFA and cohort.

13. ***[For current trainees]***: How did the all-women cohort affect your decision to apply to the EETB-RTP?
    a. **How has the all-women cohort affected your learning experience?**
    b. **How has the all-women cohort been different than co-ed learning experiences you have had?**
    c. **What is, or is not, appealing to you about an all-women cohort?**

    [For previous trainees]: How did the co-ed cohort affect your decision to apply to the EETB-RTP?

    a. **How has the co-ed cohort affected your learning experience?**
    b. **How do you think your experience would have differed if you had been in an all-women cohort?**
    c. **What is, or is not, appealing to you about an all-women cohort?**

14. How have your supported each other as females in this cohort?
    a. **How do you build relationships with other women who are researchers?**

Work-life balance

15. How would you describe the ability to balance work and home life responsibilities?
    e. **What does a good balance of work and home life look like for a TB researcher? For women?**
    f. **How do you work to maintain balance between your work and home life?**
    g. **What are some barriers to having a good balance in your work and home life for you?**
    h. **What are facilitators of a good balance between work and home life for you?**
    i. **How has the COVID-19 pandemic affected your balance of work and home life responsibilities?**
        i. **Do you feel like expectations or demands on you have changed as a result of the pandemic.**

   j. **How can the EETB-RTP better aid female researchers in maintaining a good balance of work and home life?**

Closing Questions

We are nearing the end of the interview; I just have a few closing questions for you.

16. What has been the most valuable part of the EETB-RTP regarding your career development?
    a. **What has been the least beneficial part of the program in aiding your career development?**

17. Would you recommend the EETB-RTP to other early career female TB researchers?
    a. **Why or why not?**
    b. **What would you tell them to convince them to apply?**

18. How can the EETB-RTP better support female researchers with their career development?

19. If you could create one or two opportunities to support women in research, what would you create? And dream big, what would you do if there were no limitations; it's the ideal setting, and there is all the time in the world.

20. What would you tell your younger self about pursuing a career in TB research?

Survey

Q41 By clicking here, I certify that I consent to participating in the following survey as described in the informed consent above.

- ○ Yes (1)
- ○ I do not wish to proceed with the survey (2)

End of Block: Block 6

Start of Block: Default Question Block

Q38 Please provide your first, second, and third name.

- ○ First (1) _____
- ○ Second (2) _____
- ○ Third (3) _____

Q21 What is your current job title? (i.e., PhD student, Research Associate, Researcher II) Please include all titles that apply.

_____

Q42 The next few questions are about the semester long classes and the short courses offered by the EETB-RTP. Please be as honest and thorough as possible. Your responses are highly valued.

Q1 Rate your level of effort in each of the following classes.
1= Poor effort: I did not attend, pay attention, or complete coursework for the class.

10= Excellent effort: I attended all the classes, gave my undivided attention, was an active participant, and completed my coursework on time.

	I did not take this course (11)	1- Poor effort (1)	2 (2)	3 (3)	4 (4)	5- Neutral (5)	6 (6)	7 (7)	8 (8)	9 (9)	10- Excellent effort (10)
Scientific and Grant Writing (1)	○	○	○	○	○	○	○	○	○	○	○
Biostatistics (2)	○	○	○	○	○	○	○	○	○	○	○
Data Management (3)	○	○	○	○	○	○	○	○	○	○	○
Epidemiology (Analytics Methods I) (4)	○	○	○	○	○	○	○	○	○	○	○

Q2 Rank the following short courses provided by the EETB-RTP by the most valuable to your career. (1= most valuable, 6= least valuable) Click and drag each course to move.

_____ Mentorship Training (1)
_____ English Language and Presentation Skills (2)
_____ Sex as a Biological Variable (3)
_____ Implementation Science (4)
_____ Team Science Training (5)
_____ Responsible Conduct of Research (6)

Q3 Briefly explain why you chose the top course (1) as most valuable and the bottom course (6) as least valuable?

_____

_____

_____

_____

Q4 Rate your overall engagement with the short courses provided by the EETB-RTP.
1= Low engagement: I did not attend or pay attention to the majority of the short courses.
10= High engagement: I attended all the courses I was eligible for, gave my undivided attention, and was an active participant in the short courses I was eligible for.

	1-Low engagement (1)	2 (2)	3 (3)	4 (4)	5- Neutral (5)	6 (6)	7 (7)	8 (8)	9 (9)	10- High engagement (10)
Short Courses (1)	○	○	○	○	○	○	○	○	○	○

Q5 Please select your level of agreement with each of the following statements.

	I did not take this course (1)	1- Strongly disagree (2)	2 (3)	3 (4)	4 (5)	5- Neutral (6)	6 (7)	7 (8)	9 (9)	9 (10)	10- Strongly agree (11)
The Scientific and Grant Writing course has increased my capacity to apply for and receive grants. (1)	○	○	○	○	○	○	○	○	○	○	○
The Biostatistics course has improved my ability to analyze my research. (2)	○	○	○	○	○	○	○	○	○	○	○
Data Management course has helped me obtain the skills needed to analyze my data. (3)	○	○	○	○	○	○	○	○	○	○	○
The Epidemiology course (Analytic Methods I) has improved my research methodology. (4)	○	○	○	○	○	○	○	○	○	○	○

Q29 How often did you interact with trainees from other Fogarty research training programs in EETB-RTP sponsored courses, trainings, and events (i.e., Nigeria, Georgia, India, Kenya, Vietnam)?

- ○ Never (1)
- ○ Annually (2)
- ○ Quarterly (3)
- ○ Monthly (4)
- ○ Several times a month (5)
- ○ Other (please specify) (6) _____

End of Block: Default Question Block

Start of Block: Block 4

Q43 This next set of questions has to do with mentorship.

Q22 Did you have a mentor prior to applying to the EETB-RTP?
A mentor is defined as: “a trusted counselor or guide who provides support, wisdom, knowledge, and expertise to a mentee.”

- ○ Yes (1)
- ○ No (2)

Q23 Do you currently have a mentor(s)?
"Currently" meaning you are in active communication with them and have met (in-person or virtually) within the past 6 months.

- ○ Yes (1)
- ○ No (2)

Q24 Do you currently have a female mentor?

- Yes (1)
- No (2)

Display This Question:

If Do you currently have a female mentor? = Yes

Q47 Are you at the same institution as your female mentor?

- Yes (1)
- No (2)

Display This Question:

If Do you currently have a female mentor? = No

Q25 Have you ever had a female mentor?

- Yes (1)
- No (2)

Display This Question:

If Have you ever had a female mentor? = No

Or Do you currently have a female mentor? = No

Q28 Have you previously, or do you currently have a female mentor or role model **at your institution**?
A female role model is defined as: a woman who has positively shaped your motivation for your career by her example.

- Yes (1)
- No (2)

Q39 Thinking about your time in the EETB-RTP as a whole, how would you rate the quality of all mentorship and support you received through the EETB-RTP? This includes trainings, informal mentoring with program leadership etc.

1 star= lowest possible quality of mentorship

10 stars= highest possible quality of mentorship

Quality of Mentorship (1)

Q30 While you were an active trainee of the EETB-RTP, how frequently do/did you meet with your Ethiopian mentor(s) on average (in-person or virtually)?

- ○ I have never met with my Ethiopian mentor (1)
- ○ Once a year (2)
- ○ Every 6 months (3)
- ○ Every couple of months (4)
- ○ At least once a month (5)
- ○ Weekly (6)
- ○ Daily (7)
- ○ Other (please specify) (8) _____

Q32 Overall, how would you rate your satisfaction with your mentorship with your Ethiopian mentor(s)?

1 star= lowest possible satisfaction

10 stars= highest possible satisfaction

Satisfaction with Mentorship (1)

Q33 While you were an active trainee of the EETB-RTP, how frequently do/did you meet with your international mentor(s) on average (in-person or virtually)?

- ○ I have never met with my international mentor (1)
- ○ Once a year (2)
- ○ Every 6 months (3)
- ○ Every couple of months (4)
- ○ At least once a month (5)
- ○ Weekly (6)
- ○ Daily (7)
- ○ Other (please specify) (8) _____

Q31 Overall, how would you rate your satisfaction with your mentorship with your international mentor(s)?

1 star= lowest possible satisfaction

10 stars= highest possible satisfaction

Satisfaction with Mentorship (1) ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

Q27 Have you ever used or accessed a copy of the Influential Mentoring book authored by Dawn Comeau, Miliard Derbew, and Damen Haile Mariam?

- ○ Yes (1)
- ○ No (2)

End of Block: Block 4

Start of Block: Block 1

Q6 Did you work individually with Hannah Nicol for English language assistance since beginning your training with the EETB-RTP? This could be for support with grants, publications, or other program or work-related activities.

- Yes (1)
- No (2)

Display This Question:

If Did you work individually with Hannah Nicol for English language assistance since beginning your... = Yes

Q7 How many times did you work individually with Hannah Nicol over (in-person or virtually) for English language assistance since your beginning training with the EETB-RTP?

▼ 1 (4) ... More than 20 times (24)

Q8 Did you work individually with Dr. Janet Gross to prepare a grant for submission (in-person or virtually- including email) since beginning your training with the EETB-RTP?

- Yes (1)
- No (2)

Display This Question:

If Did you work individually with Dr. Janet Gross to prepare a grant for submission (in-person or vi... = Yes

Q9 How many times did you work individually with Dr. Janet Gross (in-person or virtually- including email) for grant writing assistance including coursework and external opportunitiessince beginning your training with the EETB-RTP?

▼ 1 (4) ... More than 20 (24)

End of Block: Block 1

Start of Block: Block 2

Q10 The next few questions are about **grants applied** to and **received** before and after starting the EETB-RTP. Please consider all grants where you were a principal investigator, or multiple principal investigator (including site PI), regardless of size (large or small) or whether it was a travel grant. Any grant where you were the primary recipient and director of the funds.

Q11 How many grants did you **apply** to as a principal investigator **before starting** the EETB-RTP?
(Your best estimate is fine)

▼ 0 (4) ... More than 30 (36)

Q12 How many grants did you **receive** as a principal investigator **before starting** the EETB-RTP?
(Your best estimate is fine)

▼ 0 (4) ... More than 30 (35)

Q13 How many grants have you **applied** to as a principal investigator **since starting** the EETB-RTP?
(Your best estimate is fine)

▼ 0 (4) ... More than 30 (35)

Q14 How many grants have you **received** as a principal investigator **since starting** the EETB-RTP?
(Your best estimate is fine)

▼ 0 (4) ... More than 30 (35)

Q15 Do you have any grants that you are currently drafting?

- Yes (1)
- No (2)

Display This Question:

If Do you have any grants that you are currently drafting? = Yes

Q16 How many grants are you currently drafting?

▼ 1 (4) ... More than 10 (25)

End of Block: Block 2

Start of Block: Block 3

Q45 The following questions focus on the financial support provided by the EETB-RTP.

Q17 Please select your level of agreement with the following statements.

	1- Strongly disagree (1)	2 (2)	3 (3)	4 (4)	5- Neutral (5)	6 (6)	7 (7)	8 (8)	9 (9)	10- Strongly agree (10)
The EETB-RTP stipend support from the EETB-RTP increased the number of weekly hours I am/was able to work on my research and/or training as a Fogarty fellow. (1)	○	○	○	○	○	○	○	○	○	○
The EETB-RTP stipend support from the EETB-RTP decreased the amount of stress I experience(d) from trying to balance my financial needs with the research and/or training demands on my time as a Fogarty fellow. (2)	○	○	○	○	○	○	○	○	○	○

Q18 Rate how the EETB-RTP has increased your access to the following:

	Not at all (1)	Somewhat (2)	Greatly (3)
Journal articles (1)	○	○	○
Laboratory supplies (2)	○	○	○
Software (e.g., SPPS, Endnote, SAS) (3)	○	○	○
Funds to conduct research (e.g., participant incentives, travel costs to research sites, etc.) (4)	○	○	○

Q20 Have you received any direct financial support from the EETB-RTP for your participation in a conference

○ Yes (1)

○ No (2)

Q19 While you were an active EETB-RTP trainee, you received an annual stipend and a monthly research stipend. What other financial support did you receive from the EETB-RTP? This could include financial support for software or classes outside of those offered by the EETB-RTP. If none, write "none".

_____

End of Block: Block 3

Start of Block: Block 5

Q44 The final few questions focus on the request for applications, career development, and recommendations to better support female trainees. Your answers to these questions are invaluable as we seek to understand and improve how the EETB-RTP supports female trainees. Thank you for taking the time to complete this survey.

Q34 How did you learn about the request for applications for the EETB-RTP?

- ○ Sent to you by a mentor (1)
- ○ Sent to you by a colleague or peer (2)
- ○ Advertising by your institution (3)
- ○ Recommended by a previous trainee (4)
- ○ Other (please specify) (5) _____

Q35 Did you attend the Zoom application workshop for the all-women RFA live, or watch the full recording of the workshop?"

- ○ Yes, I attended the workshop live (3)
- ○ Yes, I watched the full recording (4)
- ○ No, I did not attend or watch the recording of the workshop (6)

Q36 What part of the EETB-RTP has contributed the most to your career development?

_____

Q37 How can we better support female trainees of the EETB-RTP?

_____

End of Block: Block 5

References

Adefuye, A. O., Adeola, H. A., & Bezuidenhout, J. (2018). The physician-scientists: Rare species in Africa. *The Pan African Medical Journal*, *29*(8), Article 8. https://doi.org/10.11604/pamj.2018.29.8.13239

Adigun, R., & Singh, R. (2022). Tuberculosis. In *StatPearls*. StatPearls Publishing. http://www.ncbi.nlm.nih.gov/books/NBK441916/

American Association of University Women. (n.d.). *The STEM Gap: Women and Girls in Science, Technology, Engineering and Mathematics*. AAUW : Empowering Women Since 1881. Retrieved February 14, 2023, from https://www.aauw.org/resources/research/the-stem-gap/

Ayentimi, D. T., & Abadi, H. A. (2022). Why are women opting out of academic careers in higher education in Ghana? Implication for policy and practice. *Higher Education Research & Development*, *0*(0), 1–15. https://doi.org/10.1080/07294360.2022.2048636

Azoulay, P., Fons-Rosen, C., & Graff Zivin, J. S. (2015). *Does Science Advance One Funeral at a Time?* (Working Paper No. 21788). National Bureau of Economic Research. https://doi.org/10.3386/w21788

Bavdekar, S., & Tullu, M. (2016). Research publications for academic career advancement: An idea whose time has come. But is this the right way? *Journal of Postgraduate Medicine*, *62*(1), 1–3. https://doi.org/10.4103/0022-3859.173184

Bennett, S., Paina, L., Ssengooba, F., Waswa, D., & M'Imunya, J. M. (2013). The impact of Fogarty International Center research training programs on public health policy and program development in Kenya and Uganda. *BMC Public Health*, *13*(1), 770. https://doi.org/10.1186/1471-2458-13-770

Biehle, L., Crowl, A., Park, H. C., Vos, S., & Franks, A. M. (2021). The Power of Peer Mentoring to Support Women Pharmacy Faculty Personally and Professionally. *American Journal of Pharmaceutical Education*, *85*(2), 8471. https://doi.org/10.5688/ajpe8471

Bloch, C., Graversen, E. K., & Pedersen, H. S. (2014). Competitive Research Grants and Their Impact on Career Performance. *Minerva*, *52*(1), 77–96.

Blumberg, H. M., & Ernst, J. D. (2016). The Challenge of Latent TB Infection. *JAMA*, *316*(9), 931–933. https://doi.org/10.1001/jama.2016.11021

Buchholz, L. (2022, May 26). *60% of women in STEM careers inspired by role models*. https://march8.com/articles/60-of-women-in-stem-inspired-by-role-models-study-says

Castro Torres, A. F., & Alburez-Gutierrez, D. (2022). North and South: Naming practices and the hidden dimension of global disparities in knowledge production. *Proceedings of the National Academy of Sciences*, *119*(10), e2119373119. https://doi.org/10.1073/pnas.2119373119

CDC Morbidity and mortality weekly report,. (2006). *Emergence of <I>Mycobacterium tuberculosis</I> with Extensive Resistance to Second-Line Drugs—Worldwide, 2000—2004*. https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5511a2.htm

CDCTB. (2022, January 14). *World TB Day History*. Centers for Disease Control and Prevention. https://www.cdc.gov/tb/worldtbday/history.htm

Chapter 2: Transmission and Pathogenesis of Tuberculosis. (n.d.). Retrieved February 2, 2023, from https://www.cdc.gov/tb/education/corecurr/pdf/chapter2.pdf

Charani, E., Mendelson, M., Ashiru-Oredope, D., Hutchinson, E., Kaur, M., McKee, M., Mpundu, M., Price, J. R., Shafiq, N., & Holmes, A. (2021). Navigating sociocultural

disparities in relation to infection and antibiotic resistance—The need for an intersectional approach. *JAC-Antimicrobial Resistance*, *3*(4), dlab123. https://doi.org/10.1093/jacamr/dlab123

Chilot, D., Woldeamanuel, Y., & Manyazewal, T. (2021). Real-Time Impact of COVID-19 on Clinical Care and Treatment of Patients with Tuberculosis: A Multicenter Cross-Sectional Study in Addis Ababa, Ethiopia. *Annals of Global Health*, *87*(1), 109. https://doi.org/10.5334/aogh.3481

Conradie, F., Bagdasaryan, T. R., Borisov, S., Howell, P., Mikiashvili, L., Ngubane, N., Samoilova, A., Skornykova, S., Tudor, E., Variava, E., Yablonskiy, P., Everitt, D., Wills, G. H., Sun, E., Olugbosi, M., Egizi, E., Li, M., Holsta, A., Timm, J., … ZeNix Trial Team. (2022). Bedaquiline-Pretomanid-Linezolid Regimens for Drug-Resistant Tuberculosis. *The New England Journal of Medicine*, *387*(9), 810–823. https://doi.org/10.1056/NEJMoa2119430

Cross, M., Lee, S., Bridgman, H., Thapa, D. K., Cleary, M., & Kornhaber, R. (2019). Benefits, barriers and enablers of mentoring female health academics: An integrative review. *PLoS ONE*, *14*(4), e0215319. https://doi.org/10.1371/journal.pone.0215319

Dara, M., Kuchukhidze, G., Yedilbayev, A., Perehinets, I., Schmidt, T., Van Grinsven, W. L., & Boeree, M. J. (2021). Early COVID-19 pandemic's toll on tuberculosis services, WHO European Region, January to June 2020. *Euro Surveillance: Bulletin Europeen Sur Les Maladies Transmissibles = European Communicable Disease Bulletin*, *26*(24), 2100231. https://doi.org/10.2807/1560-7917.ES.2021.26.24.2100231

DeCastro, R., Sambuco, D., Ubel, P. A., Stewart, A., & Jagsi, R. (2013). Mentor Networks in Academic Medicine: Moving Beyond a Dyadic Conception of Mentoring for Junior

Faculty Researchers. *Academic Medicine : Journal of the Association of American Medical Colleges*, *88*(4), 488–496. https://doi.org/10.1097/ACM.0b013e318285d302

Dei, G. J. S., & Asgharzadeh, A. (2002). What Is to Be Done? A Look at Some Causes and Consequences of the African Brain Drain. *African Issues*, *30*(1), 31–36. https://doi.org/10.2307/1167087

Deribew, A., Deribe, K., Dejene, T., Tessema, G. A., Melaku, Y. A., Lakew, Y., Amare, A. T., Bekele, T., Abera, S. F., Dessalegn, M., Kumsa, A., Assefa, Y., Kyu, H., Glenn, S. D., Misganaw, A., & Biadgilign, S. (2018). Tuberculosis Burden in Ethiopia from 1990 to 2016: Evidence from the Global Burden of Diseases 2016 Study. *Ethiopian Journal of Health Sciences*, *28*(5), 519–528. https://doi.org/10.4314/ejhs.v28i5.2

Dhumal, G., DeLuca, A., Chandanwale, A., Kadam, D., Joshi, S., Kinikar, A., Gupte, N., Mave, V., Gupta, A., Suryavanshi, N., & Bollinger, R. C. (2020). Impact of the Fogarty Training Program on Trainee and Institutional Research Capacity Building at a Government Medical College in India. *Annals of Global Health*, *86*(1), Article 1. https://doi.org/10.5334/aogh.2932

Eshetu, F., Guye, A., Kelemework, G., & Abebe, S. (2018). Determinants of students vulnerability to attrition in higher education: Evidence from Arba Minch University, Ethiopia. *Educational Research and Reviews*, *13*(15). https://doi.org/10.5897/err2018.3533

Evans, H. K., & Bucy, E. P. (2010). The Representation of Women in Publication: An Analysis of Political Communication and the International Journal of Press/Politics. *PS: Political Science & Politics*, *43*(2), 295–301. https://doi.org/10.1017/S1049096510000168

Fogarty International Center. (n.d.). *Our Global Health Research Mission and Vision—Fogarty International Center @ NIH*. Fogarty International Center. Retrieved February 17, 2023, from https://www.fic.nih.gov:443/About/Pages/mission-vision.aspx

González-Pérez, S., Mateos de Cabo, R., & Sáinz, M. (2020). Girls in STEM: Is It a Female Role-Model Thing? *Frontiers in Psychology*, *11*. https://www.frontiersin.org/articles/10.3389/fpsyg.2020.02204

Haileamlak, A. (2021). Ethiopia is on Track of Achieving the WHO End Tuberculosis Milestone. *Ethiopian Journal of Health Sciences*, *31*(1), 1–2. https://doi.org/10.4314/ejhs.v31i1.1

Harrison, M., Tran, D. N., Pena, A., Iyengar, S., Ahmed Abubakar, A., Hoernke, K., John-Akinola, Y. O., Kiplagat, S., Marconi, A. M., Vaghaiwalla, T. M., Kalbarczyk, A., & Weinberg, J. L. (2022). Strategies to Improve Women's Leadership Preparation for Early Career Global Health Professionals: Suggestions from Two Working Groups. *Annals of Global Health*, *88*(1), 53. https://doi.org/10.5334/aogh.3705

Hawkes, S., Pantazis, A., Purdie, A., Gautam, A., Kiwuwa-Muyingo, S., Buse, K., Tanaka, S., Borkotoky, K., Sharma, S., & Verma, R. (2022). Sex-disaggregated data matters: Tracking the impact of COVID-19 on the health of women and men. *Economia Politica*, *39*(1), 55–73. https://doi.org/10.1007/s40888-021-00254-4

Hodson, D. Z., Etoundi, Y. M., Parikh, S., & Ii, Y. B. (2023). Striving towards true equity in global health: A checklist for bilateral research partnerships. *PLOS Global Public Health*, *3*(1), e0001418. https://doi.org/10.1371/journal.pgph.0001418

Hunt, D. V., Lee, L., Prince, S., & Dixon-Fyle, S. (2018). *Diversity ethnicity Ex 5 online*. http://ceros.mckinsey.com/diversity-ethnicity

Jolly, S., Griffith, K. A., DeCastro, R., Stewart, A., Ubel, P., & Jagsi, R. (2014). Gender Differences in Time Spent on Parenting and Domestic Responsibilities by High-Achieving Young Physician-Researchers. *Annals of Internal Medicine*, *160*(5), 344–353. https://doi.org/10.7326/M13-0974

Joshi, A. (2014). By Whom and When Is Women's Expertise Recognized? The Interactive Effects of Gender and Education in Science and Engineering Teams. *Administrative Science Quarterly*, *59*(2), 202–239. https://doi.org/10.1177/0001839214528331

Kempker, R. R., Tukvadze, N., Sthreshley, L., Sharling, L., Comeau, D. L., Magee, M. J., Rio, C. del, Avaliani, Z., & Blumberg, H. M. (2018). The Impact of a Fogarty International Center-Supported Tuberculosis Research Training Program in the Country of Georgia. *The American Journal of Tropical Medicine and Hygiene*, *98*(4), 1069–1074. https://doi.org/10.4269/ajtmh.17-0667

Knoema. (2021). *Ethiopia Tuberculosis death rate, 1960-2022—Knoema.com*. Knoema. https://knoema.com//atlas/Ethiopia/topics/Health/Risk-factors/Tuberculosis-death-rate

Kokwaro, G., & Kariuki, S. (2001). Medical research in Africa: Problems and some solutions. *Malawi Medical Journal : The Journal of Medical Association of Malawi*, *13*(3), 40.

Langer, A., & Starks, A. (2022, February 2). *Dear Colleague Letter*. Centers for Disease Control and Prevention. https://www.cdc.gov/tb/publications/letters/2022/surv-def-xdr.html

Liani, M. L. (2021). *Barriers and enablers for enhancing career progression of women in science careers in Africa*. https://www.ukcdr.org.uk/blog-millicent-liani-barriers-and-enablers-for-enhancing-career-progression-of-women-in-science-careers/

Liani, M. L., Nyamongo, I. K., Pulford, J., & Tolhurst, R. (2021a). An intersectional gender analysis of familial and socio-cultural drivers of inequitable scientific career progression

of researchers in Sub-Saharan Africa. *Global Health Research and Policy*, *6*(1), 30. https://doi.org/10.1186/s41256-021-00213-3

Liani, M. L., Nyamongo, I. K., Pulford, J., & Tolhurst, R. (2021b). An intersectional gender analysis of familial and socio-cultural drivers of inequitable scientific career progression of researchers in Sub-Saharan Africa. *Global Health Research and Policy*, *6*(1), 30. https://doi.org/10.1186/s41256-021-00213-3

Liani, M. L., Nyamongo, I. K., Pulford, J., & Tolhurst, R. (2021c). Institutional-level drivers of gender-inequitable scientific career progression in sub-Saharan Africa. *Health Research Policy and Systems*, *19*(1), 117. https://doi.org/10.1186/s12961-021-00767-1

Maharaj, B. (2014). The African Brain Drain: Causes, Costs, and Consequences. In S. Sahoo & B. K. Pattanaik (Eds.), *Global Diasporas and Development: Socioeconomic, Cultural, and Policy Perspectives* (pp. 121–138). Springer India. https://doi.org/10.1007/978-81-322-1047-4_7

Manyazewal, T., Woldeamanuel, Y., Blumberg, H. M., Fekadu, A., & Marconi, V. C. (2020). The fight to end tuberculosis must not be forgotten in the COVID-19 outbreak. *Nature Medicine*, *26*(6), Article 6. https://doi.org/10.1038/s41591-020-0917-1

Martinez, L., Cords, O., Liu, Q., Acuna-Villaorduna, C., Bonnet, M., Fox, G. J., Carvalho, A. C. C., Chan, P.-C., Croda, J., Hill, P. C., Lopez-Varela, E., Donkor, S., Fielding, K., Graham, S. M., Espinal, M. A., Kampmann, B., Reingold, A., Huerga, H., Villalba, J. A., … Andrews, J. R. (2022). Infant BCG vaccination and risk of pulmonary and extrapulmonary tuberculosis throughout the life course: A systematic review and individual participant data meta-analysis. *The Lancet Global Health*, *10*(9), e1307–e1316. https://doi.org/10.1016/S2214-109X(22)00283-2

Mbuagbaw, L., Anderson, L. N., Lokker, C., & Thabane, L. (2020). Advice for Junior Faculty Regarding Academic Promotion: What Not to Worry About, and What to Worry About. *Journal of Multidisciplinary Healthcare*, *13*, 117–122. https://doi.org/10.2147/JMDH.S240056

Melak, A., & Singh, S. (2021). Women's Participation and Factors Affecting Their Academic Performance in Engineering and Technology Education: A Study of Ethiopia. *Sustainability*, *13*(4), Article 4. https://doi.org/10.3390/su13042246

Molla, T., & Cuthbert, D. (2014). Qualitative inequality: Experiences of women in Ethiopian higher education. *Gender and Education*, *26*(7), 759–775. https://doi.org/10.1080/09540253.2014.970614

Muktar, S. A., Desta, B. F., Damte, H. D., Heyi, W. K., Gurmamo, E. M., Abebe, M. G., Mesele, M. G., & Argaw, M. D. (2022). Exploring the opportunities and challenges of female health leaders in three regional states of Ethiopia: A phenomenological study. *BMC Public Health*, *22*(1), 1471. https://doi.org/10.1186/s12889-022-13871-w

Murdoch, J., Curran, R., van Rensburg, A. J., Awotiwon, A., Dube, A., Bachmann, M., Petersen, I., & Fairall, L. (2021). Identifying contextual determinants of problems in tuberculosis care provision in South Africa: A theory-generating case study. *Infectious Diseases of Poverty*, *10*, 67. https://doi.org/10.1186/s40249-021-00840-5

National Institutes of Health. (n.d.). *Activity Codes Search Results*. Retrieved February 17, 2023, from https://grants.nih.gov/grants/funding/ac_search_results.htm?text_curr=d43&Search.x=0&Search.y=0&Search_Type=Activity

Nielsen, M. W., Alegria, S., Börjeson, L., Etzkowitz, H., Falk-Krzesinski, H. J., Joshi, A., Leahey, E., Smith-Doerr, L., Woolley, A. W., & Schiebinger, L. (2017). Gender diversity leads to better science. *Proceedings of the National Academy of Sciences*, *114*(8), 1740–1742. https://doi.org/10.1073/pnas.1700616114

Nimmesgern, H. (2016). Why Are Women Underrepresented in STEM Fields? *Chemistry – A European Journal*, *22*(11), 3529–3530. https://doi.org/10.1002/chem.201600035

Oxford Vaccination Group. (2022). *BCG Vaccine (TB vaccine)*. https://vk.ovg.ox.ac.uk/bcg-vaccine

Pan American Health Organization. (2022). *Tuberculosis deaths and disease increase during the COVID-19 pandemic—PAHO/WHO | Pan American Health Organization*. https://www.paho.org/en/news/27-10-2022-tuberculosis-deaths-and-disease-increase-during-covid-19-pandemic

Papageorgiou, J. D. O., Jorge A. Alvarez,Raphael A. Espinoza,Chris. (2018). *Economic Gains From Gender Inclusion: New Mechanisms, New Evidence*. IMF. https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2018/10/09/Economic-Gains-From-Gender-Inclusion-New-Mechanisms-New-Evidence-45543

Reimagining-girls-education-through-stem-2020.pdf. (n.d.). Retrieved February 17, 2023, from https://www.unicef.org/media/84046/file/Reimagining-girls-education-through-stem-2020.pdf

Sax, L. J., Hagedorn, L. S., Arredondo, M., & Dicrisi, F. A. (2002). Faculty Research Productivity: Exploring the Role of Gender and Family-Related Factors. *Research in Higher Education*, *43*(4), 423–446. https://doi.org/10.1023/A:1015575616285

Schoonbroodt, A. (2018). Parental child care during and outside of typical work hours. *Review of Economics of the Household*, *16*. https://doi.org/10.1007/s11150-016-9336-y

Shuchman, M. (2018). Obtaining funding an age-old problem for young researchers with novel ideas. *CMAJ : Canadian Medical Association Journal*, *190*(16), E516–E517. https://doi.org/10.1503/cmaj.109-5583

Sougou, N. M., Ndiaye, O., Nabil, F., Folayan, M. O., Sarr, S. C., Mbaye, E. M., & Martínez-Pérez, G. Z. (2022). Barriers of West African women scientists in their research and academic careers: A qualitative research. *PLOS ONE*, *17*(3), e0265413. https://doi.org/10.1371/journal.pone.0265413

Sugimoto, C. R., Ahn, Y.-Y., Smith, E., Macaluso, B., & Larivière, V. (2019). Factors affecting sex-related reporting in medical research: A cross-disciplinary bibliometric analysis. *The Lancet*, *393*(10171), 550–559. https://doi.org/10.1016/S0140-6736(18)32995-7

Sustainable Development Solutions Network. (n.d.). *17.18 by 2020, enhance capacity building support to developing countries, including for LDCs and SIDS, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts – Indicators and a Monitoring Framework*. Retrieved March 29, 2023, from https://indicators.report/targets/17-18/

Tamrat, W. (2018). *The Meager Output of Ethiopian Ph.D.s | Inside Higher Ed*. https://www.insidehighered.com/blogs/world-view/meager-output-ethiopian-phds

Tassew, B., Getnet, Y., Nega, A., Tilahun, E., Abebe, W., Roro, M., Yigeremu, M., Woldeamanuel, Y., Ketema, B., Demisse, H., Awraris, M., Assefa, S., Girma, S., Gezu, M., Zenebe, M., Wondimagegnehu, A., Girma, S., Nega, A., & Sisay, M. M. (2021).

Female Academic Career Development and Administrative Positions at Addis Ababa University: A Mixed-Method Study. *Ethiopian Journal of Health Development*, *35*(2), Article 2. https://www.ajol.info/index.php/ejhd/article/view/211868

UNESCO. (2016, November 18). *Women in Science*. http://uis.unesco.org/en/topic/women-science

Woolley, A. W., Chabris, C. F., Pentland, A., Hashmi, N., & Malone, T. W. (2010). Evidence for a Collective Intelligence Factor in the Performance of Human Groups. *Science*, *330*(6004), 686–688. https://doi.org/10.1126/science.1193147

World Bank. (2023a). *Incidence of tuberculosis (per 100,000 people)—Ethiopia | Data*. https://data.worldbank.org/indicator/SH.TBS.INCD?locations=ET

World Bank. (2023b). *Researchers in R&D (per million people)—Ethiopia | Data*. https://data.worldbank.org/indicator/SP.POP.SCIE.RD.P6?locations=ET

World Bank. (2023c). *Tuberculosis case detection rate (%, all forms)—Ethiopia | Data*. https://data.worldbank.org/indicator/SH.TBS.DTEC.ZS?locations=ET

World Bank. (2023d). *Tuberculosis treatment success rate (% of new cases)—Ethiopia | Data*. https://data.worldbank.org/indicator/SH.TBS.CURE.ZS?locations=ET

World Health Organization. (2018). *Tuberculosis: Extensively drug-resistant tuberculosis (XDR-TB)*. https://www.who.int/news-room/questions-and-answers/item/tuberculosis-extensively-drug-resistant-tuberculosis-(XDR-TB)

World Health Organization. (2021). *Tuberculosis (TB)*. https://www.who.int/news-room/fact-sheets/detail/tuberculosis

World Health Organization. (2023a). *2.3 Drug-resistant TB*. https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2022/tb-disease-burden/2-3-drug-resistant-tb

World Health Organization. (2023b). *SDG Target 3.3 Communicable diseases*. https://www.who.int/data/gho/data/themes/topics/sdg-target-3_3-communicable-diseases

World Health Organization. (2023c). *The End TB Strategy*. https://www.who.int/teams/global-tuberculosis-programme/the-end-tb-strategy

World Health Organization. (2023d). *WHO releases new global lists of high-burden countries for TB, HIV-associated TB and drug-resistant TB*. https://www.who.int/news/item/17-06-2021-who-releases-new-global-lists-of-high-burden-countries-for-tb-hiv-associated-tb-and-drug-resistant-tb