Accelerating knowledge translation with a multilevel TB consortium: Strategies from South Africa

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A dissertation

submitted in partial fulfillment of the

requirements for the degree of

Doctor of Philosophy

University of Washington

2025

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Program Authorized to Offer Degree:

Global Health

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Abstract

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This dissertation examines the Developing Innovative Solutions for Rapid Undoing of Pulmonary Tuberculosis (TB) Consortium (DISRUPT TB Consortium) in South Africa as a case study to understand how a multilevel research consortium can contribute to accelerating knowledge translation in global public health. Inefficient knowledge translation hinders the uptake of effective interventions into policy and practice, a critical challenge in South Africa given its high burden of TB. This research holistically examines the Consortium's design, function, and contributions to knowledge translation through three studies.

The first aim entailed developing an explicit theory of change (TOC) model based on steering committee members' perspectives and analyzed its operationalization. The results indicated that the Consortium emphasized bringing together stakeholders and conducting strong demonstration studies in the first phase of work, with less focus on the scale and sustainability of the interventions. The study highlighted the importance of upfront planning for impact, including a detailed and regularly revisited TOC.

The second aim employed an embedded comparative case study design to understand how the three provincial working groups (subunits within the multilevel consortium) functioned and managed challenges in the absence of explicit guidance. The findings revealed strong alignment in the PWGs' focus on supporting demonstration studies but a lack of alignment on other aspects of their mandates.

The study results underscored the importance of clear definition of strategic objectives and structural decisions for the subunits to support those objectives. Recommendations from the study include clear conceptualization and documentation of subunits' mandate and structure, and regular performance evaluation of their function.

The third aim again used an embedded comparative case study approach to examine the Consortium's contributions to the knowledge translation of the Targeted Universal Testing for TB (TUTT) and LINKEDin interventions. The results showed that the Consortium facilitated timely, relevant, and strong research; expedited the conduct of demonstration studies; and supported broad and targeted dissemination of results. The Consortium also experienced qualified success in ensuring the feasibility and consistent implementation of interventions across diverse settings, and missed opportunities to support the full knowledge translation lifecycle and leverage synergies between interventions.

The case study methodology employed qualitative content analysis of semi-structured interviews with Consortium members and stakeholders as well as review of the Consortium's founding documents. The findings provide insights into the strengths, challenges, and opportunities for research consortia in facilitating the translation of research into practice. The dissertation highlights that collaborative partnership structures require strategic planning and maintenance at all levels (using a TOC or similar tool can be helpful). The research also underscores the complexities of managing multilevel structures and the importance of clearly defining the mandate and structure of subunits to ensure alignment with overall consortium objectives. Strategic objectives should inform structural decisions in a research consortium, and it is critical to document both, including assumptions, trade-offs and risk mitigation plans to the extent possible. Ultimately, this dissertation contributes to the knowledge base on how research consortia can contribute to facilitating knowledge translation, offering valuable insights for the design and evaluation of current and future research consortia aiming to improve health outcomes.

TABLE OF CONTENTS

List of Tables ii
List of Figures ii
Acknowledgements and Dedication iii
Chapter 1. Introduction 1
Chapter 2. Making the implicit explicit: Stakeholder perspectives on the theory of change 9
Introduction 9
Methods 12
Results 15
Discussion 35
Conclusion 39
Chapter 3. Navigating complexities: Alignment and adaptation in a multilevel research consortium 40
Introduction 40
Background 41
Methods 42
Results 45
Discussion 55
Conclusion 61
Chapter 4. Facilitating knowledge translation: A research consortium's role in South Africa 63
Introduction 63
Background 63
Methods 65
Results 67
Discussion 78
Conclusion 82
Chapter 5. Conclusion 84
References 88
Appendix 1. Semi-Structured Interview Guide (2020-2021) 96
Appendix 2. Semi-Structured Interview Guide (2023-2024) 98
Appendix 3. Provincial working group case studies 104
Gauteng Province 104
KwaZulu-Natal Province 107
Western Cape Province 110
Appendix 4. Successful intervention case studies 113
Targeted Universal Testing for Tuberculosis 113
LINKEDin 118

LIST OF TABLES

Table 1. Groups represented in the Consortium steering committee 5
Table 2. Interventions studied by the Consortium 6
Table 3. Study participants by stakeholder group 13
Table 4. Interventions studied by the Consortium 18
Table 5. Successes and challenges of the Consortium's theory of change as operationalized 22
Table 6. Study participants by province and stakeholder group 44
Table 7. Successful interventions studied under the Consortium 65
Table 8. Study participants by stakeholder group 66
Table 9. Timeline of TUTT knowledge translation process 118

LIST OF FIGURES

Figure 1. DISRUPT TB Consortium theory of change 19

ACKNOWLEDGEMENTS AND DEDICATION

I have so many people to thank for their support and encouragement during this eight-year PhD journey. First, I extend my sincerest gratitude to my committee members for supporting me throughout this non-linear, prolonged dissertation process. I am so grateful to Bryan Weiner, Pren Naidoo, Steve Gloyd, and Mary Kay Gugerty for agreeing to serve on my committee and for their unwavering support for my research. I have learned so much from each of you. Special thanks to Bryan for being the absolute best advisor and coach and meeting me where I was every time we met. Thank you to Pren for helping to shape this research into a useful end product, and for being such a positive, encouraging force. Thank you to Steve for being my teacher since GH 511 in 2008 and for always asking the big, hard questions.

I would not have embarked on this journey without the initial push and support from Gilla Kaplan and Zameer Brey and I have so much gratitude for their friendship and mentorship. Thank you to Bose, for supporting such an ambitious professional development project and for your mentorship at work that has helped hone my analytical skills. Thank you to Adilah Petersen, who injected fresh energy into this research with her help doing data collection, transcription and analytical support. Thank you to all who participated in interviews for this research, for your vision in creating the DISRUPT TB Consortium, your confidence in me to allow me to study it, and your patience waiting for the results. I am in awe of the work that all of you do to improve the health and wellbeing of South Africans.

Thank you to all my friends and family who supported me throughout these eight years and who knew better than to ask about my progress, but cheered me on, nonetheless. Thank you to my parents and grandparents for always believing in me and leading by example – I simply would not be where I am without you. To my beautiful, brilliant children, Esther and Ari, I appreciate your love and understanding of all the weekends I spent typing away – I cannot wait to see where your inquisitive minds take you in this life and I will be cheering you on the whole way. And finally, the greatest gratitude of all to Carl Petrillo, my perfect match, the most supportive and loving husband a scholar could ask for – you have supported me every step of this journey in just the right way. This work is dedicated to my ancestors, grandparents, parents, and children with deep respect and gratitude for those who came before me and immense hope for the future.

CHAPTER 1. INTRODUCTION

Inefficient knowledge translation is a persistent challenge in global public health as in many other fields (1). Knowledge translation is a complicated process involving multiple stakeholders in the generation, adaptation, and application of knowledge, which requires linking disparate domains of expertise. The body of literature on knowledge translation (and the related concepts of research translation and evidence-based policy making) spans both the public health and public policy arenas, with perspectives and targeted recommendations for both researchers and policymakers as to how to effectively translate research into policy (2–7). Moreover, many stakeholders including researchers, funders, and norm-setting bodies have explored approaches to accelerating the knowledge translation process and making the implementation of evidence-based practices more efficient (8–13). One factor contributing to the problem is a lack of collaboration among those who generate knowledge, those who develop policies based on that knowledge, and those who are responsible for implementing those policies (14). Without collaboration, a research agenda is typically set and pursued independently by academicians and researchers, resulting in knowledge generated that may be irrelevant to policy priorities or incompatible with the implementation context.

Even countries, such as South Africa, with a strong research environment experience challenges related to knowledge translation. South Africa is home to a robust community of tuberculosis (TB) researchers, with domestic investments in TB research ranging from a peak of $8.4 million in 2017 to $4.2 million reported in 2022, as well as significant external funding including $9 million from the U.S. National Institutes of Health in 2020 (40% of their global investment in TB that year) (15). Despite a large volume of research on new interventions to control TB in South Africa, progress remains slow – partially hampered by a lack of innovative interventions and slow translation of effective interventions into practice.

TB is an especially pressing concern in South Africa, which is among the top 30 countries with the highest burdens of TB, TB/HIV coinfection, ad multidrug-resistant TB, and it accounts for 3% of cases globally (16). South Africa had an estimated prevalence of 468 per 100,000 people in 2023 (17). Although incidence and deaths from TB have been decreasing since 2009, TB remained the seventh leading cause of death in South Africa, with an estimated 56,000 deaths from TB in 2023 (18). The main driver of the TB epidemic in South Africa is high HIV prevalence (19% of pop aged 15-49) (18). The

burden of other major risk factors in South Africa also contributes: prevalence of undernourishment (5.7% of population), smoking prevalence (7.1% of females, 34% of males aged ≥15 years), diabetes prevalence (13% of females, 9.7% of males aged ≥18 years), and alcohol use disorder prevalence (1.8% of females, 12% of males aged ≥15 years) (18). While global estimates are high, the 2018 TB prevalence survey done in South Africa found that an estimated prevalence of bacteriologically confirmed pulmonary TB of 852 cases per 100, 000 population among the population aged ≥15 years (19). Of note, 135 (57.7%) of 234 participants with TB screened positive by chest X-ray only and were not symptomatic and only 55 (28.8%) of 191 participants with TB with known HIV status were HIV-positive (20). These results are notable because they are much higher than the global estimates, they illustrate how many TB cases are being missed in the population because they are asymptomatic, and that TB control needs to go beyond the HIV-positive population. In 2017, Naidoo et al estimated the loss of patients at each step in the TB care cascade (the term given to the multistep process of identifying, testing, evaluating and treating people with TB infection) in South Africa (21). Their model showed the magnitude of losses at multiple steps: 5% at test access, 13% at diagnosis, 12% at treatment initiation, and 17% at successful treatment completion. Losses were similar among drug-susceptible cases and those with HIV coinfection (54% and 52%, respectively, successfully completed treatment), however they were substantially higher among rifampicin-resistant cases, with only 22% successfully completing treatment. The burden and challenges within the existing system to address the TB epidemic in South Africa provided the rationale for taking measures to improve knowledge translation of any interventions demonstrated to improve TB outcomes.

Research consortia and other forms of collaborative structures are increasingly being put in place to support knowledge translation as more and more institutions see the value in collaboration (22). A research consortium is differentiated from “collaborations that carry out single projects in the multiplicity of their goals, scope of their activities, and nature of their management” (22,23). At the most basic level, research consortia bring together the expertise and resources of multiple researchers and institutions to be able to increase the reach, size, generalization, and contextualization of studies by validating the results in different settings (7). A challenge in situating this research in the broader body of knowledge on research consortia is the lack of specificity in the use of the term consortium and the use of other terms to

refer to similar structures, such as “research network” (24). This dissertation is focused on the category of research consortia that are composed of members from multiple sectors with an implementation science orientation, rather than those that include only research institutions or are focused on basic science or clinical trials. When it comes to defining and assessing the effectiveness of consortia, the literature has little evidence to-date with many calls for further research and evaluation. Lepore et al, like other researchers, lamented the fact that much of the literature on research networks and consortia is conceptual rather than empirical, lacking an “understanding of the processes and dynamics of their overall functioning (for example, the process by which certain network conditions lead to various network-level outcomes)” (25). The research that does exist on the effectiveness of consortia mainly defines outcomes of interest as 1) publications, 2) collaboration between researchers, and 3) capacity building efforts. A number of research articles evaluating research consortia report on the number of peer-reviewed publications produced as outputs and the extent to which they reflect collaborative and equitable authorship from across institutions/organizations and disciplines (26–29). This dissertation aims to go beyond these output measures of research consortia to understand if and how a research consortium can work to achieve its objectives of knowledge translation and impact on health outcomes.

The Developing Innovative Solutions for Rapid Undoing of Pulmonary Tuberculosis (TB) Consortium, commonly referred to as the DISRUPT TB Consortium, also known as the TB Innovations Consortium (hereafter referred to as the “Consortium”), was established specifically to facilitate research of novel interventions and support their translation into practice in South Africa. The Consortium was a multilevel structure with a steering committee and provincial working groups. Members of the Consortium aligned on priority areas for research, selected novel interventions that address local challenges and context, and collaborated on the demonstration studies of the chosen interventions. The hypothesis underlying the Consortium assumed that if these processes were done collaboratively and the novel interventions proven effective, the likelihood of being adopted into policy and practice would be higher and the process of implementation and scale-up would be faster and smoother (30). The Consortium was conceived in 2017, established in 2018 and continued through 2021.

The Consortium was founded on the principle that deliberately considering the scale-up and institutionalization when designing and conducting a demonstration study would improve the chances of

an evidence-based intervention achieving the desired impact (30). The founders agreed on an approach based on the concept of “beginning with the end in mind.” This approach includes three phases – Demonstration, Scale, and Sustainability – as informed by a model developed by John Snow, Inc. as well as the World Health Organization (WHO) and ExpandNet guides (31–33). Published literature and local experiences of implementation research and scale up of evidence-based interventions in South Africa also contributed to the design process (34,35). The model defines three distinct phases in planning for the impact of innovative interventions once interventions are selected for study in alignment with Department of Health priorities and appropriateness to the high-burden province contexts.

1) Demonstration: Appropriate stakeholder engagement during the intervention design and refinement are essential. The assessment of feasibility, effectiveness, costs and other questions of importance to the implementers are required to make the decision to take an innovation to scale.
2) Scale: The decision to scale is catalyzed by a policy decision or political commitment to adopt the innovation. During this phase operational transfer to implementers occurs with integration into routine practice.
3) Sustainability: To ensure sustainability, innovation needs to be fully institutionalized with continued political commitment. The ability to sustain impact requires a continuous learning environment, where team-based management, accountability, routine data availability and utilization and quality improvement approaches are in place.

The three high TB burden provinces of Gauteng, Kwazulu-Natal, and Western Cape were selected to focus the work of the Consortium on the reductions of TB mortality and incidence. While these provinces shared the characteristic of having a high incidence of TB cases, they differed greatly in terms of population demographics and health system infrastructure. Initial meetings were held in the provinces, including partners from each of the key stakeholder groups to shape the Consortium’s approach. The Consortium steering committee was then established to bring together stakeholders from all three provinces. These discussions within and across provinces resulted in the founding documents of the Consortium, namely the concept note, terms of reference, and memorandum of understanding (30,36,37). The Gates Foundation supported the establishment of the Consortium and committed to funding three

demonstration studies of interventions selected to address gaps in the TB care cascade and provide funding for Consortium meetings and coordination as part of those grants.

The membership of the Consortium was composed of four groups of stakeholders including researchers from academic institutions, officials from the Department of Health TB Programs in the three participating provinces, implementing organizations/NGOs that support the TB Program, and Civil Society Organizations (Table 1).

Table 1. Groups represented in the Consortium steering committee

Stakeholder Group	Description
Department of Health (DOH) Officials	Government officials who are responsible for interpreting National DOH policies for local implementation and managing TB program at the provincial level and lower (city, district)
Academic Researchers	Principal Investigators and staff from four South African academic institutions who led the demonstration studies to generate evidence on innovations to improve TB care
Implementers	Non-Governmental Organizations that provide support to the TB program, including providing training, providing health care workers to supplement the DOH staff at facilities, conduct outreach, and assist with adherence to TB regimens
Civil Society	Members of organizations that conduct advocacy and awareness campaigns to elevate the importance of TB and to represent the TB patients' interests and needs

The Consortium Steering Committee was composed of a nominated individual from each participating organization and was the decision-making body, with an elected Chairperson from one research institution and an elected Secretariat from another research institution. The Steering Committee selected an organization to lead each funding application, implement the study, administer the grant, and give progress reports to the Steering Committee. The proposals were developed collaboratively, with input from all participating organizations. The members of the Consortium adhered to a "Memorandum of Understanding", accepting the roles and responsibilities specified and agreeing to the accepted processes for working together as defined in the "Terms of Reference" document (30,36).

Three interventions were selected to study (Table 2) and the results of these studies have been published in peer-reviewed journals (38–40). The TUTT and LINKEDin demonstration studies were fully funded by the Gates Foundation, while the TB-MATE demonstration study also received funding from the Stop TB Partnership and the South African Medical Research Council. Each of the interventions was

studied at different sites in each of the three participating provinces in order to determine the feasibility of the intervention across different settings, while ensuring no cross-contamination. Each of the interventions aimed to impact a different step of the TB care cascade, with the first focusing on increasing diagnosis, the second focusing on reducing initial loss to follow-up, and the third focusing on improving adherence to the treatment regimen. Consortium members set up provincial working groups in each province that include the researchers and study staff, the local TB Program staff from the DOH, health care workers and implementing partners. These provincial working groups provided a forum for securing approvals, giving updates from each of the studies to local DOH officials, and collectively troubleshooting challenges experienced across the demonstration studies.

Table 2. Interventions studied by the Consortium

Intervention and demonstration study aims	Outcomes of interest
Targeted Universal Testing for TB (implemented at 62 sites) aimed to increase the diagnosis rate of TB by: 1. Testing all high-risk groups for TB using GeneXpert Ultra and mycobacteria growth indicator tube regardless of the presence of TB symptoms, including: • All HIV-infected individuals • Individuals with prior TB disease in the past 2 years • Those who had contact with an adolescent or adult with TB in the past year 2. Assessing the utility of an mHealth contact tracing application	Number of TB cases diagnosed per month Number of tests to diagnose one TB case Number of contacts screened Cost per patient diagnosed
LINKEDin (implemented in 6 subdistricts) aimed to reduce initial loss to follow-up among TB patients by developing and implementing: 1. An automated notification system of laboratory-confirmed TB patients in hospitals, thereby including non-reporting hospitals into the existing electronic TB notification system 2. An alert and response TB patient management system to rapidly link newly diagnosed TB patients to TB treatment	Proportion of diagnosed patients notified to TB program Proportion of patients initiated on TB treatment Cost per patient linked
TB Monitoring Adherence and Treatment Endpoints (TB-MATE) (implemented at 18 sites) aimed to improve drug-sensitive TB treatment outcomes by implementing: 1. The Wisepill evriMED electronic pillbox that provides reminders for timely drug intake and monthly follow-up visits to patients and allows real-time monitoring of adherence by providers through a central database 2. Differentiated care based on adherence data, including strengths-based and motivational counseling approaches	Adherence rate to drug-sensitive TB treatment Proportion of TB patients who successfully complete drug-sensitive TB treatment Cost per patient

The consortium model is promising and, if effective, could provide a model for other areas of public health beyond TB, but like any intervention or implementation strategy, requires study to understand if and how it works (41). Establishing and operating a research consortium is resource

intensive so understanding whether and how consortia can be effective is important to make the most of the finite resources available for public health implementation research. There is, therefore, a critical need to determine if, how, and why consortia and other collaborative structures are effective at contributing to knowledge translation. Without rigorous study, we cannot know whether this is a worthwhile approach in which more investment should be made, whether modifications to the approach are needed, or whether consortia should be abandoned altogether, and attention and resources focused elsewhere. Until this knowledge gap is closed, funders will continue to channel resources to consortia without knowing whether or how they are effective at facilitating knowledge translation or understanding key enablers of and barriers to their success. The overall objective of this research is to holistically examine a multilevel consortium to understand how it was designed, how it functioned, and how it contributed to knowledge translation using case study methodology (42).

The first study developed an explicit Theory of Change (TOC) model based on the perspectives of steering committee members of the implicit TOC in the founding documents and examined how it was operationalized and evolved over time. The TOC describes how the Consortium aimed to improve the demonstration, implementation, and scale-up of new interventions. This aim used a single, holistic case study design with the Consortium serving as the unit of analysis and conducted qualitative content analysis of semi-structured interviews with members of the steering committee to understand how members saw the Consortium attaining its goal, uncover implicit assumptions, identify differences in how stakeholders view the TOC, and explore how perspectives on the TOC have evolved over time.

The second study is a comparative case study of the sub-units embedded in the multilevel research consortium. The research study sought to understand how three provincial working groups functioned and managed challenges in the absence of explicit guidance on their expected contributions to the overarching consortium goal. The research team conducted semi-structured interviews with participants of these working groups and reviewed documentation to understand similarities and differences in their functioning and how the subunits interacted with the Consortium steering group. The findings from this study inform a set of recommendations for multilevel research consortia going forward.

The third study is a comparative case study that sought to examine the contribution of the Consortium to the knowledge translation of the TUTT and LINKEDin interventions that were studied under

the auspices of the Consortium. These interventions had positive results from the demonstration studies and proceeded to be adopted to some measure of scale and therefore are interesting case studies to understand how the consortium model affected various aspects of the knowledge translation process, including the selection and design of the intervention itself, the demonstration study, dissemination of findings, policymaking process (where relevant), and the subsequent implementation at scale. The study also identified contextual and intrinsic factors of these interventions that contributed to the outcomes and gleaned lessons for future similar efforts to conduct implementation research within a consortium model. Collectively, this body of work aims to inform the design and evaluation of current future research consortia that aim to support implementation research and knowledge translation.

CHAPTER 2. MAKING THE IMPLICIT EXPLICIT: STAKEHOLDER PERSPECTIVES ON THE THEORY OF CHANGE

Introduction

Despite a large volume of research on new interventions to control TB in South Africa, progress remains slow – partially hampered by a lack of innovative interventions and slow translation of effective interventions into practice. South Africa is among the top 30 countries with the highest burdens of TB, TB/HIV coinfection, and multidrug-resistant TB, and it accounts for 3% of cases globally (16). In the face of these burdens, South Africa is also home to a robust community of TB researchers, with domestic investments in TB research ranging from a peak of $8.4 million in 2017 to $4.2 million reported in 2022, as well as significant external funding including $9 million from the U.S. National Institutes of Health in 2020 (40% of their global investment in TB that year) (15). Even countries with a strong research environment experience challenges related to the slow translation of research into practice. For example, in the United States, this process has been estimated to take 17 years on average (43). One factor contributing to the problem is a lack of collaboration among those who generate knowledge, entities that develop policies based on that knowledge, and organizations that are responsible for implementing those policies (14). Without collaboration, a research agenda is typically set and pursued independently by academicians and researchers, resulting in knowledge generated that may be irrelevant to policy priorities or incompatible with the implementation context.

The South African Developing Innovative Solutions for Rapid Undoing of Pulmonary Tuberculosis Consortium, commonly referred to as the DISRUPT TB Consortium (hereafter referred to as the “Consortium”), also known as the TB Innovations Consortium, was established to accelerate knowledge translation. The Consortium was made up of four stakeholder groups in South Africa: research institutions, local Department of Health (DOH) TB programs, implementing partners and NGOs that support the TB program, and a civil society organization (CSO). Through its establishment, the Consortium proposed to foster collaboration among these stakeholders to align on priority areas for research, select novel interventions that address local challenges and context, and collaborate on the demonstration studies of the chosen interventions. The hypothesis was that if these processes were done collaboratively and the novel interventions proved effective, the likelihood of these interventions being

adopted into practice would be higher and the process of adoption and implementation would be faster and smoother.

The Consortium was conceived in 2017 jointly by staff of the Gates Foundation as well as a consultant hired by the foundation to provide technical assistance to the foundation and its partners in South Africa. Based on the findings of a study that estimated the loss of patients at each step in the TB care cascade (the term given to the multistep process of identifying, testing, evaluating and treating people with TB infection), the consultant conducted initial desktop research on the reasons for delays and failures in translating research into policy and practice to inform the Consortium's approach (21). A primary reason identified was a lack of planning for ultimate scale and impact from the outset of research projects, which became the foundation of the Consortium. The founders agreed on an approach based on the concept of "beginning with the end in mind." This approach includes three phases – Demonstration, Scale, and Sustainability – as informed by a model developed by John Snow, Inc. as well as the World Health Organization (WHO) and ExpandNet guides (31–33). Three high TB burden provinces were selected to focus the work of the Consortium on the reductions of TB mortality and incidence. Initial meetings were held in the provinces, including partners from each of the key stakeholder groups to shape the Consortium's approach. The Consortium steering committee was then established to bring together stakeholders from all three provinces. These discussions within and across provinces resulted in the founding documents of the Consortium, namely the concept note, terms of reference, and memorandum of understanding (30,36,37). The Gates Foundation supported the establishment of the Consortium and committed to fund three demonstration studies of interventions selected to address gaps in the TB care cascade and provide funding for Consortium meetings and coordination.

A review of the literature defines a research consortium as a community of individuals or organizations with shared interest that engages with one another to collaborate, share, and develop resources to target and conduct more effective, efficient research (22). Research consortia differ from other collaborative structures that are put in place for a single project and because they pursue multiple goals, have a broader scope, and accordingly, a different governance structure (22,23). The DISRUPT TB Consortium differed in three important ways from most other research consortia that have been examined in the literature. First, its efforts supported not only the study of new innovations but also scale-up and

sustainability. Second, rather than collaborating only with research institutions, it also involved DOH officials, implementing partners and NGOs, and CSOs. Third, the Consortium was made up of stakeholders from within one country, whereas many global public health research consortia bring together research institutions from high-income and lower-middle-income countries, often with an explicit aim to improve equity or capacity building (25,44). Existing literature on the function of research consortia is limited and does not offer much guidance for this investigation since previous studies define the outcomes of interest as (1) publications, (2) collaboration between researchers (quantity and quality), and (3) capacity building efforts (26–29). Several articles report on the number of peer-reviewed publications produced as outputs from the research consortium and the extent to which they reflect collaborative and equitable authorship from across institutions/organizations and disciplines. In contrast, this Consortium was concerned with the uptake, scale, and sustainability of the interventions studied, with the goal to implement robust demonstration studies that evaluate innovations to close gaps in the TB care cascade and accelerate knowledge translation to reduce TB incidence and mortality. Thus, we did not consider the number of scientific publications or capacity building efforts as appropriate measures to study its function (30).

Instead, using a TOC offers an opportunity to better understand the Consortium, including how it operated to achieve its goal of implementing rigorous demonstration studies that (1) evaluate innovations that close gaps in the TB care cascade and (2) advance pathways to scale up those innovations on the incidence and mortality of TB (30). Given the ambitious goal of the Consortium and its somewhat unique structure compared with other research consortia identified in the literature, the use of a TOC helps examine how it was intended to work and how it actually worked, including how it facilitated collaboration among its members. An examination of the TOC helps reveal how members see the Consortium attaining its goal, uncovers implicit assumptions, identifies differences in how stakeholders view the TOC, and shows how perspectives on the TOC have evolved over time. The founding documents of the Consortium laid out the rationale for its formation and structure as well as its governance model and expectations of members. These documents represent intentional and unintentional choices and assumptions that contributed to the implicit TOC; an explicit TOC was developed as part of this research. This article describes the Consortium as it was established, explores its TOC as articulated by steering committee

members through interviews, and offers recommendations based on lessons learned from how the TOC operated in practice based on the perspectives of stakeholders.

Methods

Setting

This study was set in South Africa, where the Consortium is based. The Consortium is composed of researchers from academic institutions, officials from the DOH TB programs in the three participating provinces (Gauteng, Kwazulu-Natal, and Western Cape), implementing organizations and NGOs that support the TB program, and CSOs. The Consortium was conceived in 2017, established in 2018, and ran through 2021. The Consortium had a predetermined focus on TB and the areas of interest included health systems interventions and implementation research. It explicitly did not focus on clinical trials, basic science research, or interventions outside of the health system. The Consortium membership was made up of entirely South African institutions; the three participating provinces were selected because of their high TB burdens. The initial round of data collection was done only with the steering committee membership of the Consortium, while the second round of data collection included stakeholders outside of the Consortium.

Study design

To explore the TOC of the Consortium, we used a single, holistic case study design with the Consortium serving as the unit of analysis (45). This study aimed to (1) develop an explicit, coherent TOC for the Consortium; (2) understand similarities and differences in Consortium member perspectives of the activities and mechanisms (assumptions) in the TOC; and (3) document how the perceptions of the conduct of the activities in the TOC have changed over time, including reflections on the successes and challenges.

TOCs have become a commonly used tool for organizations to set goals and a shared vision for how the activities to be undertaken by the organization will contribute to achieving those goals. TOCs can be described narratively and are typically represented in a figure using arrows to denote causal linkages between activities and outcomes to demonstrate how the planned activities will ultimately lead to the overall goal. TOCs vary greatly in their level of detail and frame of reference and can include assumptions

and external factors as has been done in this study. It is similar to, and sometimes referred to interchangeably with, other models such as results frameworks, logic models, and log frames that can be used for goal setting and monitoring and evaluation purposes. This research drew on the TOC definitions and approaches for development and revision from the Center for the Theory of Change (46) BetterEvaluation (part of the Global Evaluation Initiative) (47) and Funnell and Rogers (46–48). TOCs are generally developed and revised through engagement with key stakeholders, which can be done either in a group workshop setting or through individual interviews, as was done here. The Consortium did not create an explicit TOC as part of its establishment; however, its concept note and terms of reference offer insight into the implicit assumptions that guided decisions about the structure, activities, and roles in the Consortium. This study aimed to make explicit the Consortium's TOC, understand the variety of perspectives on it, and explore the successes and challenges once it was operationalized.

Study population and data sources

The primary data source for this research was in-depth interviews with members of the Consortium's steering committee, with triangulation and reference to the Consortium's founding documents as needed. All members who were invited to participate in this research belonged to the Consortium steering committee (N=22). Total population sampling was used, with every member of the Consortium steering committee invited to participate via email, and two follow-up emails sent to those who did not respond. A total of 11 (50%) members consented and participated in the interviews, which took place in 2020–2021. The breakdown of participants by stakeholder group for this study is shown in Table 3.

Table 3. Study participants by stakeholder group

Stakeholder Group	Interviewed in 2020-2021	Interviewed in 2023-2024
Research institution	5	6
Department of Health	2	4
Implementer/NGO	3	2
Civil society organization	1	1
Total	**11**	**13**

Data collection in 2023–2024 for the related studies presented an opportunity to include perspectives from a subset of the participants (N=13) who had knowledge of the Consortium's work after

the conclusion of the Consortium. The interviews conducted in 2023–2024 were from a larger pool of individuals who were connected to the Consortium but not necessarily on the steering committee, so their responses provided additional valuable perspectives on the implicit TOC from the founding documents, and the subsequent activities, successes, and challenges of the Consortium. All participants completed consent forms electronically (Word document or PDF) that were returned via email and consented verbally at the beginning of the interviews, which were recorded.

Data collection

Semi-structured interviews were conducted between September 2020 and May 2021 online using Microsoft Teams software. The second round of interviews was conducted between November 2023 and April 2024 online using Zoom software. The interview guide development was informed by sample interview questions in a book by Funnell and Rogers on TOCs (30,37,48) and by the founding documents of the Consortium (concept note and terms of reference); the founding documents were also used for triangulation and validation of data (30,37,48). The interview guides (Appendix 1 and 2) were pilot tested and subsequently revised for clarity and comprehension. The semi-structured interviews guided participants through each of the core activities of the Consortium, which were shared on screen during the interview. Participants gave their perspectives on the causal mechanisms of each activity (e.g., if that happens, what will the consequence be?) and explained the assumptions that underlie that causal linkage and the importance/weight of each component to the function of the Consortium and its ability to achieve its objectives. The interviewers sought to understand whether the goal or key activities of the Consortium had changed over time, and to reflect on the relative successes and challenges of the Consortium. All interviews were recorded, anonymized, and transcribed verbatim, with light editing for clarity and ease of reading when quotations were excerpted.

Data analysis

Transcripts were analyzed iteratively using a directed approach to qualitative content analysis (49) using ATLAS.ti software (desktop version 24.1 and web version) to organize and code the data. Coding was an iterative process, starting with an initial code book that was updated with emergent codes as analysis proceeded. The initial set of codes was developed based on relevant themes from the scant

literature on research consortia, including collaboration, networking, and funding, as well as the core phases of work and activities of the Consortium as detailed in the founding concept note. The data were coded independently by two members of the research team to reconcile any discrepancies and ensure consistency of categorization and interpretation of the data. Once coded, a TOC model was constructed that reflects the data collected from the interviews and the data from the founding documents. The data were then analyzed to draw out key themes and pull direct quotes to illustrate these themes.

Ethical considerations

The study was exempted from review by the University of Washington Institutional Review Board and approved by the Stellenbosch University Health Research Ethics Committee (N20/01/007). All participants were literate and able to understand the purpose of the study. They were all given an opportunity to ask questions and all provided written informed consent before the interviews. Participation was completely voluntary, and participants could withdraw from the study at any time. Personal identifiers were removed from transcripts before the analysis and this article only uses stakeholder categories to identify the source of quotations.

Results

Establishment of the Consortium

The DISRUPT TB Consortium was conceived in 2017 and developed jointly by officials in the DOH TB programs in Gauteng, Kwazulu-Natal, and Western Cape provinces; implementing partners that support the TB program in each of the three provinces; and leading TB researchers located in the same provinces, namely the Desmond Tutu TB Centre at Stellenbosch University, the Aurum Institute, and the Perinatal HIV Research Unit at the University of the Witwatersrand. The Consortium terms of reference and concept note do not mention the inclusion of CSOs in the membership; however, this omission was acknowledged early on and CSO representatives were invited to participate. In addition to the stakeholder groups in the Consortium membership, the concept note recognizes the critical roles of donors and the TB Think Tank, a scientific body that evaluates evidence and advises the DOH on policy adoption. Another early decision in the establishment of the Consortium was to include DOH TB program representatives from the provincial and local (city) levels, rather than the national level. The focus was on

the provinces with high TB burdens, with the rationale that the DOH TB programs in those provinces would be motivated to engage in the Consortium and would see impact on TB incidence and mortality if the interventions were successful and subsequently scaled up. In the three high-burden provinces selected, the Consortium identified research institutions working in implementation science research and implementing partners supporting the TB program, which were the only organizations invited to join. The DOH at the national level was informed at the outset; however, participation in the steering committee and continuous engagement was with provincial, district, and city-level DOH TB program officials. These early decisions laid the foundation for the Consortium's structure and work.

The Consortium had a multilevel structure, with a national-level steering committee and provincial-level working groups. The Consortium was managed by a steering committee comprising a nominated member from each of the participating organizations. The steering committee then elected a chairperson and secretariat, both of whom were researchers from academic institutions. While the Consortium was conceived as an equal collaboration between the various stakeholder groups, it was led by the chair and secretariat, who were responsible for convening meetings, setting agendas, and capturing meeting notes. The steering committee selected which organizations would lead each funding application, based on the declared interests of the participating research institutions. Different research institutions were selected for each of the funding applications to help ensure an equitable approach. Rules for governance were established, including what constituted quorum, how decisions would be made, and how conflicts or split votes would be decided (the chairperson) (37). The concept note laid out the expectations for each stakeholder group and a memorandum of understanding was drafted for each participating individual to sign. Although legal policies of some organizations prevented several members from signing the memorandum, this did not preclude their participation in the Consortium (36).

Provincial working groups were established in each of the three provinces. The working group in Western Cape Province was coordinated by a research institution, the working group in Gauteng was an implementing partner/NGO, and the working group in Kwazulu-Natal was coordinated by the provincial TB program. This distribution of leadership at the provincial level may reflect some level of power sharing across the various stakeholder groups. The provincial working groups were set up as a forum for collaboration and coordination at the local level to provide updates across the three provinces,

troubleshoot or resolve issues in the study setup or conduct, share preliminary and final results, and plan for implementation at the local level.

In 2018, three interventions were selected and study teams were established, each led by a different research institution and made up of multiple research groups and implementing partners who successfully applied for funding to the Gates Foundation to initiate the studies. The primary recipients of the grants were the principal investigators for each of the studies at the Desmond Tutu TB Centre at Stellenbosch University, the Aurum Institute, and the Perinatal HIV Research Unit at the University of the Witwatersrand; they then sub-awarded funding to the other research institutions and implementing partners involved in the studies. Funding for the coordinating functions of the Consortium was also allocated as components of the grants to the elected chair at the Desmond Tutu TB Centre at Stellenbosch University and the secretariat at the Perinatal HIV Research Unit at the University of the Witwatersrand. The DOH TB Programs did not receive funding, but their travel and participation in Consortium meetings was paid for as part of the funding from the Gates Foundation granted to the university hosting the secretariat.

The three selected interventions targeted different gaps in the TB care cascade (the term given to the multistep process of identifying, testing, evaluating and treating people with TB infection). Specifically, (1) the Targeted Universal Testing for TB (TUTT) intervention aimed to increase the rate of diagnosing new TB cases by testing high-risk groups irrespective of symptoms, (2) the LINKEDin intervention aimed to reduce initial loss to follow-up among TB patients by automating notification and establishing an alert and response system triggered by a positive test, and (3) the TB Monitoring Adherence and Treatment Endpoints (TB-MATE) intervention aimed to improve drug-sensitive TB treatment outcomes using an electronic pillbox and differentiated model of care based on adherence. In addition to funding from the Gates Foundation, the TB-MATE demonstration study received funding from the Stop TB Partnership and South African Medical Research Council. The implementation research studies were designed and conducted in public health facilities and systems, although study staff did augment DOH capacity for the conduct of study activities. The aims and outcomes of interest for each intervention demonstration study (Table 4) varied, but they can all be characterized as type 1 hybrid effectiveness-implementation research designs that primarily focus on the effectiveness outcomes while exploring the “implementability” of the

intervention (50). Each of the demonstration studies included an outcome related to the cost of the intervention to help inform implementation planning.

Table 4. Interventions studied by the Consortium

Intervention and demonstration study aims	Outcomes of interest
Targeted Universal Testing for TB (implemented at 62 sites) aimed to increase the diagnosis rate of TB by: 1. Testing all high-risk groups for TB using GeneXpert Ultra and mycobacteria growth indicator tube regardless of the presence of TB symptoms, including: • All HIV-infected individuals • Individuals with prior TB disease in the past 2 years • Those who had contact with an adolescent or adult with TB in the past year 2. Assessing the utility of an mHealth contact tracing application	Number of TB cases diagnosed per month Number of tests to diagnose one TB case Number of contacts screened Cost per patient diagnosed
LINKEDin (implemented in 6 subdistricts) aimed to reduce initial loss to follow-up among TB patients by developing and implementing: 1. An automated notification system of laboratory-confirmed TB patients in hospitals, thereby including non-reporting hospitals into the existing electronic TB notification system 2. An alert and response TB patient management system to rapidly link newly diagnosed TB patients to TB treatment	Proportion of diagnosed patients notified to TB program Proportion of patients initiated on TB treatment Cost per patient linked
TB Monitoring Adherence and Treatment Endpoints (TB-MATE) (implemented at 18 sites) aimed to improve drug-sensitive TB treatment outcomes by implementing: 1. The Wisepill evriMED electronic pillbox that provides reminders for timely drug intake and monthly follow-up visits to patients and allows real-time monitoring of adherence by providers through a central database 2. Differentiated care based on adherence data, including strengths-based and motivational counseling approaches	Adherence rate to drug-sensitive TB treatment Proportion of TB patients who successfully complete drug-sensitive TB treatment Cost per patient

Theory of change

The founders of the Consortium did not create an explicit TOC when it was established, and therefore the author created a TOC based on the primary data collected through interviews and secondary review of the founding documents (primarily the concept note and terms of reference). This TOC represents how the Consortium intended to achieve its goal (Figure 1) by outlining the activities and outcomes as well as external factors. The TOC is laid out from left to right across the three phases – Demonstration, Scale, Sustainability – with the ultimate health outcomes of interest on the far right (31). The Consortium applied the Demonstration-Scale-Sustainability lens to the interventions studied under its umbrella and the TOC shows the interconnections between activities of the Consortium (in blue), external factors (in red), and outcomes of interest (in purple).

At the top of the figure is the stated aim of the Consortium (37). While reduction in TB incidence and mortality in South Africa are the health outcomes of interest (far right of figure), the stated aim underscores that a key underlying premise of the TOC is that initial work in the planning and demonstration phases to engage appropriately will lead to the desired outcomes of scale-up and ultimate impact. Accordingly, most of the Consortium activities are concentrated in Phase 1, the Demonstration phase of work.

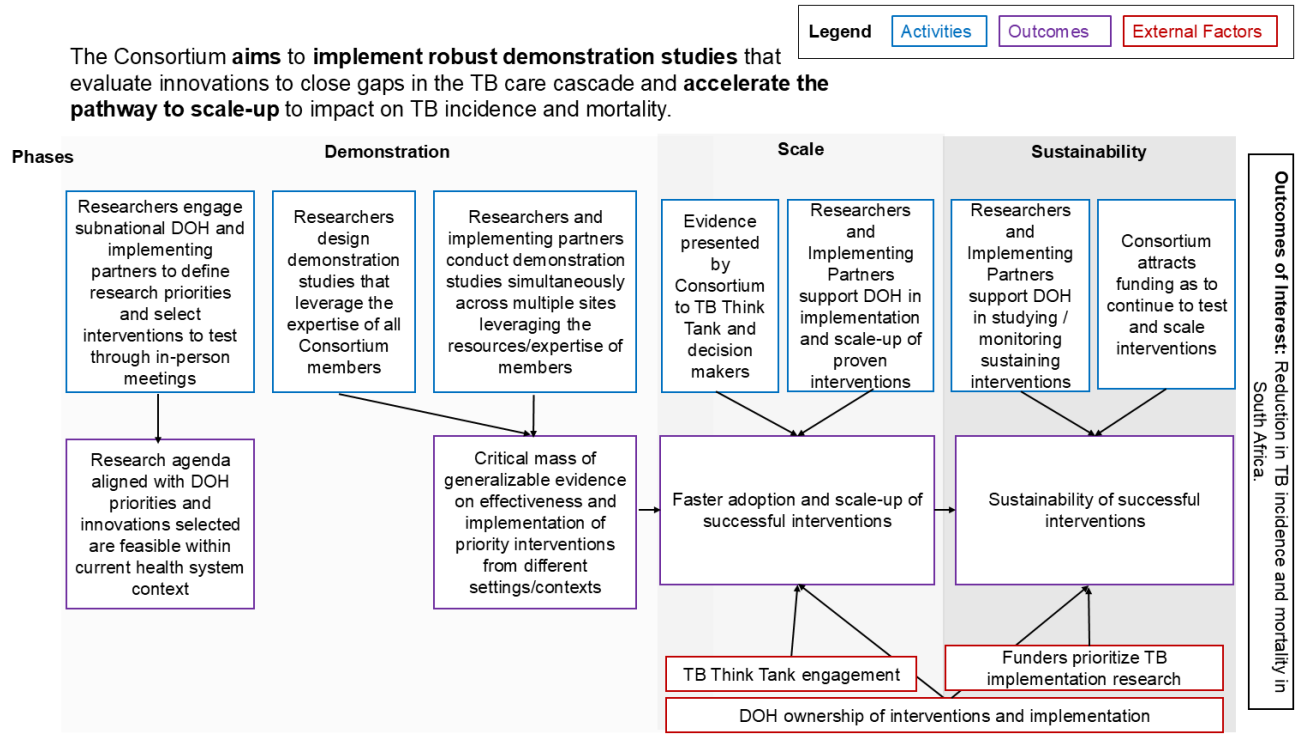

Figure 1. DISRUPT TB Consortium theory of change

Starting on the left-hand side in the Demonstration phase, there were three main activities defined: (1) collectively defining research priorities and selecting interventions to test (a process co-created by provincial DOH officials, researchers, and implementing partners); (2) designing demonstration studies (researchers led this process, soliciting input and feedback from the other stakeholders); and (3) conducting demonstration studies across multiple sites (researchers led the studies, with support from other researchers and implementing partners in the conduct of the studies). These three activities were intended to happen through in-person meetings at the steering committee level (activities 1-3) and the provincial working group level (activity 3). The following two outcomes were expected: (1) a research

agenda that aligned with DOH priorities and that is feasible in the health system; and (2) a critical mass of generalizable evidence on the tested innovations from different contexts.

The Scale phase (center section) applies to interventions that are successful, with two key activities: presenting the evidence to the TB Think Tank and DOH decision makers, at the national or provincial level depending on the kind of intervention, and the level at which the decision needs to be made for uptake; and researchers and implementing partners from the Consortium that led the demonstration studies supporting DOH in implementing the intervention. These two activities, in turn, would lead to more expedient adoption and scale-up of successful interventions. In the Scale phase, two external factors are outlined in the founding documents, including the level of TB Think Tank engagement and DOH ownership of the interventions and their implementation.

The Sustainability phase (right section) also displays two main activities. The first is for researchers and implementing partners from the Consortium to continue supporting the DOH in studying the impact and implementation of interventions. The second concerns Consortium funding: attract additional funding to support conducting demonstration studies of new innovations; and provide a platform for funding researchers and implementing partners to provide technical support to the DOH in the Scale and Sustainability phases. Key external factors include ongoing ownership by DOH and funders continuing to prioritize TB implementation research.

Participant perspectives on the theory of change

The results from participant interviews shed light on how the TOC worked in practice and uncovered the trade-offs or consequences of key decisions and implicit assumptions made when designing the Consortium. The primary emphasis of the Consortium and the bolus of activity was front-loaded during the Demonstration phase, and accordingly most of the findings relate to that phase. Decisions related to the selection and engagement of stakeholders, inclusion of provinces, collaborative model to leverage stakeholders, and design of the demonstration studies all had trade-offs, which are explored through the results of this study.

Goal

During the interviews, participants were asked to state the goal of the Consortium in their own words. Many participants included references to bringing together the stakeholder groups, conducting

strong demonstration studies, and the resulting implementation of new interventions. Only three participants mentioned the ultimate impact on health outcomes (TB incidence and mortality) as part of the Consortium goal or reflected on whether it was successful in achieving this goal. Participants more often referred to the role of the Consortium in testing innovative approaches to TB care and emphasized the importance of the feasibility, adaptability, and cost-effectiveness of the interventions for them to be scaled and sustained. The emphasis on proximate and process indicators in how most participants described the goal of the Consortium may reflect the research orientation in the setup of the Consortium structure and activities. This emphasis also has several implications, as can be seen throughout the exploration of the TOC as envisioned and operationalized. The first implication is that the Consortium focused largely on the Demonstration phase of activities, which is where the Consortium saw its primary role. The second implication is that if the Consortium's resources and attention were dedicated to "planning for impact" by meaningfully engaging DOH and implementing partners in the first part of the Demonstration-Scale-Sustainability process, the implicit assumption is that rest of the anticipated outcomes would follow. As one steering committee member phrased the goal:

> "The consortium is a platform that would aim to generate high quality evidence to address key gaps in the TB care cascade in South Africa with clear evidence of demonstration of efficacy and with a clear potential and feasibility to be able to be scaled up, to have impact at a national level in South Africa, and I think ideally also beyond our borders to other high burden TB settings." (1.17)

Findings on the remainder of the TOC are organized by phase and reflect the participants' perspectives on the successes and challenges of the TOC as operationalized. These findings are summarized in Table 5.

Table 5. Successes and challenges of the Consortium's theory of change as operationalized

Theory of Change Component	Successes	Challenges
Goal	Emphasized bringing together stakeholders, conducting strong demonstration studies, and implementing new interventions.	Less focus on ultimate impact on health outcomes, such as tuberculosis (TB) incidence and mortality.
Phase 1: Demonstration		
Stakeholder selection and engagement in the Demonstration phase	The Consortium engaged the Department of Health (DOH) at provincial, district, and local levels to ensure alignment with TB program priorities, improve the conduct of demonstration studies, and increase the likelihood of implementation.	The National DOH (and other potentially valuable stakeholders) were not included initially, causing delays in gaining buy-in at the national level later.
Geographic inclusion	The selection of three high-burden provinces aimed to increase the generalizability of results and to contribute to impact on the TB burden.	Broader geographic participation could have addressed equity and practical differences in implementing new interventions.
Collaborative approach	The collaborative approach strengthened study design and conduct and reduced competition among researchers.	Certain stakeholders, including civil society, were not sufficiently engaged in research design and protocol development.
Design of demonstration studies	The studies focused on determining intervention effectiveness across a diverse set of contexts and settings.	Greater focus could have been given to aspects of implementation strategies, affordability, and impact modeling.
Phase 2: Scale		
Definition of success	One intervention tested was adopted into national policy within two years, while another was implemented at scale in one province.	There was no shared understanding of what constituted "faster" translation of evidence into policy.
Dissemination of research findings	The Consortium effectively leveraged the TB Think Tank to disseminate results.	Broader dissemination would have been valuable for sharing lessons learned and facilitating buy-in, including at the community and facility levels.
Engagement of stakeholders in the Scale phase	One of the interventions studied under the Consortium was included in the National TB Recovery Plan.	Engagement of stakeholders decreased in frequency during the Scale phase, with no plan in place for how often the Consortium should meet in this phase.
Phase 3: Sustainability		
Engagement of stakeholders in the Sustainability phase	DOH ownership of the interventions at this phase was emphasized.	The Consortium's structure did not sufficiently plan for the sustainability of interventions, nor was the role of the implementing partners and researchers in supporting the sustainability of the interventions clearly defined.
Ability to attract additional funding to conduct demonstration studies of new interventions	The Consortium was revived to conduct two studies on adaptations for the TUTT (Targeted Universal Testing for TB) intervention.	The Consortium has not become a standing platform for funding novel interventions to address gaps in the TB care cascade.

Phase 1: Demonstration

The activities and outcomes in the Demonstration phase reflect a set of decisions made based on assumptions both implicit and explicit. These decisions were related to (1) stakeholder selection and engagement, (2) geographic inclusion, (3) leveraging stakeholders through a collaborative approach, and (4) the design of the demonstration studies.

Stakeholder selection and engagement in the demonstration phase: A fundamental, explicit assumption underlying the Consortium's TOC is that engaging with DOH and implementing partners during study design and demonstration study processes will accelerate and facilitate the scale-up and sustainability of interventions. In the Demonstration phase, there was an early decision that informed how the DOH was engaged to inform the research agenda and ensure it aligned to TB program priorities. The decision was made to center the inclusion of DOH at the provincial, district, and local levels in the Consortium through the steering committee and provincial working. The National DOH was informed at the outset of the Consortium but they were not included in the Consortium steering committee. These intentional decisions were made to ensure that officials from the subnational levels would be empowered to speak up and share their priorities and challenges, rather than deferring to their national-level counterparts. It also was based on the recognition that the provincial officials were accountable for the implementation of interventions and that authorization for the demonstration studies was needed at the provincial level. Participants in this study expressed that their participation in the Consortium as steering committee members and provincial working group members improved the salience and practicality of the research designs, smoothed the process for approvals to conduct the demonstration studies, and facilitated problem-solving when needed. While participants emphasized the value of including subnational DOH representatives in the Consortium, many, including the subnational DOH representatives, reflected that there should have been a greater effort to more closely engage at the national level. They shared that not doing so introduced delays later, as they had to reintroduce the Consortium and the interventions to officials at the national level to gain buy-in for adoption into policy, which is made at the national level.

> "We identified problems from the ground up, in terms of Department of Health colleagues at the local level, at the provincial level, and we thought that it would somehow filter up to the national level, but that hasn't necessarily been the case. It was felt that the provincial partners wouldn't have the freedom to express [themselves] and actually help shape things which they thought

were relevant in their province. There would be very strong national level political influence. But in retrospect, it is important to try and engage everyone simultaneously." (1.17)

> "Not all the key decision makers were involved in the consortium that could influence the…scale process, [for example] the National Department of Health [and] the head of health in the provinces. So, the results of the consortium or these demonstration projects still need to be taken to those bodies to translate this into policy, to be able to take it to scale." (1.21)

An implicit assumption in the Demonstration phase was that the correct and appropriate stakeholders had been selected for inclusion in the Consortium; upon reflection in the interviews, many participants questioned whether this assumption held. Among those who participated in the Consortium from provincial and local-level TB programs, there was variability in their perceived authority and agency for decision-making. Several participants discussed the need to engage more senior-level provincial and city officials directly, rather than assume that the TB program officials involved with the Consortium conveyed the necessary information to their superiors and obtained their buy-in. The Consortium terms of reference explicitly refer to the decision to keep the number of steering committee members limited to facilitate a nimble and collaborative structure. However, this trade-off had unintended consequences by excluding potentially useful voices and stilting the progress of the Consortium's work later, when additional stakeholders needed to be brought up to speed. Three years into the Consortium's work, participants expressed that the structure and TOC did not account for all critical stakeholders that should be engaged, either as active members of the Consortium or others who should be informed of progress and findings on a regular basis. Participants mentioned that other relevant stakeholder groups to engage may include the national DOH, provincial heads of health (not just the TB program), private sector, advocacy groups, national scientific bodies, and multilateral organizations.

> "We [researchers as part of the Consortium] were very good at working with the provinces, but maybe not quite as good with the national key stakeholders. And possibly we should also have consulted other stakeholders such as WHO, who may advise differently in terms of what are key issues they think will be relevant." (1.8)

Engagement of stakeholders throughout the Demonstration phase also depended on the assumptions that stakeholders would attend regular meetings and be incentivized to remain engaged on an ongoing basis. Many participants credited the early meetings of the Consortium as being well-run, well-attended, and important for establishing the collaborative relationships among the steering committee. Participants asserted that the virtual meetings accomplished the business at hand but were

less useful for building relationships. Most participants expressed that the in-person nature of meetings at the beginning of the Consortium facilitated relationship building and networking among stakeholders and facilitated leveraging those relationships when needed for problem-solving later.

> "I found it much more useful when we could have the face-to-face engagement. Obviously COVID [put an end] to that. I think the majority of the time people actually flew to the meetings, which was great. But if the meetings were hosted elsewhere, because of bureaucratic wranglings within organizations and obtaining permissions, we couldn't always go. [It was hard to] engage meaningfully, although we could do some by conference calls, they're not the greatest." (1.21)

In terms of incentives, most participants signed a memorandum of understanding when joining the Consortium (although some did not sign it due to their organization's legal constraints), and travel expenses were covered for in-person meetings. Most of the research institutions and implementing partners involved in the Consortium received some amount of grant funding to conduct the demonstration studies either directly or as sub-awardees, and two research institutions received funding to support their chairperson and secretariat roles. Outside of travel/meeting support, DOH participants did not receive any funding for their work as part of the Consortium, nor did three other participating organizations (a research institution, an implementing partner, and a CSO) because they were not directly involved in the conduct of any demonstration studies. Interestingly, there was no attrition from the steering committee for the duration of the Consortium from 2018-2021, even those who did not receive funding as part of one of the studies maintained their participation. The terms of reference sets out roles for each stakeholder group and expectations for publication, with an implicit assumption that members of the Consortium would derive benefits through their participation and would want to continue. This held true to an extent, with the ongoing participation (even by those not funded), an indicator of the perceived value of the Consortium.

The upfront alignment with DOH on the research agenda and the innovative interventions to test was a key activity that all participants viewed as a main value-add of the Consortium's approach to research. One assumption that appeared to be implicit at the outset and was made explicit during the interviews was that DOH priorities would remain constant – from intervention selection until implementation and scale-up. However, participants recognized that this was unrealistic, and that the Consortium's TOC should account for potential changes and shifts in priorities over time and be able to

track them and adapt as needed. Consideration of changing priorities underscores the need for appropriate ongoing engagement with DOH stakeholders as mentioned earlier. As a participant reflected:

> "We haven't necessarily had a specific engagement with the DOH at the national level, even the various provinces, to say how they've redefined the priorities in the context of COVID." (1.3)

Geographic inclusion: Another important decision point was the selection of three provinces for participation in the Consortium and the conduct of the demonstration studies. The steering committee made the important decision to simultaneously conduct demonstration studies in multiple locations to increase the external validity (generalizability) of the results and to better understand the adaptations and contextualization needed for the interventions to be implemented across various settings. By selecting three high TB burden provinces, the steering committee made an explicit assumption that it would maximize its impact by focusing on higher-burden provinces during the demonstration and scale phases. They also assumed implicitly that the evidence would be relevant and of interest to other, perhaps lower TB burden, provinces. Multiple participants lamented the fact that participation in the Consortium and the conduct of the demonstration studies was limited to three high-burden TB provinces where there were strong research institutions. The case that participants made in retrospect for broadening geographic participation was both philosophical (i.e., greater equity) and practical (i.e., implementing new interventions in a low TB burden setting may differ from a high TB burden setting).

> "[We should look] at expanding to the other provinces that are not partaking so that it's not just specific provinces that are actually getting a chance to do these demonstrations. It's important to make a greater effort for the provinces that are not partaking to make them understand the impacts or the positive results that came through." (1.1)

Collaborative approach: Participants praised the evidence-based, collaborative approach to set the research agenda and determine interventions for testing. Most participants had positive recollections of the robust discussions on the TB care cascade and the high level of engagement from all stakeholder groups that resulted in a coordinated, carefully planned research agenda. Participants from all stakeholder groups commented on the value of creating a collaborative forum for researchers, who were perceived to be frequently in competition with each other and often unintentionally duplicating research efforts. As a researcher commented:

> "It happens because we're all in different entities and use same literature and we find the same research questions in the literature and we then most of us end up focusing on more or less the same things." (1.7)

Several participants commented on the value of the Consortium as a means to drive more collaboration rather than competition. While we cannot conclude that the Consortium removed competition among researchers, the demonstration studies were an opportunity for them to work cooperatively, with different research institutions (and sometimes implementing partner organizations) leading the studies in each province. Additionally, during the design phase of the demonstration studies, the Consortium facilitated review and discussion by researchers from all participating institutions and other stakeholders to strengthen the final study designs. Consortium members valued it as a platform for collaboration, and these efforts were noticed even by those who did not participate. For example, a National DOH official who was not part of the Consortium reflected:

> "As an observer from outside, it brought different organizations together for a common goal. What we've seen amongst researchers is a lot of competition… but here we found that it was different in the sense that the organizations were forced to work together." (3.6)

As discussed earlier, the Consortium membership was limited, which meant that other researchers were not part of this shared research agenda. One participant expressed that it was perhaps a missed opportunity for broadening awareness of the Consortium's research agenda:

> "Even though one of the intentions was to coordinate a response, there were still other activities that were happening outside of [the Consortium]. And there were researchers and groups that were not aware of what was going on [with the Consortium]. So, I guess from that perspective, it would be good if there was a way of kind of broadening that coordination… whether it's through the Department of Health or through some other mechanism… I know there was at least one instance where we heard from one of the attendees at the meeting that they were aware of some other research that was happening that might have been similar. And that was one of the things that we were trying to address. And I guess we did, to a degree, but not completely." (2.9)

A key assumption necessary to leverage the expertise and resources of stakeholders was that the Consortium would provide a platform for respectful debate and critique. The participants differed in their assessment of how well this was operationalized. While one civil society participant did not feel that their feedback had been sufficiently solicited on the research design and protocol development, most researchers, implementing partners, and DOH officials spoke highly of the "robust debate and discussions" that occurred in the research design phase, as one said:

> "Since the members of the consortium are so varied, in terms of type of organization and type of skill and capacity, that it really adds richness, kind of complementary expertise… in terms of intellectual ability and capacity." (1.17)

Conversely, one researcher was uncomfortable critiquing others' proposals and protocols because of the warm, collegial environment.

> "I found it hard to criticize the other studies because I didn't really want to feel like… I was not being a team player… once the consortium was formed, it became a safe space, and people didn't really want to criticize each other too much." (1.8)

The explicit assumption that the Consortium would leverage the expertise and resources of its members to strengthen the design and conduct of the demonstration studies seems to have held true, according to most participants. Participants reflected positively on the Consortium's ability to leverage its members' geographical presence and infrastructure to implement the demonstration studies simultaneously across numerous sites in the three provinces. The involvement of provincial DOH officials meant that issues could be dealt with swiftly as they arose. For some of the demonstration studies, local implementing partners and NGOs were responsible for leading the study implementation in a given province with mixed results – they had expertise in the local context and study sites but lacked connections that would have facilitated local research approvals and the experience necessary to run a research study. For example, one researcher reflected that:

> "It has its upsides, like in [one province], the implementing partner really put their foot on the gas. In the two other provinces, our requirements for collecting research, having individual consent and stuff like that wasn't really up their alley and I don't think they quite understood what we were trying to compare. You know in some places we didn't really get the requisite numbers. They were responsible for recruiting the clinics… and that didn't turn out as well as it could have. To do any research in South Africa, you need to get the approval of the province and we as researchers do it all the time, whereas [implementing partners are not used to getting] the provincial people to say yes to research, which is different group of people [than] who they have to supplicate to get approval for PEPFAR [U.S. President's Emergency Plan for AIDS Relief] stuff." (3.2)

Design of demonstration studies: The Consortium sought to ensure that the demonstration studies generated evidence on implementation strategies and feasibility; however, they were primarily designed to determine the effectiveness of the interventions. Participants reflected that the demonstration studies were not sufficiently resourced to achieve all of their outcomes of interest. Each demonstration study included sub-studies on cost from the outset, but the analyses were done toward the end of each demonstration study with less emphasis on disseminating the findings broadly. Participants reflected that the demonstration studies could have had a greater focus on feasibility, cost, and impact modeling (this

was done in 2023, after a nationally calibrated model was developed and outcome and cost data were available from the demonstration studies). As one researcher noted:

> "[We should have given more thought to] complementary activities like epidemiological mathematical modeling, to be able to model the impact of interventions, social behavioral work, and health economics work which were not originally seen as high priority… it's become very clear that they are extremely important and so you can't just actually implement the intervention without knowing whether it's going to be acceptable, what the uptake will be in terms of the social behavioral work, how cost effective it will be, and potentially modeling the impact of their intervention." (1.17)

Another key component of the Consortium's TOC was that the research studies were designed and conducted across various settings and contexts in South Africa with the aim to ensure that the findings were generalizable and applicable across the country. Variations in the settings include differences between provinces, such as with IT infrastructure, and differences within provinces, such as urban vs. rural health facilities. For example, the LINKEDin intervention was designed based on plans to implement an electronic system nationally, which did not materialize; scaling was therefore not feasible using existing DOH staff. This approach added complexity to the studies, for example, by increasing the number of approvals needed and the factors to be considered, and with one of the interventions requiring greater adaptations than anticipated. Despite these challenges, most participants expressed that the variety in settings was a strength of the Consortium overall, and that the study teams included stakeholders with deep familiarity working across the provinces. Two participants' reflections highlight the sentiments that were shared broadly:

> "Policy gets developed, and it often doesn't take these contexts into account. We were trying to do the same thing in three different geographies [with] three different strong, experienced research groups, [which] I think adds richness to what we were doing." (1.21)

> "An intervention can look very different depending on where you're implementing it and based on the capacity on the ground. It's frustrating that everything is not standardized across South Africa, but it also shows that one does need to work with what there is and learn about each different context in each different setting." (1.17)

In summary, the Consortium focused primarily on the Demonstration phase and planning for impact from the outset. Generally, participants reflected favorably on the work of the Consortium being aligned with the TOC in this phase of work. Engagement between the provincial and local DOH, implementing partners, and researchers resulted in a strong research agenda that addressed priorities of the provincial DOH TB programs and effectively implemented demonstration studies that generated

evidence across diverse settings in the three provinces. The decisions related to selection and engagement of stakeholders, inclusion of provinces, the collaborative model, and the design of the demonstration studies all had trade-offs. Many of these trade-offs were only identified retrospectively, which meant the Consortium could not adjust to address the challenges they raised in real time.

Phase 2: Scale

As described earlier, the Consortium TOC depended on the activities in the Demonstration phase to facilitate swift and smooth scale-up of proven interventions. The activities and outcomes in the Scale phase of the TOC reflect a set of decisions made upfront based on assumptions both implicit and explicit. These decisions are related to the (1) definition of success in the outcome of interest, (2) focus of dissemination activities, and (3) ongoing engagement of stakeholders.

Definition of success: The Consortium sought to speed up the process of translating evidence into policy, but the results of this study illustrate that participants did not share an understanding of the intended time for the process and what would constitute "faster." For example, some participants celebrated that the TUTT intervention was written into national policy within two years of the demonstration study ending, while others were disappointed by lags in the policy and implementation process. As one participant mentioned:

> "There was quite a lag between the completion of some of those studies and coming out as national policy… the transition is so high in terms of staff and even managers, that actually we found there was still very little footprint on the ground that had survived from the operational research time. So, it's almost like we've had to start TUTT from scratch. But at the time when we set up the consortium, we thought we'd already have a footprint that could then be built on when it did come through as national and provincial policy." (2.18)

Focus of dissemination activities: Dissemination of results in the Scale phase was focused on the TB Think Tank and DOH decision makers and implementers. Participants largely agreed that the connection with the TB Think Tank functioned as envisioned. However, some participants who were not as involved in the TB Think Tank expressed some confusion about the relationship between the Consortium and the TB Think Tank. Perhaps because several steering committee members were also members of the TB Think Tank, the Consortium leveraged it well as a platform for disseminating results and driving uptake in policy for the TUTT intervention. As one participant shared:

> “There was good collaboration between the Think Tank and the DISRUPT [Consortium] to make results available, to disseminate the findings, and also to push for the interventions to be implemented as well.” (3.10)

Participants across all stakeholder groups expressed that the TOC should prioritize using the Consortium as a platform for disseminating results and sharing lessons learned from the conduct of the demonstration studies broadly, including with researchers outside of the Consortium. Participants shared that while results from the TUTT intervention were widely shared and generated a lot of interest, results from the other two demonstration studies were not as widely shared. One participant expressed that the TUTT results could also have been more widely disseminated beyond policy makers, decision makers, and implementers. Some participants discussed the potential of the Consortium as a forum for widely disseminating not only results but also implementation lessons from the studies. Specifically, one participant commented that the dissemination efforts could have included a focus on the community and facility level to drive uptake by health care workers and social mobilization for the successful intervention:

> “The practical lessons learned were also relevant for facilities. There was a gap in how to make sure all health workers believe in TUTT and implement TUTT at facilities. And how are we going to create demand that high risk groups want to be tested.” (2.18)

Ongoing engagement of stakeholders in the Scale phase: The concept note for the Consortium envisioned that implementing partners, and, to a lesser extent, researchers would play a role in supporting implementation at scale. While this occurred in some cases, the Consortium did not explicitly plan for how this support would be enabled, either financially or structurally. For example, the provincial DOH must give the mandate to support implementation of a new intervention; however, there was no process within the Consortium to secure this mandate for participating implementing partners or researchers.

An assumption that several participants discussed, with mixed perspectives, was that either DOH priorities needed to remain constant, or the Consortium needed to stay up to date on shifts in priorities in order to scale up successful interventions. Several participants thought the Consortium could have done better and been more intentional about handling changing priorities. With the onset of COVID-19, participants recognized there were significant shifts in the priorities and resources available for new interventions, and that the Consortium could have addressed these shifts more directly. However, closing gaps in the TB care cascade remained the priority of the DOH, and the Consortium’s work on TUTT was

included in the National TB Recovery Plan following COVID-19 (51). The differences in perspective may reflect the level of engagement of participants in other fora where DOH priorities were discussed (for example, the TB Think Tank). Additionally, an explicit assumption was that the Consortium would obtain DOH buy-in on the interventions and feel ownership, having been involved from the outset. According to participants, this assumption mostly held true where there was limited staff turnover in the provincial DOH TB programs, and conversely, did not hold true where staff turnover was high. However, some expressed that the DOH was more of a recipient in the work, rather than an owner and driver of efforts to translate evidence from the demonstrations studies into policy. As one implementer shared:

> "The Department of Health has to be seen as a key driver of these programs rather than being seen as driven through the NGO sector or the donor sector… we need to create systems that are resilient that are actually empowering the Department of Health to drive these programs and just know where to sit for our support from the partners but allow the Department of Health to be the key driver of public health programs, particularly for TB related programs." (1.5)

Finally, the Scale phase was marked by a decrease in the frequency and duration of Consortium meetings. The founding documents make no mention of the intended frequency of steering committee or provincial working group meetings across the three phases of work, so we cannot conclude whether this was an anticipated or unanticipated change. Our understanding from participants is that the steering committee did not have much discussion upfront on what role the Consortium would play during the Scale and Sustainability phases. As the frequency of Consortium meetings declined, the interventions were discussed in other fora such as the TB Think Tank and routine provincial manager meetings convened by the national DOH (attended by DOH, implementing partners and donors). Members of the Consortium who participated in these other structures said they remained connected to the work on the interventions as they progressed, but other members reported that engagement and information sharing gradually ended. Additionally, the onset of the COVID-19 pandemic and its impact on meetings and prioritization of TB research cannot be discounted. It seems that individuals from the Consortium steering committee were involved in various capacities, but the Consortium as a platform was not leveraged as fully as envisioned to support the scale process. As two participants reflected:

> "Certainly in 2021 I feel there has been meetings to report back on the findings of the DISRUPT Consortium studies and there was a press conference about a month and a half ago, and there may have been one other meeting that I was aware of that was a joint meeting… but quite

> suddenly I feel like there's been a pause in the activity of the consortium, and I'm left wondering is it still alive." (1.17)
>
> "When we were actually doing the research, we were meeting quite regularly. Once we got to the results dissemination, it was hugely influenced by COVID, in face meetings became less possible. I know the consortium did try to continue having kind of virtual meetings. I don't think they were quite as successful as the in-person meetings. I had a sense that people became less invested – with the in-person meetings event we had really strong involvement, even from groups that weren't directly involved in the research. And I saw that trickle off a little bit once we started the virtual meetings, and of course you know the needs and the interests are slightly different once you've actually got results and then it's about policy, you know, researchers generally don't play in that space. This was one of the reasons why we wanted to bring in these different partners, because researchers often do research and then just expect it to be turned into policy without really understanding the implications or the role they could play as advocates." (2.20)

The Consortium did see the successful adoption of the TUTT intervention into national policy and scaled nationally, as well as the scaling of the LINKEDin intervention (which did not require national policy for adoption) in at least one province. The scaling phase of the TUTT intervention led to the creation of a new consortium with some new partners included. This new consortium is engaged to coordinate two new demonstration studies (both funded by the Gates Foundation) that will assess adaptations to the TUTT intervention. However, the Consortium's role in the Scale phase of the TOC for the studied interventions was not as clear as it could have been, which seems to reflect a challenge of the Consortium's structure, as it was researcher convened and led. Several of the assumptions, including that DOH priorities would remain constant and DOH ownership would be an outcome of their involvement in the Demonstration phase, did not hold.

Phase 3: Sustainability

Some of the findings related to the decisions and assumptions in the Sustainability phase of the TOC echo the decisions and assumptions around the engagement of stakeholders in the Scale phase, namely (1) the importance of DOH ownership in this phase; (2) the assumption that the researchers and implementing partners involved in the Demonstration phase would continue providing support to DOH through the scale and sustainability phases; and (3) the Consortium meetings and engagement of the group as a whole became less frequent. Importantly, data collection for this study occurred during the demonstration studies for the first round, and for the second round, it occurred within the first year of national scale-up of the TUTT intervention and implementation at the provincial level of the LINKEDin intervention. Thus, participants could not reflect on the success of the Consortium in promoting

sustainability of the interventions; rather, they could only discuss their perspectives on the Consortium's approach to sustainability. While the Consortium addressed sustainability as it pertained to the interventions, there is also a broader question about the sustainability of the Consortium itself. The founding documents (and thus the TOC) included the objective of the Consortium proving itself and becoming an ongoing mechanism whereby financing would be obtained to test and scale promising innovations (30).

Ongoing engagement of stakeholders in the sustainability phase: The Consortium focused on the study and implementation of three selected interventions and dissemination of those results; however, it did not focus on disseminating findings from its overall work as a Consortium. Participants discussed that this was perhaps a missed opportunity for the Consortium to share more about its operating model, shared research agenda, and unique partnership approach to managing the demonstration studies. Such dissemination efforts may have further benefits to the TB program and research community and would underscore the value of working in a consortium model. As one participant reflected:

> "I think the one thing that we maybe don't touch is to share these processes, I know we talk about scale, but perhaps sustainability is not necessarily addressed. [We need] to share that information and engage with others who are not necessarily part of the consortium… this is a good way to align so that we are not testing multiple similar things and dissipating resources in a sense, but outside the context of the consortium, how do you do that?" (1.23)

Another participant noted two additional challenges that the Consortium did not address during the Sustainability phase of work – namely, the bureaucratic hurdles faced during the Scale phase and collective problem-solving to pave the way for future innovations. These challenges could underscore a need to better engage DOH stakeholders, both inside and outside the Consortium.

> "I would have liked another discussion on how to overcome red tape that often happens at provincial level… because what good is the policy if there's unnecessary bureaucracy?" (2.18)

Ability to attract funding to conduct demonstration studies of new interventions: The Consortium aimed to serve as a mechanism to attract additional funding for the testing of new interventions and to support proven interventions in the Scale and Sustainability phases. The Gates Foundation was the sole funder of two of the three demonstration studies and the funding to run the Consortium was given as part of these grants. An unintended consequence of this model was that

financial resources were no longer available for convening in-person meetings in the Scaling and Sustainability phases. Participants expressed disappointment that the Consortium did not continue to advance a shared research agenda or select a new set of innovations to test. It was unclear to some participants whether the intention was for the Consortium itself to be established as an entity that could receive funding directly or for individual or partnerships of member organizations to continue receiving funding. While the former did not materialize, the latter did to a certain extent, with new collaborative partnerships coming out of the Consortium. Additionally, a new consortium was started in 2023 to support two studies related to adaptations to the TUTT intervention (again funded by the Gates Foundation). The Consortium fell short of participants' expectations that it could have generated even more novel ideas and been a forum for collaboration on even more demonstration studies of new interventions. As one participant in 2023 mentioned:

> "We had those three projects, and there haven't really been new projects from the consortium. I think they're still in development. I think the fact that [the Consortium] didn't get its own legs in a way, is a way that it kind of fell short." (3.10)

The Sustainability phase, like the Scale phase, was critical to achieving the ultimate health outcomes of reduced TB incidence and mortality. However, the decisions made at the outset of the Consortium's establishment did not allocate sufficient resources or attention to activities in this phase for the interventions tested and scaled. Beyond the sustainability of the individual interventions, the steering committee did not plan for the sustainability of the Consortium itself from the outset, limiting its potential impact in the long term.

Discussion

The results of this research are presented here as a case study that offers a holistic understanding of the TOC, in theory and in practice, of a research consortium that was conceived to address a specific challenge in public health. The Consortium and its implicit TOC sought to address the challenge of slow and often ineffective knowledge translation, frequently due to a disconnect and power imbalance between researchers and health officials. The case study illustrates how the Consortium intended to work to achieve its goal, and the decisions, trade-offs, and assumptions made along the way that ultimately informed how its TOC worked in practice. The TOC model provided a valuable framework

for reflecting on what aspects of the Consortium's design were explicit and/or shared from the outset vs. what components were implicit and/or not shared among participants, analyzing the trade-offs and unintended consequences of some of the decisions made, and reflecting on how the operationalization differed from the plan. The results have implications for decisions made by current and future consortia.

As noted earlier, the existing body of knowledge on research consortia is limited. This case study offers an example of how studying the function of a research consortium using a TOC model could be beneficial for advancing the understanding of how they work to achieve their goals. As is clear from the scarcity of literature on consortia, the field would benefit from spending more time and effort on analyzing their efforts, whether as a formal evaluation or group reflection. The implications of this study result in the following four recommendations for similar consortia going forward.

Keep the end goal in mind and plan for the long term

The Consortium's goal went beyond generating high-quality research outputs to include the scale-up and sustainability of novel interventions and their impact on TB incidence and mortality. This ambitious and far-reaching goal should inform the TOC from the outset and drive the content of funding applications (funder interest needs to be present to support the broader set of activities beyond just demonstration studies), resource allocation, activities, meeting frequency, and effort across the phases of the TOC. The finding from this research that meeting frequency declined over time may indicate that fewer meetings were necessary as the demonstration studies progressed, or it could indicate a lack of clarity about the Consortium's role in later stages of the process to scale up findings; the COVID-19 pandemic also likely played a role. Upfront definition of the meeting frequency throughout the full lifecycle of the demonstration projects and/or the Consortium itself – and consideration of how meeting frequency and content should change in each phase – could help ensure the Consortium fulfills its defined roles through all phases of work. The findings from this study reinforced the assumption that DOH ownership was critical for the successful scale-up and sustainability of the new interventions. Despite this, the Consortium structure placed researchers in the chair and secretariat roles, whereas the DOH was in a contributor role only. Similarly, this Consortium, as with many others in the literature, focused primarily on the demonstration studies it undertook in the near term at the expense of long-term planning and monitoring (52). Accordingly, the Consortium's TOC accounted for the lifecycle of the novel interventions it

studied but not for the lifecycle of the Consortium itself. It is important to plan for the continuity and long-term role of a research consortium from the outset, for example, by developing informational materials to sensitize other parties to the concept and developing processes for reevaluating decisions related to membership and activities to achieve each outcome. While the Consortium fostered new connections and partnerships between groups that resulted in new applications for funding, the Consortium itself was not set up as a platform to receive funding, nor was there a clear plan to secure funding for the Scale and Sustainability phases.

Critically think through which stakeholders to engage when and how

Three years into the Consortium's work, participants expressed that the structure and TOC did not account for all critical stakeholders that should be engaged, either as active members of the Consortium or those who should be informed of progress and findings on a regular basis. Participants mentioned that other relevant stakeholder groups to engage may include the national DOH, provincial heads of health, private sector, advocacy groups, national scientific bodies, and multilateral organizations. Additionally, the level of authority and agency of the DOH officials involved in the Consortium varied by province, with some being able to truly lead and drive change. Several participants lamented the fact that national DOH officials were not engaged sufficiently in the Demonstration phase, which then led to delays as buy-in was built in the Scale phase. By creating a Consortium that centered the voice and contributions of subnational DOH entities to ensure that those responsible for implementation and scale-up were involved from the outset of new research, the founders may have introduced an unintentional power imbalance, whereby the researchers were the primary grant recipients (who had more discretionary money) who worked with lower-level DOH officials (who had less discretionary money). A key recommendation that emerges is to engage high-level stakeholders (or others who will play a vital role later) throughout the process. Additionally, individuals in roles change, priorities change, and circumstances change, so while engagement upfront was an important emphasis of the Consortium to ensure the research agenda reflected the priorities of DOH officials at that time, the upfront engagement was not sufficient to ensure buy-in when required. Ultimately, consortia such as this one, with the end goals of scale and sustainability of novel interventions, would benefit by being led/funded or co-led/co-

funded by DOH officials at national and subnational levels; this would be the strongest indication of "ownership" needed for success.

Start with a detailed TOC and revisit it often

The Consortium started with a set of founding documents, namely the concept note and terms of reference, which laid out the underlying rationale for establishing the Consortium, the roles of the stakeholders, and the key activities. There was a high degree of shared understanding among participants in this study about the intention and focus of the Consortium at the outset. While these documents implied a TOC, it would be useful to develop an explicit TOC or similar model to draw out the many linkages and assumptions that underpinned the choices made in setting up a consortium and the activities of focus. Discussing a TOC as a group at the outset would have also allowed for recognition of assumptions or external factors that might warrant risk mitigation strategies. Additionally, a recommendation that emerges from the research is to revisit the TOC throughout the existence of a consortium and potentially set up predefined checkpoints for evaluation based on the TOC. This would serve to prioritize the ultimate goal by clarifying it, so that members can assess progress and adjust as needed. A TOC and goal statement may benefit from additional specificity, including time horizons and targets, which would facilitate measurement of progress and a clear way to assess achievement.

Document trade-offs and plan for risks

As a consortium is conceived and established, there are decisions and trade-offs that need to be considered when developing the structure, membership, and activities that contribute to the TOC. Documenting the decisions made, and the assumptions and considerations behind those decisions, will support planning for and responding to risks and unintended consequences that will inevitably arise. For example, documenting the intentional decision to maintain a limited number of stakeholders could be accompanied by a risk mitigation plan that includes assigning a role in the consortium to be responsible for external stakeholder engagement, including the development of a list of external stakeholders that should be regularly informed, a schedule for doing so, and informational materials to support those efforts. Additionally, the consortium may consider regularly reevaluating the list of internal and external stakeholders and if individuals have changed roles and how that should be accounted for.

Study limitations

This case study, while attempting to present a holistic exploration of the Consortium's TOC, does have potential limitations. These include (1) selection bias of the convenience sample of informants; (2) recall bias of interviews who were asked to remember experiences after several years; and (3) lack of validated data collection tools and analytical approach due to the dearth of existing literature. We attempted to address the potential recall bias by showing the founding documents during the interviews so that all participants would have the same information to inform their reflections. This study and its findings emphasize the need for additional research on the TOC and function of research consortia globally to contribute to the knowledge base on structures that facilitate knowledge translation.

Conclusion

The DISRUPT TB Consortium has demonstrated a novel approach to addressing the persistent challenge of slow translation of research into practice. Through its unique structure, the Consortium successfully brought together a diverse group of stakeholders, including health officials, implementers, and researchers, to align research priorities and conduct demonstration studies in a collaborative way. The results of this study offer important lessons and recommendations to support the success of research consortia during all phases of their work. The findings underscore the importance of not only early, but also ongoing meaningful engagement of key stakeholders and a reexamination of who the key stakeholders are. For longer-term sustainability, a consortium would benefit from having a bigger-picture focus and leveraging a TOC or other similar tool to agree upon key decisions, assumptions, and success metrics. Research consortia have the potential to meaningfully contribute to efforts to improve the alignment of implementation research efforts with programmatic priorities to make knowledge translation more efficient. This examination of one consortium's TOC provides insights about critical aspects that should be included in upfront planning for impact throughout the research and consortium lifecycle. The field would also benefit from additional inquiry into other research consortia with similar and different structures. The approach taken in this study could be replicated in future research to derive additional insights.

CHAPTER 3. NAVIGATING COMPLEXITIES: ALIGNMENT AND ADAPTATION IN A MULTILEVEL RESEARCH CONSORTIUM

Introduction

Research consortia and other similar collaborative structures are becoming more common as a strategy to bring together researchers and institutions with diverse expertise to generate evidence and translate it into practice. Although research consortia have differing structures and characteristics, as well as different tools used to document and guide their work, common lessons about their function can be extracted. This research focuses on the function of subunits in a multilevel research consortium.

The strategic and functional alignment of multilevel structures within organizations has been the topic of research in the fields of organizational management and operations in both the public and private sectors (53,54). Using a multilevel structure to achieve stated goals requires alignment across levels, both strategic and structural. In the business operations and management literature, charters are often the tool of choice to drive alignment between strategic objectives and structures because they clarify the expectations, membership, activities, and ultimate goal of subunits in relation to the overarching organization (54). In public health, climate change, development, and other social impact sectors, theories of change (TOCs) are often used to explicitly state an organization's goal and how its activities are meant to contribute to that goal. Research on TOCs has begun to address the need to define them for more complex structures, suggesting the use of actor-based TOCs to more clearly specify how the actions of individuals and subgroups contribute to the intended outcomes, but the work is nascent (55).

Within the limited knowledge base on research consortia, there is little research on governance and procedural decisions and their role in the success of multilevel structures or other critical aspects necessary for alignment within such a structure (23,52,56). Multilevel collaborative structures, such as research consortia, have their own complexities as described by Currie-Alder et al (57), including (1) the need to integrate diverse perspectives and backgrounds, (2) limited authority over partners who have their own organizational demands, and (3) the need to balance flexibility with firm management structures to provide direction to the diverse and diffuse groups within the research consortia.

This research is a comparative case study of a multilevel research consortium in three provinces of South Africa and offers recommendations for other similar research consortia. We sought to

understand how three provincial working groups functioned and managed challenges in the absence of explicit guidance on their expected contributions to the consortium.

Background

The Developing Innovative Solutions for Rapid Undoing of Pulmonary Tuberculosis Consortium, also known as the DISRUPT TB Consortium or TB Innovations Consortium (hereafter referred to as the "TB Consortium") was active from 2018 to 2021 and consisted of researchers, Department of Health (DOH) officials, implementing organizations/NGOs, and civil society organizations. It was established to address the problem of slow knowledge translation, despite a robust research community in South Africa that is prolific in its efforts to generate evidence on TB prevention and treatment. The TB Consortium sought to increase collaboration among those who generate knowledge, those who develop policies based on that knowledge, and those who are responsible for implementing those policies (33). Their specific objectives were to align on priority areas of research, select novel interventions that address local challenges and context, and collaborate on demonstration studies of the selected interventions. Two of the three interventions were adopted in some fashion after the demonstration studies: Targeted Universal Testing for TB (TUTT) and LINKEDin to reduce initial loss to follow-up.

The TB Consortium had a multilevel structure with a steering committee and three provincial working groups (PWGs) functioning as subunits. This multilevel structure was considered necessary for several reasons. First, in South Africa, the health sector is largely decentralized with the provincial level responsible for allocating central DOH funding and making implementation decisions. Second, the necessary approvals to conduct implementation science research within health facilities come from the provincial and local levels. And finally, the steering committee recognized that some evidence-based interventions are not implemented into routine practice because they are not feasible or do not account for context-specific realities at the local level; they hoped to address this challenge with ongoing input from provincial and local health system actors.

The steering committee included a nominated member from each stakeholder group, with an elected chairperson and secretariat (elected by the group from two different research institutions). The PWGs were composed of representatives from academic research institutions, DOH TB programs,

implementing organizations/NGOs, and civil society organizations. Many PWG members were also members of the steering committee. Each PWG selected a coordinator who was also a member of the steering committee and had a shared sense of the objectives and principles based on their participation in the establishment of the TB Consortium: the coordinator in KwaZulu-Natal (a DOH official) was elected unanimously, the coordinator in Western Cape (a researcher) was selected by default, and we were unable to determine how the coordinator in Gauteng (an implementing partner) was selected. The overlap in membership and leadership was the primary mechanism by which the objectives and principles guiding the TB Consortium's work were translated to the PWGs.

The TB Consortium was established with a set of founding documents including a concept note, memorandum of understanding, and terms of reference (TOR) that described the roles and responsibilities of various stakeholder groups involved in the steering committee. However, the roles and responsibilities of PWGs and other stakeholders at the provincial level were not explicitly stated in the founding documents (30,36,37).

The first author of this study developed an explicit TOC for the TB Consortium based on interviews with the steering committee members and the founding documents, which is described elsewhere in a related study (submitted). The TOC is meant to represent how the steering committee intended for the TB Consortium's actions to contribute to its outcomes of interest. The TOC is organized based on three main phases of work identified in the concept note: demonstration, scale, and sustainability.

Methods

Study design

This study used a multiple comparative case study design with the three PWGs serving as the units of analysis (45). A multiple case study design allows for exploration of literal and theoretical replication across the aspects of interest. To understand how the TB Consortium was operationalized at the provincial level and what adaptations were made in the absence of explicit guidance to the PWGs, we conducted semi-structured interviews with individuals from each PWG including the coordinators. We also reviewed documentation, such as PWG TORs and meeting minutes.

The field of public health implementation science has been grappling with the role of fidelity and adaptation in the implementation of interventions in different contexts (58–61). The Framework for Reporting Adaptations and Modifications to Evidence-based Implementation Strategies (FRAME-IS) informed the study design and data collection tools. The original FRAME was developed to characterize modifications to an intervention and the FRAME-IS was subsequently created to do the same for implementation strategies (62). Although the TB Consortium is not an implementation strategy, the FRAME-IS is the most widely used framework in implementation science to document and understand adaptations and is, therefore, a valuable starting point for exploring how the PWGs align with the TB Consortium's implicit TOC (63). The FRAME-IS modules were used to inform the interview guide and data analysis.

Study population

The study population included anyone who participated in the Gauteng, KwaZulu-Natal, and Western Cape PWGs, estimated to be 15 to 20 individuals per group. First, we invited the coordinator of each group to participate and subsequently requested each coordinator to provide a list of other PWG members to invite. We used total population sampling, inviting everyone from the lists to participate via email. We also used purposive snowball sampling, asking each participant for names of additional individuals to invite to participate. Of the 35 individuals invited to participate, 23 gave consent (66% response rate) and were interviewed. However, 6 interviewees (5 from Gauteng, 1 from KwaZulu-Natal) did not participate in or have any knowledge of the PWGs and were therefore excluded from analysis, resulting in 17 relevant interviews (Table 6).

Table 6. Study participants by province and stakeholder group

Province	Stakeholder group	Number of participants
Gauteng	Research institution (2) Department of Health (0) Implementer/NGO (1) Civil society organization (0)	3
KwaZulu-Natal	Research institution (2) Department of Health (2) Implementer/NGO (0) Civil Society Organization (0)	4
Western Cape	Research institution (5) Department of Health (2) Implementer/NGO (2) Civil Society Organization (1)	10

All participants were literate and able to understand the purpose of the study. In addition, all participants signed written informed consent before the interview began and provided verbal consent at the start of the interview. Participants were also given opportunities to ask questions. Participation was completely voluntary, and participants were allowed to withdraw from the study at any time. Personal identifiers were removed from transcripts before analysis to ensure anonymity.

Data collection

Primary data were collected through semi-structured individual interviews conducted remotely by the research team between November 2023 and April 2024 using Zoom software. An interview guide was developed based on the FRAME-IS modules to elicit participants' perspectives on how the TB Consortium implicit TOC was operationalized in their province, how it aligned with expectations at the outset, and what adaptations were made. The interview guide can be found in Appendix 2. All interviews were recorded, anonymized, and transcribed verbatim, with light editing for clarity and ease of reading when quotations were excerpted.

We also requested relevant documentation, such as PWG norms, TORs, meeting agendas and minutes, or email communications, from the PWG coordinators in each province. However, only documentation, including TORs and meeting minutes, from KwaZulu-Natal and Western Cape were received and used for analysis.

Data analysis

Interview transcripts were summarized, and rapid coding was done using a spreadsheet to organize responses for all participants by PWG, following the interview guide. We first drafted individual case studies for each PWG that described how each group functioned and the successes and challenges they experienced in operationalizing the TOC (Appendix 3). We did not assess fidelity to the TOC because it was developed retrospectively by the first author rather than by the members of the TB Consortium. We then conducted thematic content analysis to identify themes in the data that illustrated commonalities and differences across PWGs in terms of clarity of mandate, structure and administration, and how they responded to challenges and ambiguities during the three phases (demonstration, scale, and sustainability). This analysis became the foundation of the comparative case study, as described in the Results section.

Ethical considerations

The study was exempted from review (given that the data collected was from low-risk interviews) by the University of Washington Institutional Review Board and approved by the Stellenbosch University Health Research Ethics Committee (reference number N20/01/007).

Results

Findings from the comparative multiple case study of the TB Consortium PWGs illustrate what occurred in the absence of explicit guidance to the PWGs on their expected contributions to the overarching goal and the implicit TOC. In this section, we compare findings from the PWG case studies with regard to their mandate, structure and administration, and ability to adapt to shocks and changes.

Mandate and goals of the PWGs

The founding documents of the TB Consortium did not explicitly describe the intended role of the PWGs in achieving the TB Consortium's outcomes of interest. According to interviewees, the PWGs relied on communications from the steering committee and PWG shared membership and leadership to guide their understanding of the TB Consortium's implicit TOC and how the PWGs were expected to contribute to it.

Two-thirds of participants reported knowing about the TB Consortium from attending a steering committee meeting, and the remainder reported having no knowledge of its objective or model and no expectations of what the PWG would do before they attended the first meeting. Of those who had some knowledge and expectations of the PWG, they generally agreed that the PWG was a forum for collaboration between study teams (made up of academic researchers and implementing partners) and local DOH TB Program officials. However, their perspectives differed in terms of (1) which phases – demonstration, scale, or sustainability – they envisioned the PWG contributing to the most; and (2) the function of the PWG as a forum for information-sharing, decision making, or collective troubleshooting. For example, some participants mentioned that they expected the PWG to serve primarily as a forum for handling practical logistics associated with demonstration studies, including site selection and obtaining local approvals, whereas others expected the PWG to serve as a forum for sharing study updates with DOH stakeholders. While these functions are not mutually exclusive, the variety of participant responses illustrates that the mandate of the PWGs was interpreted differently across participants and provinces. One implementing partner, who was part of the demonstration studies in Gauteng, commented:

> "[The PWG was a forum] for [the research teams] to be able to be accountable to the DOH and to keep them involved. Rather than just get their permission, we keep them involved, because that's part of the sustainability priority. We felt that if they could be involved in it, troubleshoot as things came along, see how it was going, that it would be more powerful than when it came to dissemination, sharing of results, but, most importantly, action on results." (3.1)

Findings from the interviews, review of documentation, and outcomes of the PWGs indicate strong alignment across all PWGs in their understanding of their mandate as it related to supporting the demonstration studies. Specifically, they agreed the PWGs were primarily meant to serve as a forum at the provincial level to (1) facilitate site selection and local approvals for the demonstration studies, (2) provide updates on progress across the three demonstration studies, (3) troubleshoot and resolve issues during the demonstration studies, and (4) share interim and final results. The terms of reference for the Western Cape PWG included activities in the latter phases of scale and sustainability, but these did not materialize. This primary focus of the PWGs on the demonstration phase parallels the focus of the TB Consortium as a whole.

In contrast, participants were not aligned on several other critical components, with disagreement on which components were part of the PWGs' mandate. First, participants noted a lack of clarity as to whether PWGs were intended to generate novel ideas for the TB Consortium's research agenda. A researcher from the Western Cape PWG noted that there was disagreement as to whether this aspect of the Consortium's TOC was the mandate of the steering committee alone or whether new ideas from the PWGs were welcome:

> "Someone proposed an additional innovation to address losses along the care cascade at this provincial working group as a potential opportunity. There was tension about this, a challenge in terms of [the] overall goal of this consortium. [Some at] the provincial level saw that goal statement as something that belonged to the national level, not to the province. They saw the provincial working group [as] a platform for the implementation of the three defined studies, not to engage in any other discussions about other innovations or other opportunities. I think there was a disconnect between the perceived goals of the broader consortium and the role of the provincial working group." (2.5)

Second, several participants noted ambiguity as to whether PWGs were expected to identify synergies or facilitate cross-pollination between the three demonstration studies. Additionally, participants noted a lack of clarity on whether the TB Consortium intended to foster collaboration between researchers within the PWGs or only at the steering committee level. Instead, as several participants noted, the PWGs functioned more as a forum for bidirectional dialogue between the research teams and DOH officials, rather than multidirectional dialogue that encouraged interactions beyond study updates. As the same Western Cape researcher mentioned:

> "I don't think there was a particular relevance to having the three [studies] together in a provincial working group. It was perhaps like a meeting of convenience, because there were three studies, and they were funded by similar funders, but they didn't really look at synergies between the studies or programs in terms of taking the results forward. I don't think they actually came together as three studies towards a single goal. The platform was useful for each researcher to speak to the partners and the Department of Health, but I don't see that it was a platform that was used for the researchers to speak to each other." (2.5)

Similarly, participants had mixed perspectives on the extent to which PWGs should have served as a forum for DOH staff (at provincial, local, and facility levels) and implementing partners to provide feedback and input on the demonstration study designs and protocols. For some researchers, receiving feedback from DOH and implementing partners helped shape their studies and make them more practical. For example, another researcher in the Western Cape noted:

> "We changed some of the data we were collecting because… having that interaction [with DOH representatives] made us realize what was more important, gave some insight into what we were implementing, how that might differ from the research question and what other [questions we needed] to answer. That local interaction was very good." (2.1)

In contrast, others noted that the PWGs were established too late (after study designs had been finalized and approvals received) to incorporate their input. Because of this, participants noted some misalignment in terms of expectations about the extent to which the PWGs could shape the studies. As a researcher from the KwaZulu-Natal PWG noted:

> "Depending on how big a suggestion is in terms of implementation, in some instances we [researchers] are not able to [incorporate feedback], because it means you'd have to change your whole protocol." (3.11)

As noted earlier, expectations differed in terms of which of the three phases of the TB Consortium's work the PWGs were meant to support. Although it was clear that the PWGs were meant to support the demonstration studies, whether or how the PWGs were meant to engage during the scale and sustainability phases was less clear. As a result, the PWGs had a much smaller role, if any, in the latter two phases of the TB Consortium. Participants from the Gauteng and Western Cape PWGs asserted that most of the success was seen in the initial demonstration phase of work. As one researcher from Western Cape stated:

> "I think there was a disconnect between the perceived goals of the broader consortium and the role of the provincial working group…. In the formative stage – setting up the study, how are we going to implement the study – there was a lot of achievement, but toward the end, when we were talking about translating from the study towards practice, we didn't necessarily achieve much." (2.5)

The divergence in participant perspectives illustrates an incomplete understanding of the TB Consortium's implicit TOC and expectations for the PWGs. Although there was strong alignment on the PWGs serving as a forum for supporting the demonstration studies, other expected functions of the PWGs were ambiguous. This lack of clarity potentially limited the potential contributions of the PWGs in the scale and sustainability phases of work.

Structure and administration

An examination of the structure and administration of the PWGs reveals how they were aligned or misaligned with the TB Consortium's TOC. Without centralized guidance on how the PWGs should function, the KwaZulu-Natal and Western Cape PWGs developed their own TORs (64,65). The TORs

defined some aspects of the mandate of the PWGs, and they detailed expectations for the logistics and administrative function of the PWGs. The following three aspects of structure and administration emerged as important contributors to the effectiveness of the PWGs: leadership orientation, membership, and responsibilities of and benefits to members.

Leadership orientation: The leadership structure of the PWGs varied across provinces, but all three PWGs were led by individuals who were also members of the TB Consortium steering committee. This comparative case study provided an opportunity to draw observations from a natural experiment, given that each PWG selected a coordinator from a different stakeholder group (Gauteng was coordinated by an implementing partner, Kwazulu-Natal by a DOH representative, and Western Cape by a researcher). The KwaZulu-Natal PWG was a representative from the provincial DOH who ensured that the appropriate DOH officials were informed and invited to participate in the PWG and was able to facilitate the necessary approvals. Most participants reported a favorable view of the effectiveness of the KwaZulu-Natal PWG, largely due to the perceived authority and proactive orientation of its coordinator. Several participants noted that this coordinator had the authority with the DOH to champion the work, make decisions, and resolve issues in a timely manner, which was critical to the ultimate effectiveness of the PWG. As one implementing partner in the Gauteng PWG remarked:

> "The TB representative from KZN [KwaZulu-Natal] came up with [one of the] research idea[s], raised it and she seems to, within her organizational culture, not just be a representative who toes the line handed down to her, but makes the position." (1.24)

The leadership structure of the Western Cape PWG presented a different model. It was originally envisioned to rotate among the three research institutions leading the demonstration studies in the province, with each taking a turn organizing and hosting the meetings. Ultimately, for convenience, it remained with one research institution, led by a co-principal investigator. From participant interviews and corroborated by the documentation, the Western Cape PWG coordinator maintained a high level of organization, conducted meetings frequently, and had strong participation from multiple levels of the local DOH. The PWG focused primarily on implementation of the demonstration studies, with strong participation from the local and provincial DOHs throughout the process, but it did not result in proactive uptake of the new interventions.

In contrast, the Gauteng PWG coordinator was from an implementing partner organization that was part of the research team for two demonstration studies. We do not have information about how the coordinator was selected, but when the coordinator took a personal leave of absence in early 2020, the PWG essentially discontinued operations and any interactions between study teams and the DOH occurred on an ad hoc basis.

The variation in leadership orientation across the three PWGs underscored that the selection of coordinator should align with the expected role of the PWGs. All three PWGs were successful in securing local approvals, facilitating site selection, and launching the demonstration studies to an extent. The Western Cape PWG led by a researcher had a strong focus on timely updates on study execution, while the KwaZulu-Natal PWG led by the DOH official had the strongest track record of ensuring the final results and implementation learnings reached the appropriate decision makers within the provincial DOH. This probably contributed to the early (even before the intervention was codified into national policy guidance) adoption of the Targeted Universal Testing for TB (TUTT) intervention and the LINKEDin intervention in KwaZulu-Natal.

Membership: From interviews and meeting minutes, it is evident that the Western Cape and KwaZulu-Natal PWGs maintained relatively low numbers of meeting participants (≤20) throughout their duration, while interviewees described that the Gauteng PWG started with a small group and then expanded in size for two meetings before discontinuing. Limiting the membership aligned with the TB Consortium TOC, which emphasized the careful consideration of relevant stakeholders based on strategic objective. In addition, participants appreciated that smaller group sizes enabled meetings to serve as a forum for active collaboration, troubleshooting, and sharing feedback. The KwaZulu-Natal TOR specifically set the number of PWG members at 20 (64). Participants commented on the benefit of the smaller working group size, which enabled focused discussion and decision making. As a DOH representative in the Kwazulu-Natal PWG shared:

> “The turnaround [time for] taking decisions was quite good, maybe because it was a smaller group, [with the] same goal, and it was streamlined, focused on these three studies and, unlike a big committee or big forum where we talk about anything and everything, here things were really well outlined, and it was easy to focus.” (4.3)

The participation of stakeholder groups, especially those from the provincial and local DOHs, shifted over the course of the PWGs, and participants reported that it was most successful when the stakeholder group members had authority and were relatively high level in their organizations. The COVID-19 pandemic disrupted and reprioritized resources across the health sector, contributing to reduced attendance of PWG meetings. The Gauteng PWG experienced higher staff turnover than the other two PWGs, but all provinces experienced challenges in retaining DOH staff participation and focus because of the COVID-19 pandemic. The Gauteng PWG, and to a lesser extent, the Western Cape PWG, did not have consistent representation from the appropriate DOH stakeholders with decision-making authority, although the Western Cape PWG continued to function with some representation throughout the rest of the period. A researcher from KwaZulu-Natal described how the PWG continued to function, albeit under more challenging circumstances.

> "At the beginning it was easier, pre-COVID, to have face-to-face meetings and then in the middle, we had to deal with the meetings online. As you know, with online meetings, engagement can vary but we used whatever means possible to engage. I remember one results dissemination workshop was online. We made it work, despite the many challenges." (4.1)

In Gauteng, one researcher asserted that the stakeholders with decision-making authority were not present from the start:

> "A TB program manager [would be present] and we would give them the information, and then it still needed to go up the ranks, [we'd] still need to wait for them to engage with their boss, who might also need to be engaging with the district, the provincial chief director, [and] we wouldn't have those people in the meeting." (3.11)

In the Western Cape, intentional changes to include DOH representatives occurred at many levels, including sub-districts, who could advise on site selection and help ensure smooth implementation of the demonstration studies. In contrast, participants recognized that decision makers were not involved enough toward the end of the studies. One researcher from the Western Cape commented:

> "[The provincial working group achieved its goals] to some extent and it changed over time. At our initial meetings we had commitments from some of the most senior people to join in the meetings. It gave us, as three different researchers with different studies, an opportunity to talk to people who were the decision makers. By the end of the study, we had some new people coming to these meetings, who then didn't have the context of the meeting and what their role was and weren't there to make any decisions about how we go forward and then I think the working group wasn't necessarily achieving its objective." (2.5)

The DOH did not consider itself a decision-making authority in the Western Cape PWG, with one DOH representative stating:

> "There was regular feedback on progress, [which] generally worked well, and the group was well represented of different stakeholders, [which] was positive. But in terms of decision making, we were there in an advisory capacity. I don't feel that we ultimately had the final say or influence over decisions that were made." (2.7)

All four KwaZulu-Natal PWG participants interviewed stated that the right people were involved to make decisions, especially at the highest level of the province. As one DOH representative noted:

> "From the provincial level, it was senior management, but at a district level, it was more of district TB coordinators because they are the ones who are managing the TB [program] at a district level. Then from facilities, then the Medical Officer will attend, or maybe somebody that has been delegated." (4.4)

From the perspectives of multiple interviewees, the KwaZulu-Natal PWG was stronger both in engaging the appropriate DOH individuals throughout the lifecycle and ensuring they felt ownership over the work and empowered to make decisions that would inform the implementation of the interventions. However, one participant in KwaZulu-Natal asserted more engagement was needed with implementing partners working in the province supporting the health system (not just those involved in the demonstration study teams) during the earlier stages of work. For example, one researcher from KwaZulu-Natal said:

> "Implementing partners were key to the success of the interventions, but they weren't represented in the consortium from the very beginning and I think the implementing partners' engagement should have been more carefully solicited. We underestimate the capacity of the DOH health care workers to get things done, they face many challenges, and we really do rely on implementing partners when we are layering additional activities on a very burdened system. So, I think that earlier recognition of implementing partners and ensuring that implementing partners either had the resources or were provided the resources to actually help to deliver on the projects would have been extremely helpful." (4.2)

According to interviewees from all three PWGs (and corroborated by meeting minutes in two of the three PWGs), the appropriate DOH officials were present and engaged at the outset of the demonstration studies, such that they could approve site selection and authorize the start of the studies. However, all PWGs had challenges ensuring the right high-level officials were present for the dissemination of interim and final results, which was important for informing their decisions to ensure the successful implementation of interventions. In addition, none of the PWGs maintained engagement with

DOH officials during the final scale or sustainability phases as stated earlier, which was a missed opportunity.

Responsibilities of and benefits to members: A strong theme emerging from the data was the divergence in stakeholder perspectives on the value of their participation in the PWGs compared with the additional burden of participation. For example, some researchers mentioned that their time spent on meeting preparation to present on study progress was disproportionately burdensome, given that the TB Consortium PWGs required more frequent updates compared with other research projects. Others recognized the value of the working groups and described the benefits of receiving input and feedback from DOH and implementing partners. And still others recognized the value of the TB Consortium at the national level for setting a research agenda in a collaborative manner with multiple stakeholder groups present, but they did not see value at the provincial level.

Participants from the DOH generally found the PWG structure useful and liked receiving updates on the three demonstration studies in a consolidated forum. They appreciated that their input and engagement was more meaningful than with other research studies. From the perspective of a DOH representative in the Western Cape:

> "There was a lot of cross-fertilization between the three studies because of this joint working group. It also meant, from the [health] services point of view we could actually be engaging with the researchers more efficiently, because they were all grouped together, otherwise it's really time consuming. So that was a useful aspect from our health service lens, to be able to have them grouped together. It both strengthens the implementation, but also strengthened the process of engagement." (2.17)

When participants were asked whether the demonstration studies were conducted differently because they were under the auspices of the TB Consortium, they had mixed responses. Some participants, especially those from the DOH, reported a positive difference in how the studies were conducted. One participant from the DOH in the Kwazulu-Natal PWG said:

> "With the consortium it was a group of researchers working together with the Department of Health, which is not common, because [typically] if there is a research [study], there will be just a nurse concentrating on the study, doing the study alone until it's done. But with the consortium they were working together with the staff. There was a difference, in actual fact I would say it didn't even feel like research was being done." (4.4)

Researchers were divided, with some stating that participation in the PWGs had no impact on how their demonstration studies were conducted, whereas others appreciated the deeper engagement

and ongoing implementation support facilitated by the PWGs. Taken together, the results underscore the importance of clarifying roles, responsibilities, and expectations of each participant in the PWGs at the outset such that they can be revisited. As one researcher in the KwaZulu-Natal PWG stated:

> “I think it brought people together, but I don’t think it was very successful in achieving [its goals]. I think that the groups become unwieldy, and I think far more can be achieved one-on-one or in far more focused sessions. The working groups comprise extremely busy people and I think that the mandate for the goal of the group and what each individual was expected to contribute didn’t always come out clearly.” (4.2)

Ability to adapt to shocks

All PWGs experienced multiple challenges and made unanticipated adaptations, the most significant of which were due to the COVID-19 pandemic. The KwaZulu-Natal and Western Cape PWGs experienced an unanticipated shift to virtual meetings because of COVID-19 restrictions, and the Gauteng PWG stopped functioning shortly after the pandemic began. The Gauteng PWG faced multiple challenges, including high turnover of DOH staff, and ultimately discontinued operating due to the coordinator taking a leave of absence that coincided with the onset of the COVID-19 pandemic. The Western Cape and KwaZulu-Natal TORs did not specify contingency plans for leadership continuity in case of a transition or leave of absence, and the Gauteng PWG did not have any TOR in place.

The Western Cape and KwaZulu-Natal PWGs did not meet during the first month after the COVID-19 lockdown was announced but then resumed meeting virtually. As a DOH representative from KwaZulu-Natal shared:

> “We couldn't meet physically like we used to. We had a few virtual meetings, and then we ended up not meeting for a while because, remember, some people were working from home and some people were also sick with COVID. The whole focus changed, even in my role, I wasn’t even thinking about what I'm responsible for, because everyone was just pushing the Covid activities.” (4.3)

The two PWGs adapted to virtual meetings to continue information-sharing, problem-solving, and coordinating the work of the PWG in alignment with the TOC. However, participants reported that the shift to virtual meetings weakened the collaborative and networking aspects of the PWG structure and potentially contributed to fatigue and discontinuation of the PWG structures before all the demonstration studies had been completed and results shared. From interviews and meeting minutes, we found that the Western Cape and KwaZulu-Natal PWGs maintained virtual meetings until 2021 when two of the demonstration studies concluded. The meeting minutes show that the content of the PWG meetings also

changed due to the challenges presented by the COVID-19 pandemic, to discuss competing priorities of health workers, restrictions on access to health care facilities, and obtaining approvals from local officials to restart the studies. As a DOH representative from Western Cape described:

> "[The COVID-19 pandemic impacted our work] in a number of ways. First of all, it affected the studies on the ground that we're trying to complete that had to change some of their practices. And then actually to the working group itself. COVID is where I presume that the working groups then went online. I can't actually remember attending one. Some of the regularity fell away at that point. That could well also have been some of the problematic aspects at the end, in terms of the structure and you know the curve ball that was COVID." (2.17)

In the absence of centralized documentation, the Western Cape and KwaZulu-Natal PWGs developed their own TORs to clarify their expected deliverables, the number of members, and the frequency of meetings. Having local TORs was preferable to no documentation and the two PWGs with written TORs continued to function even when faced with the shock of the COVID-19 pandemic. The Gauteng PWG did not have a TOR and ceased functioning when the coordinator took a leave of absence from work. While the PWGs continued to regularly report on progress of the demonstration studies at the sites across their provinces to the steering committee, it does not seem that much attention was paid to how the PWGs were functioning, whether the appropriate individuals attended meetings, and whether the PWGs achieved their goals and contributed to the TB Consortium as expected.

Discussion

This study compared case studies of three working groups, or subunits, within a multilevel research consortium in South Africa. We sought to understand how the subunits functioned and managed challenges in the absence of explicit guidance on their expected contributions to the overarching research consortium. Looking across these case studies enabled us to identify aspects of the TOC and expectations that were communicated clearly and where ambiguities existed and could be improved. These findings have important implications for other entities in setting up subunits for success within a multilevel research consortium. In this section, we distill the implications of our analysis and offer recommendations for similar multilevel research consortium structures to consider.

Alignment of consortium objectives and structure

In defining the mandate and structure of consortium subunits, clear conceptualization and alignment at the outset can help mitigate the risks associated with the complexities of functioning as a multilevel consortium (53,54,66,67). A TOC can be a useful tool to drive this alignment, as long as it sufficiently accounts for the complexity and variety of roles within the subunits of the structure (55,67). Careful consideration of what elements need to be standardized across subunits and what types of adaptations are permissible or encouraged to optimize the function of each of the subunits can strengthen the operationalization of the TOC. Clarity and alignment are necessary both on how the subunits will contribute to the overall objectives of the consortium (their mandate) as well as how they should be structured to best achieve this mandate. As previous literature and the data from this study suggests, in conceptualizing how the subunits will contribute, a critical consideration for success is balancing centralized control and freedom to adapt or foster creativity within the subunits (57,68,69).

The findings from this study demonstrated challenges related to conceptualizing the alignment of objectives and structure of the consortium and its subunits, which manifested to varying degrees across the subunits, especially when confronted with the challenges presented by the COVID-19 pandemic. The role of the PWGs contribution to the TB Consortium's goals was not clear to all members, nor was the structure designed to support those goals. The structure of the subunit should be defined to support the strategic objectives of the parent structure, as has been documented previously (54). Decisions on the leadership, membership, and meeting content and cadence should all be based on the mandate of the subunits. These structural decisions could have clearly defined the roles and responsibilities of the PWG in each of the three phases of the TB Consortium's TOC – demonstration, scale, sustainability – even if it meant explicitly stating that the PWG will exist only for the duration of the demonstration study. The PWGs would have benefited from structural guidance on aspects related to meeting cadence and membership, especially how they should change over time when considering the full lifecycle of the PWGs and their role during each phase of work. The members of the PWG may need to intentionally change over time, with some individuals needed at the outset to inform site selection, and others present for readouts on interim and final results to contribute to and make informed decisions on province-wide adoption of the interventions.

The PWGs followed different processes to select their coordinators, which resulted in one PWG led by a researcher, one led by an implementing partner, and one led by a DOH official. Because scale-up and sustainability of the interventions at the provincial level was the objective of the TB Consortium, it was strategically beneficial to have leadership orientation that comes with the DOH in the coordinator role. A comparison of the PWG outcomes revealed that the PWG in KwaZulu-Natal led by a DOH official was the most successful due to her orientation to the TB Program and ability to secure necessary DOH approvals, obtain buy-in from the appropriate DOH officials, and provide continuity from the beginning phase (demonstration) through the end phases (scale and sustainability) of work, even after the PWG ceased functioning.

As seen in the TB Consortium, any gaps or weaknesses in the TOC can be duplicated, and potentially magnified, in the subunits. For example, as with the TB Consortium as a whole, the PWGs focused on the demonstration phase of work, to the detriment of the other two phases, despite that a key potential strength of the PWG is scaling up the interventions throughout the province. Because funding for PWG coordination was tied to funding for the demonstration studies, members moved on to other projects after the studies were completed and the PWGs discontinued.

Documentation of subunit responsibilities

Once there is conceptual alignment on the role of subunits within a broader research consortium, it is critical to document the decisions made on the strategic mandate of the groups and their structures. The existing literature on research consortia emphasizes the need for documentation, which could include, as Hagen et al suggest, the shared vision, formal governance policies, TORs, the agreed upon accountability framework, and a succession planning strategy to address membership change over time (69,70).

The variety of perspectives shared through the interviews underscored that the TB Consortium relied on the overlapping and durable membership between the steering committee and the PWGs as the primary method to communicate a shared understanding of the TB Consortium's objectives and TOC, rather than documenting any strategic decisions about the role and responsibilities of the PWGs. This lack of documentation is problematic on multiple fronts. First, with any professional collaboration, there is bound to be turnover as individuals change roles and organizations. Additionally, PWGs included

members who were not part of the steering committee, which contributed to a lack of shared understanding about the TB Consortium and the role of the PWGs as members' perspectives diverged and became more diffuse. Creating and sharing documentation on the value proposition and TOC and the mandate of the PWG would have set expectations for the role of the PWG within the TB Consortium structure. Documentation on how the subunits should coordinate and communicate with higher levels (in this case, the steering committee) is important, including how to escalate questions or issues and whether there is shared membership between the levels.

When the subunits invariably encounter external factors that require adaptation, such as the COVID-19 pandemic, explicit documentation of the core principles and objectives of the subunits can guide decision making around adaptations and ensure the critical functions of the group. TORs or other documentation for guiding the structure and work of subunits are further strengthened when they explicitly address whether and how the function of the subunit can change throughout the lifecycle of the work. For example, in the TB Consortium, all three PWGs ceased meeting after two of the three demonstration studies had been completed and results reported. There was no clear plan for the PWGs to account for potential delays in the demonstration studies or to determine if and how the meeting cadence, agenda, or attendees should shift across the various phases of work.

Another critical aspect to document for a collaborative endeavor such as a research consortium at all levels is clarifying expectations, roles, and expected benefits/compensation for each stakeholder group. As part of its original concept note, the steering committee included roles and responsibilities for each stakeholder group in the TB Consortium as well as for key external stakeholders, replicating this for the PWG level and the inclusion of anticipated benefit and resourcing structure would have been a useful and clarifying exercise. In the absence of this, participants in this study shared their frustration with the perceived imbalance among stakeholders. For example, some researchers felt they were expected to prepare for and contribute more to the PWG meetings than other groups, and while some valued feedback, others were frustrated that they were expected to amend their protocols after approval. In addition, others noted that the research teams received funding for their participation in this work, whereas the DOH officials participated without funding. While analysis of the power dynamics between various stakeholder groups within the Consortium was not the focus of this research, it must be

acknowledged that power differentials exist within any collaborative structure, especially where funding is not equally distributed, such as in this example. Clear documentation of expectations and the associated costs and benefits to each stakeholder group can contribute to reducing tensions between groups with power differentials.

Performance evaluation and oversight

The findings of this study build upon the literature from other research consortia showing that an intentional focus must be placed on the process and governance of a research consortium; otherwise, the specific research outcomes and outputs will become the predominant focus to the detriment of the success of the research consortium (52,71). For example, regular discussion of the utility and function of the PWGs in the TB Consortium steering committee could have surfaced topics such as whether the PWGs remained a useful forum, whether or how they should be leveraged for implementation and scale-up planning, and whether any troubleshooting or support was needed to improve their function. The results from this comparative case study build upon the existing literature on the performance of research consortia over time, emphasizing that flexibility and adaptation are critical for longevity and retaining membership (57,72,73).

The steering committee could have addressed the issues identified in the Results section with timely monitoring and mitigating actions. These issues include the mismatch in perceived burden and value of the PWGs, the impacts of and necessary adaptations due to the COVID-19 pandemic, and the challenge of staff turnover and identifying the appropriate DOH officials to participate in the PWGs. The PWGs could have also had a vital role to play to maintain momentum and plan for scale-up during the time lapse between the successful completion of a demonstration study and when the novel intervention was ready for implementation at scale.

Recommendations

This comparative case study of subunits in a multilevel consortium offers lessons and recommendations for future multilevel research consortia and other similar structures to improve their functioning to achieve their objectives. We present three main recommendations that build on existing literature: (1) conceptualize upfront how the subunits in the multilevel structure will contribute to overall

goals; (2) institutionalize the principles and expectations for subunits with written documentation; and (3) monitor the process (in addition to the progress) of work in the subunits and revisit expectations.

Conceptualize upfront how the subunits in the multilevel structure will contribute to overall goals. A multilevel research consortium requires upfront conceptual alignment of the objectives and structure at all levels. A TOC can be a useful tool to drive this alignment if it sufficiently accounts for the complexity and variety of roles within the subunits of the structure. Decisions on leadership, membership, and meeting content and cadence should all be informed by the mandate of the subunits. Each consortium will need to determine the optimal balance between centralized control and freedom to adapt or foster creativity within the subunits (57,68,69). Clear conceptualization and alignment can help mitigate the risks associated with the complexities of functioning as a multilevel consortium.

Institutionalize the principles and expectations for subunits with written documentation. It is critical to document the decisions made on the strategic mandate of the subunits and their structures including the shared vision, formal governance policies, TORs, accountability framework, and a succession planning strategy to address membership change over time. Doing so will enable the subunits to manage and adapt to external factors. Explicit documentation of the core principles and objectives can guide decision making and ensure the maintenance of critical functions, even during periods of change. Documentation should encompass the entire lifecycle and as many potential risk scenarios as possible. Clarifying the expectations, roles, and expected benefits or compensation for each stakeholder group involved in a multilevel research consortium is also crucial to align expectations and manage those expectations over time. As the complexity of a multilevel research consortium increases, so does the need for clear documentation of the strategic and structural agreements across levels.

Revisit the guiding principles and conduct process evaluations. Intentional focus must be placed on the process and governance of all levels of a research consortium to ensure its success. Subunits should be seen as not just in service to the consortium, but rather, there should be a bidirectional relationship between them to enhance the effectiveness of the collaboration as a whole. With proper documentation in place to set expectations and guide the functions of the subunits, a multilevel research consortium should regularly evaluate its processes against these expectations and make course corrections as necessary. One potential approach to monitoring process at the subunit level would be to

assign the responsibility for oversight to a steering committee member who could flag any misalignment or drift from the stated objectives. There is no one-size-fits all conduct process evaluation approach, and the leadership of each multilevel research consortium should determine the formality and frequency warranted.

Study limitations

This comparative case study does have limitations. These include (1) selection bias of the convenience sample of informants; (2) recall bias of interviews who were asked to remember experiences after several years; and (3) lack of validated data collection tools and analytical approach due to the dearth of existing literature. Several key sub-groups were not represented in the sample, notably DOH representatives from Gauteng province due to staff turnover. In addition, the findings are more generalizable to research consortia that share key characteristics with the one studied and less generalizable to those that differ in key ways. This study and its findings emphasize the need for additional research on the function of multilevel research consortia globally to develop robust methodologies and validated tools.

Conclusion

Our analysis of a multilevel research consortium that operated without documented guidance for its subunits generated important findings and recommendations to help strengthen future multilevel collaborations. The variability in how the subunits functioned and the differing perspectives of members on their effectiveness point to areas that require careful consideration. Emerging from the findings are the following recommendations for other multilevel collaborations to consider when setting up a similar structure: (1) conceptualize upfront how the subunits in the multilevel structure will contribute to overall goals; (2) institutionalize the principles and expectations for subunits with written documentation; and (3) monitor the process of work in the subunits and revisit expectations. Establishing and maintaining alignment between subunits and across levels is important and can help mitigate risks when shocks occur, and adaptation is necessary. In early 2025, at the time of writing, funding from the US National Institutes of Health, PEPFAR (US President's Emergency Plan for AIDS Relief) and the US Agency for International Development to implementing partners in South Africa and other countries has been largely

stopped. Areas of future research should include a focus on how the power dynamics shift between government health actors and implementing partners, and how academic researchers collaborate with each of them, in response to changes in the funding landscape. Additional research in this area could also further refine the recommendations by determining the most effective tools and approaches to use within a multilevel research consortium.

CHAPTER 4. FACILITATING KNOWLEDGE TRANSLATION: A RESEARCH CONSORTIUM'S ROLE IN SOUTH AFRICA

Introduction

In the field of public health, as in many other sectors, conducting research solely for the sake of generating evidence is usually not the main objective. For many, generating knowledge to inform changes in policy and practice is the definition of impact. There is a large body of literature on how to translate knowledge into policy and practice, including various frameworks for understanding the process of knowledge translation, and extensive information on the barriers and facilitators to applying research (74–81).

The World Health Organization defines knowledge translation as “the synthesis, exchange, and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving people’s health” (1). Knowledge translation is a complex process involving multiple stakeholders working together to generate, adapt, and apply knowledge, which requires linking disparate areas of expertise. Existing research on knowledge translation, including the related concepts of research translation and evidence-based policymaking, spans both public health and public policy. It offers different perspectives, insights, and recommendations for researchers and policymakers on how to effectively translate research findings into policy (2–7). Moreover, many stakeholders, including researchers, funders, and norm-setting bodies, have explored approaches to accelerate the knowledge translation process and make it easier and more efficient to apply evidence-based practices (8–13). In this study, we examined the role of a research consortium in facilitating the translation of knowledge into practice for two tuberculosis (TB) interventions in South Africa.

Background

The Developing Innovative Solutions for Rapid Undoing of Pulmonary Tuberculosis Consortium, commonly referred to as DISRUPT TB Consortium, also known as the TB Innovations Consortium (hereafter referred to as the “Consortium”), was established specifically to facilitate research translation of proven interventions into practice in South Africa. The Consortium was organized with two levels,

including a steering committee and provincial working groups. The steering committee consisted of researchers from academic institutions, officials from the provincial and local Department of Health (DOH) TB programs from three provinces (Gauteng, Kwazulu-Natal, and Western Cape), implementing organizations and NGOs that support the TB program, and civil society organizations. Members of the Consortium agreed on priority areas for research, selected novel interventions to address local challenges and context, and collaborated on testing the interventions through demonstration studies. The implicit Theory of Change (TOC) underlying the Consortium assumed that if they worked together on these processes and the novel interventions proved effective, there would be a greater likelihood of the interventions being adopted into policy and practice, in turn making implementation and scale-up faster and smoother (30). The Consortium intentionally considered how it could provide information for policy consideration to the TB Think Tank, which had some overlapping membership. The Consortium was conceived in 2017, started operating in 2018, and continued until 2021 when it ceased functioning because the funding it relied on from the Gates Foundation for its operation as part of the demonstration studies ended.

Three interventions were selected for study, two of which yielded positive results from the demonstration studies and were subsequently adopted at various degrees of scale. The two successful interventions were (1) the Targeted Universal Testing for TB (TUTT) intervention, which aimed to increase the rate of diagnosing new TB cases by testing high-risk groups, irrespective of symptoms; and (2) the LINKEDin intervention, which aimed to reduce initial loss to follow-up among TB patients by automating key aspects of the notification system and implementing an alert and response patient management system to rapidly link newly diagnosed TB patients to treatment (Table 7). The third intervention, TB Monitoring Adherence and Treatment Endpoints (TB-MATE), sought to improve TB treatment outcomes using an electronic pillbox that provided reminders for patients and collected adherence data for providers to differentiate care. The demonstration study of the third intervention showed negative results (it improved adherence but did not improve treatment outcomes) and was therefore not implemented and not included in this case study.

This research aimed to understand how the consortium model affected various aspects of the knowledge translation process – including the selection and design of the intervention itself, the

demonstration study, dissemination of findings, policymaking process (where relevant), and the subsequent implementation at scale. The study also identified contextual and intrinsic factors related to the interventions that contributed to the outcomes, which provide insights for future similar efforts to conduct implementation research within a consortium model.

Table 7. Successful interventions studied under the Consortium

Intervention and demonstration study aims	Outcomes of interest
Targeted Universal Testing for TB (implemented at 62 sites) aimed to increase diagnosis rate of TB by: 3. Testing all high-risk groups for TB using GeneXpert Ultra and mycobacteria growth indicator tube regardless of the presence of TB symptoms, including: • All HIV-infected individuals • Individuals with prior TB disease in the past 2 years • Those who had contact with an adolescent or adult with TB in the past year 4. Assessing the utility of an mHealth contact tracing application	Number of TB cases diagnosed per month Number of tests to diagnose one TB case Number of contacts screened Cost per patient diagnosed
LINKEDin (implemented in 6 subdistricts) aimed to reduce initial loss to follow-up among TB patients by developing and implementing: 3. An automated notification system of laboratory-confirmed TB patients in hospitals, thereby including non-reporting hospitals into the existing electronic TB notification system 4. An alert and response TB patient management system to rapidly link newly diagnosed TB patients to TB treatment	Proportion of diagnosed patients notified to TB program Proportion of patients initiated on TB treatment Cost per patient linked

Methods

Setting

This study was set in South Africa, spanning the provinces of Gauteng, Kwazulu-Natal, and Western Cape, and was conducted as a nested case study to understand the function of the Consortium. This study focuses on understanding and analyzing how the Consortium contributed to facilitating knowledge translation for two interventions and identifying opportunities for future research consortia to play a similar facilitator role.

Study Design

This comparative case study identified common themes from the TUTT and LINKEDin interventions that operated as part of the Consortium (42). The TUTT intervention was selected for study because it successfully increased the detection of new TB cases and was subsequently adopted into

national policy in South Africa, which was a goal of the Consortium. The LINKEDin intervention was selected because its implementation continued in two of the three participating provinces after the demonstration study ended. This case study explores the impact of the Consortium on related outcomes, including the speed and smoothness of the knowledge translation process as well as decision makers' trust in the process and data at every stage of the intervention. To develop a holistic comparative case study, we also included external and intrinsic factors that played a role in the relative successes.

Study Population and Data Sources

The study population included individuals who were involved with the Consortium and the interventions studied as part of the Consortium, those involved in the adoption of the TUTT intervention into national policy and implementation, and those involved in the implementation of LINKEDin in Western Cape and Kwazulu-Natal provinces. We began by identifying participants from the national steering committee and those at the provincial level of the Consortium. Next, we used snowball sampling to identify additional participants with knowledge of the policymaking and implementation phases of the interventions. Our goal was to collect as many diverse perspectives as possible from individuals who exert influence on the research itself or the translation of the research into policy. Inclusion criteria were based on the participants' roles and their relevance to the study and implementation of the interventions. The breakdown of participants by stakeholder group for this study is shown in Table 8. Some participants participated in the Consortium steering committee or provincial working groups, while others did not.

Table 8. Study participants by stakeholder group

Stakeholder Group	Number of Participants
Research institution	11
Department of Health (national and local)	7
Implementer/NGO	4
Civil society organization	1
Total	**23**

Data Collection

The research team conducted semi-structured interviews with participants between November 2023 and April 2024. The interviews were conducted remotely in English using Zoom software and then transcribed for analysis. An interview guide was developed that contained questions and probes for this

study as well as two related studies (Appendix 2). All interviews were recorded, anonymized, and transcribed verbatim, with minor edits to increase clarity and readability for excerpted quotations.

Data Analysis

The research team prepared transcript summaries from each interview to identify the main takeaways. Transcripts were then analyzed iteratively using a directed approach to qualitative content analysis using Atlas.ti (version 24) software to organize and code the data (49). Coding was an iterative process, starting with an initial code book based on the systematic review by Innvaer et al (4) on facilitators and barriers to research translation, which was updated with emergent codes as analysis proceeded. Data were initially coded independently by the two members of the research team to reconcile any discrepancies to ensure consistency of categorization and interpretation of the data. Two individual case studies were developed detailing the timelines and processes of the research-to-practice pathways of the TUTT and LINKEDin interventions and how the Consortium and external factors contributed (Appendix 4). We then conducted a comparative analysis of the two intervention-specific case studies to identify key themes regarding the role of the Consortium in facilitating knowledge translation.

Ethical considerations

This study was exempted from review by the Institutional Review Board at the University of Washington and approved by the Health Research Ethics Committee at Stellenbosch University (N20/01/007). Participants were interviewed in their professional capacity and were not asked questions of a personal or sensitive nature. All participants were literate and able to understand the purpose of the study. They were given an opportunity to ask questions and sign written informed consent before the interviews began. Participation was completely voluntary, and participants were able to withdraw from the study at any time. Personal identifiers were removed from transcripts before the analysis.

Results

The results from this study elucidate how a research consortium model contributed to the process of knowledge translation at various stages of implementation. Feedback from diverse stakeholders,

including policymakers, implementers, and researchers, highlight how the Consortium contributed to the successful outcomes of the TUTT and LINKEDin interventions.

Overall, the Consortium functioned as intended, by facilitating the implementation of two successful interventions and not advancing the third intervention, which showed negative results in the demonstration study. Creating holistic case studies of the two successful interventions enabled us to better understand how the Consortium model contributed to their success (Appendix 4). A comparison of the two case studies revealed that the Consortium had clear successes, qualified successes, and some missed opportunities as a facilitator of knowledge translation.

Successes of the Consortium as Knowledge Translation Facilitator

Timely, relevant, and strong research: The Consortium successfully contributed to facilitating knowledge translation in several ways. It facilitated collaboration across multisectoral stakeholders to set the research agenda, identify interventions to study, and design study protocols—all of which supported the timeliness and relevance of the research, enhanced the quality of the research, and ensured that the evidence included data on effectiveness and costing. The Consortium's steering committee brought together key stakeholders to determine the research agenda based on a shared review of recent evidence showing gaps in the TB program. After the interventions were selected, the Consortium provided a forum for stakeholders to review and provide input on the proposed study designs for both interventions. Multiple participants reported that the feedback received improved the quality of the research and served to foster personal connections between the researchers and other stakeholders, including DOH representatives from the provincial TB Programs. Researchers stated that having peer review from fellow researchers with diverse expertise in a collaborative setting was valuable and strengthened their study protocols. For example, the TUTT intervention included an additional high-risk group in its protocol, based on the recommendation of another researcher in the Consortium. Additionally, the input received from DOH representatives, implementing partners, and civil society stakeholders helped ensure that the study designs and research protocols accounted for the sensitivities and realities in practice. Receiving funding from the Gates Foundation for the demonstration studies as part of the Consortium required researchers to fully engage in the process, as described by one researcher who reflected on the value of the Consortium:

> "Providing a structure and saying if you want to get this money you got to do it this way was very beneficial. Often times when I did other studies, I disregarded the requirement to include the public health system and disregarded the preliminary test of the public health people to say that if it was successful, [it would be feasible to] actually do. Also getting feedback from peers in a non-competitive environment was very important, indeed for the TUTT study we included people who had recently been diagnosed with TB as a risk group because of a presentation from another researcher showing modeling results that a large proportion of new patients with TB were patients who previously had TB." (3.2)

LINKEDin benefited from the Consortium model in that the protocol was amended based on interim findings and local context, after discussions with Consortium stakeholders, which resulted in adding two components to the demonstration study. The first involved interacting with newly diagnosed

patients in the hospital to make sure they understood their diagnosis and how to access care once they left the hospital, and to answer their questions about treatment. The second included intensified efforts to find and counsel individuals who were lost to follow-up. The first effort proved effective, while the second did not (additional details can be found in Appendix 4). These changes demonstrated how the consortium model can help ensure ongoing relevance of an intervention while being studied, by responding to local needs and priorities. The Consortium's ability to be flexible and responsive enabled the translation of knowledge into practice, which is often missing from more traditional research that is only driven by academics without the input and partnership of implementers, civil society, and policymakers. As one researcher stated:

> "One of the early preliminary findings from LINKEDin was that there was much higher initial loss to follow-up amongst hospital patients, which wasn't something we thought about when we started the project. So, we thought about how we could address that. We implemented this very simple practical solution of finding the patients in hospital and communicating with them, making sure that they understood the importance of linking, that they knew where to link and we updated their contact details. We just really wanted to see if it was feasible, and it was, and the amount of time it took, so that whoever was discharging that patient, the health care professional could do what we did. That whole small intervention was as a result of [discussing the] preliminary findings with the provincial working group of the Consortium to determine how to address this challenge." (2.15)

Another strength of the Consortium's role in knowledge translation was that it helped to quickly carry out the demonstration studies in three high-burden provinces. The two demonstration studies began in 2018, with TUTT beginning in March and LINKEDin beginning in October. The studies were conducted in three provinces and included 62 facilities for TUTT and 6 subdistricts for LINKEDin. Both benefited from being actively engaged with the Consortium's provincial working groups, which helped to facilitate approvals, site selection, and for TUTT, an exemption from to the standard testing protocol in the province to conduct the demonstration study. Both demonstration studies were completed relatively quickly and benefited from strong support from the provincial DOH and other stakeholders in the Consortium. The large scale and wide geographic spread of the demonstration studies across diverse settings in the three provinces provided a stronger evidence base for TUTT. This was made possible by the Consortium's approach to leveraging members situated in the province to help carry out the studies. Two of the three provinces subsequently led the way in implementing the successful interventions, even doing so ahead of national policy (in the case of TUTT in Kwazulu-Natal).

The timing was also fortuitous because the national DOH was in the process of strategizing how to accelerate progress on TB outcomes after care was disrupted during the COVID-19 pandemic. This led to the subsequent inclusion of TUTT and LINKEDin in the TB National Recovery Plan, and the inclusion of TUTT in the national DOH's updated TB Screening and Testing Standard Operating Procedure (51,82). Overall, the Consortium was successful in facilitating timely, relevant, and strong evidence on the two interventions, as one implementing partner stated:

> "If there are multiple organizations working together, you bring additional resources to the table, you bring additional experience and insights and you're able to then engage more broadly. You can potentially make things too big and unwieldy, and then you can't get alignment and don't move forward. But I think if it's well organized and you have all the right stakeholders, you have a better chance of being able to advocate for change, when change is appropriate." (2.9)

Broad and targeted dissemination of results: The Consortium facilitated knowledge translation through its role in disseminating the results of the demonstration studies of the two interventions. An assumption of the Consortium was that leveraging the skills, resources, and expertise of multiple research institutions would strengthen the evidence by lending it more weight and credibility. Multiple participants mentioned this as an example of how the Consortium facilitated knowledge translation.

> "If I think about the DISRUPT consortium, perhaps in relation to some other studies, is that being part of a bigger group definitely amplifies the voice that you have and it kind of lends more weight to the research that you're doing, because it's part of something bigger and there's more buy-in, perhaps. I mean certainly we had a number of recognized investigators who were playing a role. They may have been the PIs [principal investigators] for the different studies, but by being part of the consortium it meant that instead of there being just one respected investigator there were three and it lends weight to what you're doing. And the engagement with government and with all those other stakeholders lends weight to what you're doing and makes it easier to a degree to implement change. You got the right people involved and you can make a bigger difference." (2.9)

Additionally, it was helpful to have the provincial DOH representatives stand behind the evidence generated by the Consortium, as they could share the findings in forums where researchers were not invited, such as the National Health Council and Minister and Members of Executive Council (MINMEC) meetings. Disseminating the findings through presentations was critical, since the process of publishing in peer-reviewed journals is lengthy and can take one to two years. The researchers and other Consortium members presented and discussed the findings at several global and national conferences. The Consortium intentionally linked its work to the TB Think Tank and had overlapping membership. This

relationship was crucial, given the TB Think Tank's role as a knowledge broker and its mandate to "advise and assist the [national] DOH on policy and guideline development"—in addition to its ongoing nature compared with the time-bound structure of the Consortium (83). Sharing the research findings with the TB Think Tank was especially critical for the TUTT intervention, since it required national-level policy changes to be adequately resourced and implemented widely. The TB Think Tank played an important role in developing the TUTT policy and revising the screening and testing algorithm based on the demonstration study findings. For the LINKEDin intervention, disseminating findings at the provincial level was more important, since the decision to adopt was a local one, and given that it was demonstrated to be effective in Western Cape and Kwazulu-Natal, but not in Gauteng (39).

> "The Think Tank did the recommendation eventually to the National Department of Health to implement TUTT based on the [study] results. The Consortium projects were presented at Think Tank meetings and also as part of webinars that the Think Tank has been running. There was good collaboration between the Think Tank and the DISRUPT [Consortium] to make results available, to disseminate the findings, and also to push for the interventions to be implemented as well." (3.10)

Building on the excitement and support from provincial DOH representatives who shared TUTT results in the MINMEC forum, the civil society representatives involved in the Consortium also played their part by advocating for the scale-up of TUTT. As one representative from civil society said:

> "We sent an advocacy letter to the Minister of Health to advocate, from civil society's point of view, we really are prioritizing scaling up TUTT, so we are very well aligned with the consortium that it's a priority." (2.18)

All the stakeholders engaged as part of the Consortium were effectively champions of the results. The Consortium facilitated the dissemination of research findings, especially for the TUTT study, throughout the knowledge translation process by reaching a larger audience with a strong set of champions than the study team could accomplish on its own.

Qualified successes of the Consortium as knowledge translation facilitator

The Consortium had some qualified successes in knowledge translation, where it partially succeeded in facilitating knowledge translation — sometimes for one intervention but not the other.

Ensuring feasibility of novel interventions: The Consortium's steering committee was committed to selecting interventions for study that would be feasible to scale up within the current constraints of the health system, though the results were mixed. The TUTT intervention leveraged existing tools and staff, and one of its perceived strengths was that it made incremental changes to existing protocol, which was appealing to policymakers and implementers. As one researcher said:

> "TUTT was building from an existing policy on screening high-risk groups. TUTT was trying to now test those people regardless of their symptoms, not just screen them when they come to facilities. Maybe that's why it was well-received, because we are always trying to find new ways of finding cases within South Africa. It just aligned so well with everything and with current policy." (3.11)

In contrast, the LINKEDin intervention relied on the integration of laboratory and clinical data to identify individuals who were not linked to care. The DOH had committed to integrating these databases across the country, but this did not materialize, affecting the demonstration studies and implementation in Gauteng and KwaZulu-Natal. The Consortium had not contemplated or planned for this risk, which limited its ability to expand the intervention to the national level.

In Western Cape, the provincial DOH had already prioritized the creation of an integrated data system, which included patient data from laboratories and all facilities. The LINKEDin intervention leveraged this integration to automate cross-checking to identify patients who had been diagnosed with TB but who were not on facility treatment registries. The study also helped identify and troubleshoot problems, so that a workable automated system would be in place to enable scaling in Western Cape by the end of the study. In the other two provinces, staff had to manually reconcile lists of individuals diagnosed with TB from weekly reports from the laboratories with the TB treatment registries. While a strength of the Consortium was its ability to conduct demonstration studies across different contexts in the three provinces, it was not successful in increasing the generalizability of the results of the LINKEDin study, since the technology infrastructure differed so greatly among the settings. The ramifications of this decision to proceed with the intervention, despite not fully meeting the criteria for selection, were seen later when the demonstration study showed mixed results and there was variability in uptake.

Implementation speed, fidelity, consistency, and sustainability: The Consortium's role in facilitating the implementation of the two interventions had mixed results that differed across provinces, potentially due to the variable levels of engagement with provincial and local DOH officials. In Kwazulu-Natal, a DOH official led the provincial working group and there was strong leadership support for the Consortium's work. In Western Cape, a researcher led the provincial working group, and in Gauteng, it was led by an implementing partner and ceased functioning early on. The LINKEDin intervention did not require any policy changes to be implemented at scale, so it simply continued in some of the districts where the demonstration study was conducted, especially in Western Cape. The ongoing engagement of provincial, district, and city DOH officials in the Western Cape provincial working group throughout the process meant that the LINKEDin intervention was integrated within routine processes from the outset. In Kwazulu-Natal, the DOH supported the ongoing intervention, and they attempted to keep it going. However, because the intervention required manually reconciling lists of TB patients in that setting, it faltered without the supplemental study staff in place. Additionally, the lack of centralized guidance from either the national or provincial DOH led to problems implementing the intervention due to insufficient training resources, change management, or implementation support. The researchers who led the LINKEDin study contributed to some initial trainings, but not enough attention was given to change management, training, development of standard operating procedures, and sharing of implementation lessons from the study. This lack of attention made it difficult to successfully support implementation efforts, especially in districts where the demonstration study was not conducted. As one DOH representative from Gauteng said:

> "The LINKEDin study identified the disconnect between people who are diagnosed in hospital and then need to start treatment in primary healthcare facilities, and we know that quite a large proportion of patients are diagnosed that way, about 30% in South Africa. In the LINKEDin study they used linkage officers in the hospitals to look through routine data and pick up patients who are identified and then look at tier.net to see if they attended primary health care and then use ward-based outreach teams to do tracking and tracing. It was a good model. But how do we think through how we can scale that up across the country? Do we have the resources to place those linkage officers in hospitals? What would be the responsibility of the TB coordinators in that district or sub-district?" (3.5)

Because of their strong engagement throughout the process, officials in Kwazulu-Natal implemented the TUTT intervention with an initial subset of high-risk groups even before the national

DOH released the standard operating procedures. This early uptake of both interventions shows the effectiveness of the Consortium as a knowledge translation facilitator, particularly in the province where it had a strong DOH representative in a leadership role. In the rest of the country, including Western Cape and Gauteng, the three-year delay between the end of the demonstration study and the start of implementation of the intervention at scale resulted in a loss of experience due to staff turnover. By the time implementation started, the provincial working groups of the Consortium had already disbanded. In South Africa, knowledge translation is often a lengthy process, and in this context three years is relatively short (84–86). However, since the Consortium ceased functioning during this time, valuable lessons were not captured. This represents a missed opportunity for the Consortium to support the implementation and scale-up of the successful intervention. It could have brought together key stakeholders—perhaps different individuals than were relevant for earlier stages of work—to strengthen implementation planning by drawing upon the collective experience of all involved in the demonstration study. As one DOH representative from Western Cape shared:

> "I think where it fell short was an over reliance on the representatives from the different authorities, as the sole conduit to engage with those authorities, and perhaps there wasn't enough support for further engagement with the whole health system beyond that. We gave presentations to the health management team meeting, but it was still theoretical, so I don't think it sufficiently paved the way for that next phase of being adopted once the operational research was completed. There was quite a lag between the completion of the studies and when it came out as national policy, like TUTT, which, we've only just seen provincial policy on. The transition is so high in terms of staff and even managers that actually we found there was still very little footprint on the ground that had survived from the operational research time, which we hoped would have helped to further embed it. It's almost like we've had to start TUTT from scratch. But at the time when we set up the consortium we thought we'd have a footprint that could then be built on when it did come through as national and provincial policy. So, I think that could have been a weak link and perhaps we needed more general communication along the way, with interim research outputs and briefings." (2.17)

Other participants mentioned that they had hoped the Consortium could have been leveraged during the implementation phases to help navigate the bureaucracy at the provincial level and generate demand for the new interventions among health care workers, patient advocates, and the public. Participants generally agreed that a strength of the Consortium was its ability to create a forum for ongoing interaction, which helped strengthen working relationships among the various members. However, some participants also noted the absence of key groups, which hindered the effectiveness of the Consortium as a facilitator of knowledge translation. Including policymakers, representatives from the

DOH, and health care workers at strategic points during the process would have further strengthened the Consortium's contribution to knowledge transfer. As a researcher from the Western Cape stated:

> "As for the other groups that weren't there, it's probably very important to include them, nothing gets implemented unless it's accepted by the actual healthcare workers and community partners and often there are insights that we might be missing that they can provide. We interviewed health care workers and there was probably input from various groups on each project. But they weren't really represented in the consortium, that was lacking." (2.14)

The Consortium was successful overall in providing a platform for engagement across stakeholder groups, including those from the provincial DOH. While this was a strategic decision, given that policymaking occurs at the national level in South Africa, the Consortium could have benefited from having national DOH representation in its membership or at least regular meetings with them throughout the process. Multiple participants noted this as an oversight. Similarly, while the Consortium's TOC included the process of implementing successful interventions in the scale phase, it was not designed for that purpose. The Consortium could have been more deliberate about planning for the implementation process, including ongoing coordination with and potentially transitioning activities to the TB Think Tank. The findings from the two case studies indicate that the Consortium had mixed results in its role to facilitate the translation of knowledge into practice, particularly in how it selected interventions and its involvement in the implementation of the two interventions.

Missed opportunities of the consortium as knowledge translation facilitator

The case studies of the two interventions also highlight two ways in which the Consortium might have further facilitated knowledge translation. The Consortium's founding documents set out a vision for the Consortium across three phases of the intervention lifecycle: demonstration, scale, and sustainability (30). Unfortunately, the Consortium ceased functioning after four years, because its funding was integrated with the demonstration study grants. The Consortium was therefore unable to fully contribute to the knowledge translation cycle for these interventions, because its involvement decreased during the implementation and scale-up phases, and was nonexistent to support the evaluation of sustainability of the interventions (7,87). Many participants expressed disappointment that the Consortium did not last longer. Some participants, many of whom were also members of the TB Think Tank, described the hand-off from the Consortium to the TB Think Tank as appropriate and well-timed for the scale phase. However,

some who were not directly involved in the TB Think Tank asserted that the role of the Consortium and the interaction between the two entities in the latter phases of knowledge translation was unclear. As one DOH representative from KwaZulu-Natal stated:

> "I feel [the Consortium] was something quite good. We didn't continue at the national or provincial levels after the results of those studies emerged. I feel we could have, but it takes a lot of time as well, but I feel it could still be useful." (4.3)

The second missed opportunity of the Consortium that emerged from interviews was that it approached the interventions separately rather than as interconnected. The interventions were selected to address gaps along the TB treatment cascade, strengthening the TB program from initial diagnosis all the way to treatment completion. After the interventions were selected, however, they were no longer discussed or approached as interrelated. Participants noted this lack of coherence between the three studies and interventions.

> "I don't see how the [the studies] actually worked together. [The Consortium meetings at the provincial level] didn't really look at synergies between the studies or synergies for the program in terms of taking the results forward. So I don't think they actually came together as three studies towards a single goal, but rather there were just three independent studies which happened to being discussed with the same people." (2.5)

Testing multiple interventions at the same time can complicate study design and analysis, but it could also provide value in exploring how the interventions interact and whether addressing multiple gaps at once improves TB treatment. These missed opportunities would not have been easy wins; they would have required additional financial resources to prolong the operations and augment the capacity of the Consortium. However, many participants were interested in continuing and expanding the work done by the Consortium because they were committed to making the most of the opportunity presented by the novel collaboration platform of the Consortium.

The study results indicate that the Consortium played a pivotal role in facilitating knowledge translation by fostering collaboration among researchers, policymakers, and implementers. By providing a structured forum for engagement and ongoing dialogue, the Consortium enhanced the quality, relevance, and dissemination of research findings. Although there were areas of mixed success and missed opportunities, the Consortium's work in bridging the gap between research and policy demonstrated the potential of such a model to expedite the uptake and implementation of evidence-based interventions.

Discussion

How the results from this study fit into the existing literature

The findings from our comparative case study of two interventions highlight how the Consortium facilitated knowledge translation and ways in which it could have been better leveraged. Comparing the findings with existing literature helped clarify how research consortia can best contribute to the knowledge translation process. We could not find any explicit mention of the role of research consortia in the existing literature on knowledge translation, and the limited literature on research consortia does not typically focus on knowledge translation. Interestingly, knowledge translation frameworks exist in the literature for policymakers and, separately, for academic researchers. The Consortium sought to unite these stakeholder groups, and others, to collaborate on a shared research agenda (3,30,85,88–90). However, it is useful to examine the successes and missed opportunities of the Consortium in the context of the existing literature.

The role of the research consortium may differ based on the context, membership, and type of research. For example, translating knowledge into practice for a systems-level intervention that requires policy change would be different for an intervention that requires a change in clinical practice, and the stakeholders, timelines, and evidence requirements will vary. For health system changes, values, political priorities, and the specific context play a greater role (90). Walt and Gilson's policy analysis triangle framework describes the key components of policymaking at the highest level with content, process, context, and actors playing critical roles (79,91). As a set of actors, a research consortium can be leveraged to affect the content and process aspects of policy, while accounting for the context in which new health policies are made, without directly changing that context. This includes the consortium identifying and prospectively tracking the potential windows of opportunity for informing policy decisions, as described in Kingdon's three-stream framework, when problems, policies, and politics align (92). Interdisciplinary research consortia, such as the one examined in this study, may also shape opportunities by contributing to defining the problems, identifying policies, and anticipating political conditions, such as changes in leadership that could lead to new policy decisions. Additionally, this case study underscores that a research consortium can be a facilitator of knowledge translation and is likely to be one of many actors in the process; for example, in this case, the TB Think Tank also played a critical role. The

Consortium played an important role early in the knowledge translation cycle by creating a shared research agenda and conducting the demonstration projects with input from a diverse set of engaged stakeholders. Meanwhile, the TB Think Tank was instrumental in the later stages of knowledge translation, crafting policies and standard operating procedures based on the evidence generated. Both roles were crucial for the success of the interventions, and the knowledge translation process could have been strengthened by establishing a regular schedule and guidelines for how the two structures should work together throughout the process.

The facilitating factors identified in this case study largely align with those identified in a systematic review by Innvaer et al (4), which explored health policymakers' perceptions on how they use evidence. The Consortium contributed to many factors that were identified in the review, including fostering personal connections between researchers and policymakers, ensuring the timeliness and relevance of research, enabling good quality research that included effectiveness data and that built upon existing policy, and generating community demand for the new interventions. These successes point to the strength of the contributions of a multidisciplinary research consortium to the knowledge translation process. Future research consortia could follow the example of how this Consortium facilitated knowledge translation at key points in the process, especially during the early phases. Facilitating ongoing engagement between researchers, implementers, and policymakers proved beneficial to strengthening the interventions, designing and implementing the demonstration studies, and leveraging respected and influential stakeholders to support widespread dissemination and use of the findings. To better facilitate knowledge translation, the Consortium could have more closely followed their principles for selecting interventions, while accounting for feasibility within the constraints of the health system. The literature further supports that incremental policy changes that build on existing policies or protocols are often easier to accomplish (4). This held true in this case study, where the TUTT intervention built on the existing protocol with evidence to support moving from screening high-risk groups to testing them.

In this study, we found that knowledge translation does not always include policymaking, nor does it necessarily stop with policymaking, which aligns with the knowledge to action framework developed by Graham et al, among others (7,93). Rather, research consortia should consider their role in implementation of an intervention at scale (in whatever way that is defined) and monitor implementation

to identify opportunities for improvement, new research, and ways to continue the knowledge translation cycle (93). As identified in this study, responsibilities of research consortia in the latter phases of knowledge translation can include monitoring and evaluating the implementation of a new intervention, contributing to training and change management efforts to support implementation, and ensuring that knowledge is maintained through additional inquiry into how the intervention adapts and evolves over time. Although it is not the only way to ensure that research is conducted collaboratively with health officials, implementers, and policymakers, this study illustrates that a research consortium can be a useful structure and forum for working together on research to facilitate knowledge translation.

Additional opportunities for research consortia

This case study highlights two missed opportunities for research consortia to facilitate the knowledge translation process: (1) not following the intervention all the way through the full knowledge translation lifecycle, and (2) focusing separately on individual interventions rather than identifying potential intersections and synergies between them. In addition to the opportunities specifically identified by participants, other opportunities for future research consortia emerged from the case study when comparing it to the knowledge translation literature.

Research consortia could support knowledge translation by providing resources to help research teams translate evidence into actionable summaries, issue briefs, and policy briefs (4). Evidence presented for policymakers has different needs than what is required for an academic presentation or journal article. Support could come from either a centralized resource provided through the Consortium or through a series of capacity-building workshops for the research teams. Oftentimes, research findings may be too nuanced, and frequently, demonstration studies of new interventions emphasize the effectiveness of the intervention (and what was done) without sufficiently explaining the context and how the intervention was implemented. The Consortium in this study emphasized the importance of including cost objectives and lessons learned from implementation in the demonstration studies. However, these were not the focus of the published articles, making it difficult to assess the extent to which these findings were shared with policymakers and implementers. Additionally, as has been noted as a challenge previously, staff turnover at all stakeholder organizations (academic, government, and implementing partners) leads to a loss of institutional memory. This results in stakeholders having to relearn lessons

and not leveraging the expertise developed during the demonstration study for the implementation at scale (78,94–97). A research consortium structure can mitigate these risks by documenting and institutionalizing lessons learned and providing a forum for trainings and briefings to bring newcomers up to speed. This could include documentation of lessons learned through the demonstration studies, in addition to the results of the effectiveness and costing studies, to support the scale-up of new interventions.

The reality is that academic researchers are not always equipped or incentivized to engage in processes to change policy and practice. The findings from this study underscore an observation made by the authors of a systematic review of advice to academics that "policy engagement is a career choice in which we seek opportunities for impact that may never arise, not an event in which an intense period of engagement produces results proportionate to effort" (3). Participation in a research consortium is not the only way to engage researchers in the knowledge translation process, but it may be one forum which provides visibility to all stakeholders into the efforts and contributions of others, which can improve shared ownership over the process. As Lomas stated:

> "Researchers tend to see decision making as an event—they deliver their edicts to the impenetrable cardinals' retreat and await the puff of smoke … Decision makers … tend to see research as a product they can purchase from the local knowledge store, but too often it is the wrong size, needs some assembly, is on back order, and comes from last year's fashion line. Neither side seems to recognize that the other is managing a complex process rather than presiding over an event or manufacturing a product" (98).

Participation in a research consortium can help make researchers' engagement in policy and practice changes a sustained one, with ongoing support and opportunities for interaction and collaboration between stakeholders.

Finally, in addition to identifying synergies between multiple interventions studied, a research consortium could consider including multilevel interventions and systems thinking into its approach. Bringing together different stakeholders from multiple areas of the health sector could be leveraged to explore interventions that address multiple levels of the health system as well as social determinants of health beyond the health system. Additionally, research consortia could explore the application of systems thinking to identify ways to optimize a health program and consider how to introduce multiple changes simultaneously (99,100).

Why Is This Research Important

Research consortia are becoming more prevalent in global public health and other sectors, as people recognize the inherent value of collaborative structures. For research consortia with the objective of knowledge translation, the findings from this study provide a starting point on how to prioritize resources and identify the most important aspects. For research consortia designed to generate knowledge, this study offers recommendations on how to expand the objective to achieve greater impact. Research consortia can take on several important facilitative roles in the knowledge translation process, especially if they are designed for this purpose.

Study limitations

This comparative case study does have limitations. These include (1) selection bias of the convenience sample of informants; (2) recall bias of interviews who were asked to remember experiences after several years; and (3) lack of validated data collection tools and analytical approach due to the dearth of existing literature. In addition, the findings are more generalizable to research consortia that share key characteristics with the one studied and less generalizable to those that differ in key ways. This study and its findings emphasize the need for additional research on the ways in which research consortia contribute to knowledge translation.

Conclusion

Research consortia can play a key facilitative role in the process of translating knowledge into practice. Optimizing a research consortium by aligning its strengths with the factors that facilitate knowledge translation can contribute to the speed, quality, and sustainability of testing and implementing new interventions. The findings from this comparative case study underscore the importance of a research consortium serving as a facilitator in bringing stakeholders together to carefully select interventions, generate timely and relevant research, create actionable summaries of results for decisionmakers, disseminate the findings broadly to key audiences, and ensure that implementation is fast, reliable, consistent, and sustainable. The lengthy and iterative nature of knowledge translation is an important consideration when setting up a research consortium in order to plan for how the consortium will contribute over time. As research consortia in implementation science become more common,

additional studies on their unique contributions to knowledge translation are needed. Future research consortia can build on this study to further strengthen the knowledge translation process, ensuring that research not only informs policy but also leads to sustained and meaningful improvements in health outcomes.

CHAPTER 5. CONCLUSION

This dissertation demonstrates the utility of applying case study methodology to explore the potential role for research consortia to contribute to knowledge translation through the lens of implementation science. The holistic examination of the South African DISRUPT TB Consortium provides insights into the strengths, challenges, and opportunities for research consortia going forward.

The findings from the first study, in which I developed an explicit TOC model for the Consortium and explored the operationalization and evolution of the model over time, shed light on what worked as intended and what did not. The Consortium's goal was to contribute to the reduction of TB incidence and mortality and its TOC spanned the phases of demonstration, scale, and sustainability, however, in practice, it focused primarily on the first phase to the detriment of the others. Developing an explicit TOC or similar model at the outset to agree upon key decisions, assumptions, and success metrics and then using the TOC to monitor progress over time may have supported the Consortium in achieving its goals. The findings also underscore the importance of not only early, but also ongoing meaningful engagement of key stakeholders and a reexamination of who the key stakeholders are at each phase.

The second study compared case studies of the three working groups, or subunits, within the multilevel research consortium to understand how the subunits functioned and managed challenges in the absence of explicit guidance on their expected contributions to the overarching research consortium. The findings highlighted successes and challenges across the subunits in terms of their responsibilities, structures, and ability to respond to shocks. The results of this comparative case study illustrate the importance of alignment of objectives, expectations, and structure across levels so that the subunits are set up to successfully contribute as intended. Documentation of the responsibilities of the subunits can support clarity and continuity, even with changes in membership or external circumstances. And while the provincial working groups regularly reported up to the steering committee on local study progress and challenges, the communication flow could have benefitted from being bidirectional, with additional oversight and monitoring of the subunits by the steering committee. A multilevel consortium can be a robust structure to facilitate knowledge translation, especially when attention is paid to the structural and procedural aspects from the outset and on an ongoing basis.

The third study looked across the case studies of the two interventions (TUTT and LINKEDin) that went on to some measure of scale following positive results in the demonstration studies to understand the Consortium's role in facilitating the knowledge translation process. The findings collectively demonstrate that research consortia are well suited to play a significant role in the knowledge translation process and highlight successes, qualified successes, and missed opportunities. By providing a structured forum for stakeholder engagement and ongoing dialogue, the Consortium enhanced the quality, relevance, and dissemination of research findings. In addition to those areas of strength, the Consortium could have potentially better supported the novel intervention through the full knowledge translation lifecycle (echoing the finding from the TOC examination in the first study) and could have further leveraged its work across the TB care cascade to identify potential intersections and synergies between the interventions. The literature in this space also point to the potential for research consortia to contribute to supporting academic researchers in engaging with policymaking through centralized resources (to translate research results into policy briefs, for example) or capacity building efforts. Taken together, these three studies on an implementation science-focused research consortium generate valuable insights for current and future consortia to consider when planning for, executing, and evaluating their role in knowledge translation.

This research comes at a critical time for the field of global public health when cuts to development aid have disrupted the structures and power dynamics that have shaped knowledge translation for decades. While devastating in many ways, there is the opportunity to examine how this moment in time can accelerate the decolonization of global public health efforts and shift the power dynamics for the better. Research consortia have the opportunity to contribute to this new chapter in global public health by acknowledging existing power differentials and creating a forum with equitable representation across stakeholder groups when setting the research agenda, conducting research on new interventions, supporting their scale and sustainability. Whether national in scope (as was the Consortium studied), regional, or international, research consortia could contribute through intentionality in their objectives, structures, governance, and membership (23,44). Additionally, in a time when resources are scarce for new public health research and interventions, the research consortia model could be beneficial in prioritizing a shared research agenda and leveraging the resources and

infrastructure of multiple institutions, thus using resources more efficiently. Research consortia could also consider further expanding their scope even beyond the health sector, as it is well-documented that health outcomes are largely driven by social determinants and risk factors (101–103). An expansion of scope and membership would naturally increase complexity, and thus deserves careful consideration, furthering the importance of a shared TOC (or other model) with well-documented expectations that can be monitored and evaluated over time.

Interestingly, as of this writing in 2025, a new iteration of the Consortium is active to support new research efforts related to adaptations of the TUTT intervention (new sampling method for diagnosis). Its existence points to the perceived value of the consortium model and a desire to continue its role in the knowledge translation lifecycle of the TUTT intervention and perhaps others as well. This new consortium (sometimes referred to as TUTT+, TUTT optimization, or DISRUPT 2) preserves some of the characteristics of the original, namely a steering committee with stakeholders from multiple groups represented. However, it does not employ provincial-level subunits, perhaps a reflection of the challenges and additional burden of coordination and logistics inherent in a multilevel structure.

While conducting background research for this dissertation on the landscape of research consortia, I found wide variation in terms of the public presence and acknowledgement of research consortia. The articles sharing results of research conducted as part of the Consortium do not reference the Consortium itself, nor did the Consortium have a website or materials on its role for the public. Future consortia could consider the role that external communications could play in advancing their goals and future research should seek to understand whether an external presence is beneficial to knowledge translation outcomes. The decision of how to balance the promotion of a consortium itself with the individual interventions and members' work requires careful consideration of the knowledge translation goals and the actors in the process. From my perspective this may have contributed to the short lifespan of the Consortium. The Consortium did not elevate its profile and was not widely known as an entity (compared to the TB Think Tank, for example, which has its own website) and the Consortium did not engage the National Department of Health regularly so officials in the position of funding it did not directly see its value-add, and as far as I know, the Consortium never requested funding/continuation support from the NDOH.

If time and resources are not limitations, multiple case studies should be pursued for future research for further opportunity for stronger analytical conclusions, as there would be from running multiple experiments, in the form of direct (cases of other consortia) and theoretical (counterfactual or comparator cases) replication (45). This dissertation was not without limitations, as described in each of the chapters. Future research on consortia function and role in knowledge translation could be strengthened by having multiple case studies to increase the probability of theoretical replication to strengthen the findings. The multiple cases could either be multiple research consortia or of interventions studied and slated for implementation outside of a consortium structure (as comparator for the case in Aim 3). This dissertation research relied on qualitative data, and a recommendation to strengthen future research would be to triangulate further with the incorporation of quantitative methods. This could be done by embedding the qualitative case study research in a larger mixed-methods study or conversely, inclusion of multiple or mixed methods within the case study itself. For example, a quantitative analysis comparing the speed of new intervention demonstration, policy uptake and implementation between those done within the Consortium and without would complement the “how” and “why” the Consortium works by demonstrating that it works to speed up the translation of evidence into practice. A recommendation to improve future internal and external validity is to have multiple case studies with which to do even more pattern-matching and build a stronger case for the causal linkages identified. Generally, future research on consortia and knowledge translation would be strengthened by a focus on outcomes in addition to outputs and building on the methods here to strengthen the case for important aspects of consortia for monitoring and evaluation.

Lastly, this dissertation has been both a professional and personal journey for me, strengthening my understanding of the use of models, frameworks, and methods to understand structures that are important to further implementation science and knowledge translation. My career in global public health will continue to focus on how tools and collaborations, such as research consortia, can improve the effectiveness and efficiency of knowledge translation.

REFERENCES

1. World Health Organization (WHO). Bridging the “Know–Do” Gap Meeting on Knowledge Translation in Global Health. Geneva: WHO; 2006.

2. Oliver K, Innvar S, Lorenc T, Woodman J, Thomas J. A systematic review of barriers to and facilitators of the use of evidence by policymakers. BMC Health Serv Res. 2014 Jan;14:2.

3. Oliver K, Cairney P. The dos and don’ts of influencing policy: a systematic review of advice to academics. Palgrave Commun. 2019 Feb;5(1):21.

4. Innvaer S, Vist G, Trommald M, Oxman A. Health policy-makers’ perceptions of their use of evidence: a systematic review. J Health Serv Res Policy. 2002 Oct;7(4):239–44.

5. Weiss CH, Bucuvalas MJ. Truth Tests and Utility Tests: Decision-Makers’ Frames of Reference for Social Science Research. Am Sociol Rev. 1980 Apr;45(2):302.

6. Straus SE, Tetroe J, Graham I. Defining knowledge translation. CMAJ. 2009 Aug;181(3–4):165–8.

7. Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, et al. Lost in knowledge translation: time for a map? J Contin Educ Health Prof. 2006;26(1):13–24.

8. Asamani JA, Nabyonga-Orem J. Knowledge translation in Africa: are the structures in place? Implement Sci Commun. 2020 Dec;1(1):111.

9. Welch V, Ueffing E, Tugwell P. Knowledge translation: an opportunity to reduce global health inequalities. J Int Dev. 2009 Nov;21(8):1066–82.

10. Dols JD, Muñoz LR, Martinez SS, Mathers N, Miller PS, Pomerleau TA, et al. Developing Policies and Protocols in the Age of Evidence-Based Practice. J Contin Educ Nurs. 2017 Feb;48(2):87–92.

11. Haines A, Kuruvilla S, Borchert M. Bridging the implementation gap between knowledge and action for health. Bull World Health Organ. 2004 Oct;82(10):724–31.

12. Newman K, DeForge R, Van Eerd D, Mok YW, Cornelissen E. A mixed methods examination of knowledge brokers and their use of theoretical frameworks and evaluative practices. Health Res Policy Syst. 2020 Mar;18(1):34.

13. Oxman AD, Lavis JN, Lewin S, Fretheim A. SUPPORT Tools for evidence-informed health Policymaking (STP) 1: what is evidence-informed policymaking? Health Res Policy Syst. 2009 Dec;7(Suppl 1):S1.

14. Green LW, Ottoson JM, García C, Hiatt RA. Diffusion theory and knowledge dissemination, utilization, and integration in public health. Annu Rev Public Health. 2009;30:151–74.

15. Tomlinson C (Frick M, editor). Tuberculosis Research Funding Trends, 2005–2022. New York (NY): Treatment Action Group; 2023 Dec.

16. WHO global lists of high burden countries for tuberculosis (TB), TB/HIV and multidrug/rifampicin-resistant TB (MDR/RR-TB), 2021–2025 [Internet]. Geneva: World Health Organization; 2021 [cited 2022 Aug 14]. Available from: https://cdn.who.int/media/docs/default-source/hq-tuberculosis/who_globalhbcliststb_2021-2025_backgrounddocument.pdf?sfvrsn=f6b854c2_9

17. World Health Organization. Global Tuberculosis Report 2023. World Health Organization; 2023.

18. WHO. TB profile: South Africa [Internet]. Global Tuberculosis Report 2024: South Africa Country Profile. 2021 [cited 2025 Apr 11]. Available from: https://worldhealthorg.shinyapps.io/tb_profiles/?_inputs_&entity_type=%22country%22&lan=%22EN%22&iso2=%22ZA%22

19. van der Walt M, Moyo S. The First National TB Prevalence Survey South Africa 2018 Short Report [Internet]. South African National Department of Health; 2021 Feb [cited 2022 Aug 15]. Available from: http://www.nicd.ac.za/wp-content/uploads/2021/02/TB-Prevalence-survey-report_A4_SA_TPS-Short_Feb-2021.pdf

20. Moyo S, Ismail F, Van der Walt M, Ismail N, Mkhondo N, Dlamini S, et al. Prevalence of bacteriologically confirmed pulmonary tuberculosis in South Africa, 2017-19: a multistage, cluster-based, cross-sectional survey. Lancet Infect Dis. 2022 Aug;22(8):1172–80.

21. Naidoo P, Theron G, Rangaka MX, Chihota VN, Vaughan L, Brey ZO, et al. The South African Tuberculosis Care Cascade: Estimated Losses and Methodological Challenges. J Infect Dis. 2017 Nov;216(Suppl 7):S702–13.

22. VanderZanden A, Langlois EV, Ghaffar A, Bitton A, Fifield J, Hirschhorn LR. It takes a community: a landscape analysis of global health research consortia. BMJ Glob Health. 2019 Aug;4(Suppl 8):e001450.

23. Pratt B, Hyder AA. Governance of transnational global health research consortia and health equity. Am J Bioeth. 2016 Oct;16(10):29–45.

24. Dockrell HM. Presidential address: the role of research networks in tackling major challenges in international health. Int Health. 2010 Sep;2(3):181–5.

25. Lepore W, Hall BL, Tandon R. The Knowledge for Change Consortium: a decolonising approach to international collaboration in capacity-building in community-based participatory research. Can J Dev Stud. 2021 Jul;42(3):347–70.

26. Kiparoglou V, Brown LA, McShane H, Channon KM, Shah SGS. A large National Institute for Health Research (NIHR) Biomedical Research Centre facilitates impactful cross-disciplinary and collaborative translational research publications and research collaboration networks: a bibliometric evaluation study. J Transl Med. 2021 Nov;19(1):483.

27. Adams J. Collaborations: The rise of research networks. Nature. 2012 Oct;490(7420):335–6.

28. Hohl SD, Knerr S, Gehlert S, Neuhouser ML, Beresford SAA, Unger JM, et al. Transdisciplinary research outcomes based on the Transdisciplinary Research on Energetics and Cancer II initiative experience. Res Eval. 2021 Jan;30:39–50.

29. Rigby J, Edler J. Peering inside research networks: Some observations on the effect of the intensity of collaboration on the variability of research quality. Res Policy. 2005 Aug;34(6):784–94.

30. DISRUPT TB Consortium. Demonstration, Scale, Sustainability Concept Note: Innovation to reduce gaps in the TB care cascade and accelerate the demonstration to scale process. 2018 Mar.

31. Mookherji S. From Pilot to Practice: Lessons on Scale, Institutionalization, and Sustainability from the (in-progress) journey of the SC4CCM Project. JSI; 2014 [cited 2021 Feb 7]. Available from: http://sc4ccm.jsi.com/wp-content/uploads/2016/07/Pilot-to-Practice-Brief.pdf

32. Simmons R, Fajans P. Beginning with the end in mind: planning pilot projects and other programmatic research for successful scaling up [Internet]. World Health Organization; 2011 [cited 2021 Feb 5]. Available from: https://expandnet.net/tools/

33. Ruth Simmons CF, Fajans P, Ghiron L, (editors). Scaling up health service delivery: from pilot innovations to policies and programmes, WHO & EPANDNET, 2007, 183 pp. ISBN: 9789241563512. Int J Health Plann Manage. 2009 Oct;24(4):366–7.

34. Remme JHF, Adam T, Becerra-Posada F, D'Arcangues C, Devlin M, Gardner C, et al. Defining research to improve health systems. PLoS Med. 2010 Nov;7(11):e1001000.

35. Milat A, Newson R, King L, Rissel C, Wolfenden L, Bauman A, et al. A guide to scaling up population health interventions. Public Health Res Pract. 2016 Jan;26(1).

36. DISRUPT TB Consortium. Memorandum of Understanding for Organisations Participating in the Consortium. 2017 Oct.

37. DISRUPT TB Consortium. Terms of Reference. 2017 Oct.

38. Martinson NA, Nonyane BA, Genade LP, Berhanu RH, Naidoo P, Brey Z, et al; TUTT Trial team. Evaluating systematic targeted universal testing for tuberculosis in primary care clinics of South Africa: A cluster-randomized trial (The TUTT Trial). PLoS Med. 2023 May;20(5):e1004237.

39. Meehan S-A, Hesseling AC, Boulle A, Chetty J, Connell L, Dlamini-Miti NJ, et al. Reducing Initial Loss to Follow-up Among People With Bacteriologically Confirmed Tuberculosis: LINKEDin, a Quasi-experimental Study in South Africa. Open Forum Infect Dis. 2024 Jan;11(1):ofad648.

40. Charalambous S, Maraba N, Jennings L, Rabothata I, Cogill D, Mukora R, et al. Treatment adherence and clinical outcomes amongst in people with drug-susceptible tuberculosis using medication monitor and differentiated care approach compared with standard of care in South Africa: a cluster randomized trial. EClinicalMedicine. 2024 Sep;75:102745.

41. Holbrook JA, Wixted B, Lewis BS, Cressman D. The Structure and Construction of Formal Research Networks: a Policy Oriented Understanding of Stakeholder Engagement [Internet]. Centre for Policy Research on Science and Technology; 2011 [cited 2020 Mar 27]. Available from: https://www.semanticscholar.org/paper/The-Structure-and-Construction-of-Formal-Research-a-Holbrook-Wixted/aad8e05497b0d0fc09bbe0564f805fda2b976a6d

42. Yin RK. Case Study Research and Applications: design and methods. 6th ed. Los Angeles: Sage Publications, Inc; 2018.

43. Morris ZS, Wooding S, Grant J. The answer is 17 years, what is the question: understanding time lags in translational research. J R Soc Med. 2011 Dec;104(12):510–20.

44. Pratt B, Allen KA, Hyder AA. Health Systems Research Consortia and the Promotion of Health Equity in Low and Middle-Income Countries. Dev World Bioeth. 2016 Dec;16(3):148–57.

45. Yin RK. Case Study Research and Applications: Design and Methods. 6th ed. Los Angeles: SAGE Publications, Inc; 2018.

46. What is Theory of Change? - Theory of Change Community [Internet]. [cited 2022 Jun 14]. Available from: https://www.theoryofchange.org/what-is-theory-of-change/

47. Describe the theory of change | Better Evaluation [Internet]. [cited 2022 Jun 14]. Available from: https://www.betterevaluation.org/en/managers_guide/step_2/describe_theory_of_change

48. Funnell SC, Rogers PJ. Purposeful Program Theory: Effective Use of Theories of Change and Logic Models. 1st ed. San Francisco (CA): Jossey-Bass; 2011.

49. Hsieh H-F, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res. 2005 Nov;15(9):1277–88.

50. Curran GM, Bauer M, Mittman B, Pyne JM, Stetler C. Effectiveness-implementation hybrid designs: combining elements of clinical effectiveness and implementation research to enhance public health impact. Med Care. 2012 Mar;50(3):217–26.

51. Republic of South Africa, Department of Health. National TB Recovery Plan for South Africa [Internet]. Republic of South Africa; 2022 May [cited 2024 Sep 2]. Available from: https://tbthinktank.org/wp-content/uploads/2022/09/TB-Recovery-Plan-for-South-Africa-version-7.pdf

52. Greene SM, Hart G, Wagner EH. Measuring and improving performance in multicenter research consortia. J Natl Cancer Inst Monogr. 2005;(35):26–32.

53. Jacobsen DI, Johnsen Å. Alignment of strategy and structure in local government. Public Money Manag. 2020 May;40(4):276–84.

54. Joshi MP, Kathuria R, Porth SJ. Alignment of strategic priorities and performance: an integration of operations and strategic management perspectives. J Oper Manag. 2003 May;21(3):353–69.

55. Koleros A, Mayne J. Using Actor-Based Theories Of Change to Conduct Robust Contribution Analysis in Complex Settings. Can J Program Eval. 2019 Mar;33(3):292-315.

56. Morrison M, Mourby M, Gowans H, Coy S, Kaye J. Governance of research consortia: challenges of implementing Responsible Research and Innovation within Europe. Life Sci Soc Policy. 2020 Nov;16(1):13.

57. Currie-Alder B, Cundill G, Scodanibbio L, Vincent K, Prakash A, Nathe N. Managing collaborative research: insights from a multi-consortium programme on climate adaptation across Africa and South Asia. Reg Environ Change. 2020 Dec;20(4):117.

58. Holtrop JS, Gurfinkel D, Nederveld A, Phimphasone-Brady P, Hosokawa P, Rubinson C, et al. Methods for capturing and analyzing adaptations: implications for implementation research. Implement Sci. 2022 Jul;17(1):51.

59. Moore G, Campbell M, Copeland L, Craig P, Movsisyan A, Hoddinott P, et al. Adapting interventions to new contexts-the ADAPT guidance. BMJ. 2021 Aug;374:n1679.

60. Pérez D, Van der Stuyft P, Zabala MC, Castro M, Lefèvre P. A modified theoretical framework to assess implementation fidelity of adaptive public health interventions. Implement Sci. 2016 Jul;11(1):91.

61. von Thiele Schwarz U, Aarons GA, Hasson H. The Value Equation: three complementary propositions for reconciling fidelity and adaptation in evidence-based practice implementation. BMC Health Serv Res. 2019 Nov;19(1):868.

62. Miller CJ, Barnett ML, Baumann AA, Gutner CA, Wiltsey-Stirman S. The FRAME-IS: a framework for documenting modifications to implementation strategies in healthcare. Implement Sci. 2021 Apr;16(1):36.

63. Wiltsey Stirman S, Baumann AA, Miller CJ. The FRAME: an expanded framework for reporting adaptations and modifications to evidence-based interventions. Implement Sci. 2019 Jun;14(1):58.

64. Ngozo J, Mbatha T. KZN Provincial Consortium Working Group on TB Terms of Reference. 2018 Sep.

65. TB DSS Consortium Working Group in the Western Cape Terms of Reference (ToR). 2018 Oct.

66. Langlois EV, Becerril Montekio V, Young T, Song K, Alcalde-Rabanal J, Tran N. Enhancing evidence informed policymaking in complex health systems: lessons from multi-site collaborative approaches. Health Res Policy Syst. 2016 Mar;14:20.

67. DuBow WM, Litzler E. The development and use of a theory of change to align programs and evaluation in a complex, national initiative. Am J Eval. 2018 Jul;40(2):109821401877813.

68. vom Brocke J, Lippe S. Managing collaborative research projects: a synthesis of project management literature and directives for future research. Int J Proj Manag. 2015 Jul;33(5):1022–39.

69. Liu C-C, Amin M, Overholt P, Thomas R, Sauer P, Talukdar S. How to organize research consortia [education/industry relations]. IEEE Power Eng Rev. 2002 Apr;22(4):44–7.

70. Hagen NA, Stiles CR, Biondo PD, Cummings GG, Fainsinger RL, Moulin DE, et al. Establishing a multicentre clinical research network: lessons learned. Curr Oncol. 2011 Oct;18(5):e243-9.

71. Pulford J, El Hajj T, Tancred T, Ding Y, Crossman S, Silvester L, et al. How international research consortia can strengthen organisations' research systems and promote a conducive environment and culture. BMJ Glob Health. 2023 Apr;8(4):e011419.

72. Olk P, Young C. Why members stay in or leave an R&D consortium: performance and conditions of membership as determinants of continuity. Strateg Manag J. 1997 Dec;18(11):855-77.

73. Wardenaar T, de Jong SPL, Hessels LK. Varieties of research coordination: a comparative analysis of two strategic research consortia. Sci Public Policy. 2014 Dec;41(6):780–92.

74. Orton L, Lloyd-Williams F, Taylor-Robinson D, O'Flaherty M, Capewell S. The use of research evidence in public health decision making processes: systematic review. PLoS One. 2011 Jul;6(7):e21704.

75. Milat AJ, Bauman A, Redman S. Narrative review of models and success factors for scaling up public health interventions. Implement Sci. 2015 Aug;10:113.

76. Caplan N. The Two-Communities Theory and Knowledge Utilization. Am Behav Sci. 1979 Jan;22(3):459–70.

77. Weiss CH. The Many Meanings of Research Utilization. Public Adm Rev. 1979 Sep;39(5):426.

78. Shiffman J, Smith S. Generation of political priority for global health initiatives: a framework and case study of maternal mortality. Lancet. 2007 Oct 13;370(9595):1370–9.

79. Walt G, Gilson L. Reforming the health sector in developing countries: the central role of policy analysis. Health Policy Plan. 1994 Dec;9(4):353–70.

80. Lavis JN, Robertson D, Woodside JM, McLeod CB, Abelson J. Knowledge Transfer Study Group. How can research organizations more effectively transfer research knowledge to decision makers? Milbank Q. 2003;81(2):221–48, 171-2.

81. Stetler CB. Updating the Stetler Model of research utilization to facilitate evidence-based practice. Nurs Outlook. 2001 Nov-Dec;49(6):272–9.

82. Mvusi L. TB Screening and Testing Standard Operating Procedures [Internet]. South Africa: National Department of Health; 2022 Jun [cited 2025 Mar 9]. Available from: https://www.nicd.ac.za/wp-content/uploads/2023/10/TB-SCREENING-AND-TESTING-SOP-2022.pdf

83. TB Think Tank - A national network of TB experts [Internet]. [cited 2025 Mar 6]. Available from: https://tbthinktank.org/

84. Blaauw D, Ditlopo P, Rispel LC. Nursing education reform in South Africa--lessons from a policy analysis study. Glob Health Action. 2014 Dec;7:26401.

85. Daniels K, Lewin S, Practice Policy Group. Translating research into maternal health care policy: a qualitative case study of the use of evidence in policies for the treatment of eclampsia and pre-eclampsia in South Africa. Health Res Policy Syst. 2008 Dec;6:12.

86. Thomas S, Gilson L. Actor management in the development of health financing reform: health insurance in South Africa, 1994-1999. Health Policy Plan. 2004 Sep;19(5):279–91.

87. Kothari A, Wathen CN. A critical second look at integrated knowledge translation. Health Policy. 2013 Feb;109(2):187–91.

88. Uzochukwu B, Onwujekwe O, Mbachu C, Okwuosa C, Etiaba E, Nyström ME, et al. The challenge of bridging the gap between researchers and policy makers: experiences of a Health Policy Research Group in engaging policy makers to support evidence informed policy making in Nigeria. Global Health. 2016 Nov;12(1):67.

89. Nabyonga-Orem J, Mijumbi R. Evidence for informing health policy development in Low-income Countries (LICs): perspectives of policy actors in Uganda. Int J Health Policy Manag. 2015 Mar;4(5):285–93.

90. Cairney P, Oliver K. Evidence-based policymaking is not like evidence-based medicine, so how far should you go to bridge the divide between evidence and policy? Health Res Policy Syst. 2017 Apr;15(1):35.

91. O'Brien GL, Sinnott S-J, Walshe V, Mulcahy M, Byrne S. Health policy triangle framework: Narrative review of the recent literature. Health Policy OPEN. 2020 Dec;1:100016.

92. Kingdon JW. The policy window, and joining the streams. Agendas, alternatives, and public policies. 2nd ed. HarperCollins College Publishers; 1995. p. 172–89.

93. Field B, Booth A, Ilott I, Gerrish K. Using the Knowledge to Action Framework in practice: A citation analysis and systematic review. Implement Sci. 2014 Nov;9:172.

94. Ongolo-Zogo P, Lavis JN, Tomson G, Sewankambo NK. Assessing the influence of knowledge translation platforms on health system policy processes to achieve the health millennium development goals in Cameroon and Uganda: a comparative case study. Health Policy Plan. 2018 May;33(4):539–54.

95. Heaton J, Day J, Britten N. Collaborative research and the co-production of knowledge for practice: an illustrative case study. Implement Sci. 2016 Feb;11:20.

96. Hobday K, Hulme J, Prata N, Wate PZ, Belton S, Homer C. Scaling up misoprostol to prevent postpartum hemorrhage at home births in Mozambique: A case study applying the expandnet/who framework. Glob Health Sci Pract. 2019 Mar;7(1):66–86.

97. Woelk G, Daniels K, Cliff J, Lewin S, Sevene E, Fernandes B, et al. Translating research into policy: lessons learned from eclampsia treatment and malaria control in three southern African countries. Health Res Policy Syst. 2009 Dec;7:31.

98. Lomas J. The in-between world of knowledge brokering. BMJ. 2007 Jan;334(7585):129–32.

99. Atun R. Health systems, systems thinking and innovation. Health Policy Plan. 2012 Oct;27 Suppl 4:iv4-8.

100. Paina L, Peters DH. Understanding pathways for scaling up health services through the lens of complex adaptive systems. Health Policy Plan. 2012 Aug;27(5):365–73.

101. Grange JM, Gandy M, Farmer P, Zumla A. Historical declines in tuberculosis: nature, nurture and the biosocial model. Int J Tuberc Lung Dis. 2001 Mar;5(3):208–12.

102. Emmons KM, Chambers DA. Policy Implementation Science - An Unexplored Strategy to Address Social Determinants of Health. Ethn Dis. 2021 Jan;31(1):133–8.

103. WHO. Social determinants of health [Internet]. [cited 2022 Sep 2]. Available from: https://www.who.int/health-topics/social-determinants-of-health

104. Esmail H, Lai RP, Lesosky M, Wilkinson KA, Graham CM, Horswell S, et al. Complement pathway gene activation and rising circulating immune complexes characterize early disease in HIV-associated tuberculosis. Proc Natl Acad Sci USA. 2018 Jan;115(5):E964–73.

105. Martinson NA, Nonyane BA, Genade LP, Berhanu RH, Naidoo P, Brey Z, et al. A cluster randomized trial of systematic targeted universal testing for tuberculosis in primary care clinics of South Africa (the TUTT study). SSRN Journal. 2022.

106. Marx FM, Meehan SA, Jivan D, Dunbar R, Hoddinott G, Hesseling AC, et al. Use of interactive messaging to reduce pre-diagnosis loss to follow-up for TB care. Int J Tuberc Lung Dis. 2022 Jan;26(1):26–32.

107. Osman M, Meehan S-A, von Delft A, Du Preez K, Dunbar R, Marx FM, et al. Early mortality in tuberculosis patients initially lost to follow up following diagnosis in provincial hospitals and primary health care facilities in Western Cape, South Africa. PLoS One. 2021 Jun;16(6):e0252084.

108. Viljoen L, Hendricks P, Hoddinott G, Vanqa N, Osman M, Hesseling AC, et al. Early interactions with newly diagnosed TB patients in hospital can support linkage to care. Public Health Action. 2022 Sep;12(3):121–7.

109. Vanqa N, Hoddinott G, Mbenyana B, Osman M, Meehan S-A. Linkage to TB care: A qualitative study to understand linkage from the patients' perspective in the Western Cape Province, South Africa. PLoS One. 2021 Nov;16(11):e0260200.

APPENDIX 1. SEMI-STRUCTURED INTERVIEW GUIDE (2020-2021)

Introduction: I know that the demonstration studies are in full swing, and we are looking forward to the results soon. You may be wondering why it is important to step back at this point and discuss the premise of the consortium. In order to be able to properly evaluate whether or not the consortium is working as intended, I need to explicitly define theory of change.

The goal of this interview is to understand your perspective of the theory of change of the DISRUPT TB Consortium. Through these interviews with the founding members of the consortium, I aim to clearly articulate how the consortium aims to achieve its stated goals, both how it was designed and conceived of initially as well as how you are thinking about it currently. I will start by asking you some questions about you yourself and your role – please remember that all information collected from you during this interview will be anonymized and aggregated and will not be attributed to you. You will have the opportunity to review the results of my interviews and the draft Theory of Change model that I develop based on these interviews. I will record our conversation for back up to make sure I capture what you are saying correctly and do not miss anything important you say. At any point during the interview, you can request that I turn off the recording function and I will do so. I will also be using the screen sharing function to have you respond to a document, so I'll have you confirm at that time that you can see my screen.

1. If you consent to participating in this interview and being recorded, please state your name, and say that you consent. Please describe your role and the capacity in which you have been involved with the DISRUPT TB Consortium.

Now I will ask you questions regarding the Theory of Change for the consortium. A theory of change model is a comprehensive description and illustration of how and why a desired change is expected to happen in a particular context. Let's talk through an if-then exercise about nutrition program to reinforce what a Theory of Change model is:

- Activity is a nutritional education program targeted at mothers.
- The assumption is that if mothers are educated about the importance of eating healthy food, they will be motivated to buy and prepare healthy food for their families.

- If mothers buy and prepare healthy food for their families, their children will have better nutritional status and health outcomes.
- If the children have better nutritional status, they will be able to excel at school.

With a TOC as an explicit statement as to how the activities of the consortium are intended to lead to the long-term goals, I will be able to conduct a better evaluation of the consortium and understand whether it is working as intended beyond simply measuring intermediate outputs. I want to understand the Theory of Change for the consortium better, so let's start with the activities in the consortium and then work our way forward.

I have brought up on the screen the original concept note for the consortium. I will read what the consortium originally proposed to do from the original concept note.

- Engage key stakeholders that can inform / support the demonstration to scale process
- Ensure strong alignment with DOH programme priorities
- Leverage the experience, areas of research interest, infrastructure (current research sites, current studies) of multiple research groups
- Facilitate simultaneous testing of innovation/s in multiple contexts and geographies
- Provide a critical mass of experience to accelerate the pathway from demonstration to scale-up
- Offer a mechanism to attract additional funding to test and scale promising innovation

2. Look at activity X. If that happens, what will it lead to? And what needs to be true for X to lead to Y?
3. From your perspective, are these still the main activities of the consortium? Which are still current, and which have changed or shifted?
4. In your own words, can you please state the goal of the consortium?
5. What are the key activities (either from the list or others that come to mind) that are undertaken by the consortium in order to achieve this goal?
    a. [If a new activity], please describe the activity and how it contributes to the long-term goal.

Thank you for taking the time to speak with me. Any final thoughts before we end? Any questions? I will follow up with an email to see if you have additional thoughts after today. I will be sharing the draft theory of change model with the steering committee for review once developed and you will have the opportunity to review and give feedback. Thank you again for your time today.

APPENDIX 2. SEMI-STRUCTURED INTERVIEW GUIDE (2023-2024)

Introduction: The goal of this interview is to understand your perspectives on the work of the DISRUPT TB Consortium that was active from 2018-2022. There were three provincial working groups in Western Cape, Kwazulu-Natal, and Gauteng that functioned within the Consortium as a forum for collaboration between researchers, implementing partners, and TB Programme officials from the Department of Health in each province. As you may know, there were three interventions studied under the auspices of the consortium: Targeted Universal Testing for TB, referred to as TUTT; LINKEDin to reduce initial loss to follow-up; and TB-MATE to improve adherence to TB regimens.

I will ask you questions about your perspectives on the consortium as a whole, the provincial working groups, and the three interventions studied within the consortium. If there are any questions that you feel you cannot or do not want to answer, or if you have difficulty recalling any information, please just let me know and we will move to the next question. I will start by asking you some questions about you and your role – please remember that all information collected from you during this interview will be anonymized and aggregated and will not be attributed to you. I will record our conversation for back up to make sure I capture what you are saying correctly and do not miss anything important you say. At any point during the interview, you can request that I turn off the recording function and I will do so.

If you consent to participating in this interview and being recorded, **please state your name and say that you consent.**

Please describe your role and the capacity in which you have been involved with the TB Innovations Consortium (i.e., Consortium Steering Committee, Provincial Working Group, worked on a specific intervention/demonstration study, TB Think Tank Member, Department of Health official, etc.)

1. <u>General questions on the Consortium</u>

The stated goal of the Consortium was to implement robust demonstration studies that evaluate innovations to close gaps in the TB care cascade and accelerate the pathway to scale-up to impact on TB incidence and mortality.

- What activities or actions were undertaken by the consortium in order to achieve this goal? Please describe the activity and how it contributed to the long-term goal.

[*if they have a hard time thinking of activities, you may give these as suggestions]*

- *Engage key stakeholders that can inform / support the demonstration to scale process*
- *Ensure strong alignment with DOH programme priorities*
- *Leverages the experience, areas of research interest, infrastructure (current research sites, current studies) of multiple research groups*
- *Facilitate simultaneous testing of innovation/s in multiple contexts and geographies*
- *Provide a critical mass of experience to accelerate the pathway from demonstration to scale-up*
- *Offer a mechanism to attract additional funding to test and scale promising innovation*
- From your perspective, was the consortium successful in achieving this goal?
- In what ways did the consortium work well? In what ways did it fall short?

2. <u>Provincial working groups</u>

I'm interested in your perspective from participating in the TB Consortium provincial working group as well as to understand the impact of having been part of the consortium on your work.

- Please state which provincial working group of the consortium you participated in (Western Cape, Gauteng, Kwazulu-Natal).
- Please describe your role and the capacity in which you were involved with the provincial working group.

Now, I would like to ask you about your perspective on the function of the [Kwazulu-Natal/Gauteng/Western Cape] provincial working group. *[If the participant responded to the email questionnaire] Thank you for your responses to the email questionnaire sent out, based on your responses to that I primarily have clarifying and follow-up questions.*

- Did you have any expectations of the consortium working group before the inception?
    - What did you understand the goals of the consortium working group to be?
    - In your opinion, did the working group achieve its goal(s)?
    - In what ways did the working group function to achieve its goal(s)?
    - In your opinion, did the working group meet often enough to achieve its goal(s)?
    - Did the frequency/regularity of the meetings differ over time? If yes, why?

- I'd like to understand your perspective on the level of engagement and participation of stakeholders throughout the duration of the provincial working group. For each of the stakeholder groups below, I'll ask you about their participation during meetings and their level of engagement between meetings.
    - Research teams (PIs, study site coordinators, other staff)
    - DOH / TB Programme officials
    - Implementing partners
    - CSOs - Civil society organisations
    - Healthcare workers
- Were the right people in the room to be able to make decisions and commitments?
    - Did senior level participants send delegates or did they attend themselves?
- Meeting content
    - Who determined the agenda for the meetings?
    - In what way were the meetings useful?
- Communications
    - Were emails an effective medium for the working group between meetings?
    - How were they useful in advancing the work?
    - How did they hinder the work?
- Were there other functions of the provincial working group in support of the Consortium's goal? *[GOAL STATEMENT: The Consortium **aims** to **implement robust demonstration studies** that evaluate innovations to close gaps in the TB care cascade and **accelerate the pathway to scale-up** to impact on TB incidence and mortality.]*
    - *Were there other functions that the TB consortium played a role in? Besides what is presented in the goal statement?*
    - Have you been a part of other working groups? If yes, how did the TB Consortium working group differ?
- In your opinion, did the provincial working group function as intended at the outset? If yes, in what ways. If not or not really, why might that have been.

    - How did the COVID-19 pandemic affect the working group if at all?
- Were there other factors that contributed to the changes made in the function of the working group?
- Given your experience with other research studies that were run on their own and **not** done as part of a consortium, what is your perspective on how the consortium and working group impacted the conduct of the demonstration studies?
    - In your perspective, was it valuable to have conducted the demonstration study as part of the consortium? Why or why not?
    - Would you implement such a working group to support the current project/research you are working on?
    - What benefits would it bring to your current research/project?

3. Interventions studied

There were three interventions studied as part of the TB Innovations Consortium between 2018-2022. **Now, I would like to ask you questions to understand your perspective of how the demonstration studies were impacted as a result of being done as part of the Consortium.** I realize you may not be equally familiar with all three studies, feel free to respond based on your experience.

- How did the conduct of the demonstration study/ies differ by being done as part of a consortium?
    - Was this similar across all three demonstration studies?
- What was the impact/effect of the consortium on the subsequent implementation and scale of the tested interventions studied?
- How did the consortium work with other structures (TB Think Tank, State/Province/National level decision-makers) during the consideration and implementation of new interventions?

Were you involved with/are you familiar with the TUTT intervention or study? *[if no, skip to 5.]*

4. TUTT Intervention

The Targeted Universal Testing for TB (TUTT) intervention has been adopted into national policy and implementation has begun in some provinces. For this section, I'm going to ask you to compare the TUTT intervention and study process to others that you have been involved with or to imagine what would have been different if this study had been conducted outside the consortium.

- From your perspective, was there anything that differentiated the TUTT demonstration study from the other two intervention studies (LINKEDin and TB-MATE)?
- Can you talk me through the process that the TUTT intervention went through to be adopted as national policy and be implemented?
- What was the impact/effect of the consortium on the subsequent policy and implementation of TUTT?
    - Do you have a sense of whether this was similar or different for the LINKEDin and TB-MATE interventions?
- What contextual factors facilitated adoption and scale up of the TUTT intervention?
    - What barriers were there to the adoption and scale up of the TUTT intervention?
- Do you have additional reflections on the role that the consortium played in the conduct of the TUTT demonstration study or its pathway to adoption and scale-up?

Are you familiar with or involved in the newly formed consortium to support the TUTT intervention implementation and adaptations? *[if no, skip to 6.]*

5. <u>TUTT/DISRUPT 2 Consortium</u>

Thinking about the TUTT optimization Consortium, which has been established to support the implementation and testing of adaptations to the TUTT intervention – how has the organization and function of the TUTT+ Consortium been informed by the original TB Innovations Consortium? Consider the following aspects:

- Organizational structure and function
- Goals and focus of the consortium
- Membership and roles
- Frequency of meetings and communications
- What (if any) aspects of the original consortium have been carried into the TUTT+ Consortium?
    - What (if any) changes have been made?
- Are there any other ways in which the original experience with the consortium has influenced the ongoing work related to the TUTT intervention?

6. Conclusion

Thank you for taking the time to speak with me. Any final thoughts before we end? Any questions? Are there any documents or emails that you could share that would be relevant to this research? Any other individuals who we should reach out to participate in this research?

APPENDIX 3. PROVINCIAL WORKING GROUP CASE STUDIES

Gauteng Province

The experience with the DISRUPT TB Consortium's provincial working group (PWG) in Gauteng Province was the most challenging of the three PWGs. Accordingly, identifying and interviewing individuals who could contribute information to inform this case study was also challenging. Of the eight participants interviewed from Gauteng, only three participated in or had knowledge of the Gauteng PWG. We were unable to identify or contact other individuals because many had changed roles and organizations since 2020. In addition, we were unable to access any documentation, such as meeting minutes, for this PWG. The Gauteng PWG was coordinated by an implementing partner that co-led two of the demonstration studies in the province. The Gauteng PWG began meeting in the middle of 2019 with a small set of stakeholders, including the researchers and implementing partners involved in the demonstration studies and the provincial-level Department of Health (DOH) tuberculosis (TB) program officials. This membership was consistent with the TB Consortium's implicit theory of change (TOC). After several monthly meetings with this small group, and after the study sites in the province were selected, the PWG shifted to quarterly meetings and invited a much larger number of stakeholders, including TB focal points from the study sites (e.g., health facilities and hospitals), study staff, and DOH TB program officials from city, district, subdistrict, and provincial levels. This adaptation seemed to align with the spirit and intentions of the TOC to include relevant local stakeholders in an effort to increase engagement and buy-in for ultimate scale-up of the interventions; however, it does not seem that the appropriate individuals were included to make that happen. This challenge at the PWG level parallels a challenge reported at the level of the Consortium steering committee level, which reflects a misalignment between the TOC and the stakeholders who were ultimately included. As one researcher shared:

> "A provincial TB program manager [would be present to hear the] information, and then it still needed to go up the ranks, if let's say you're trying to get a written letter to say that you can access facilities or something like that, you'd still need to wait for them to engage with their boss, who might also need to be engaging with the district, the provincial chief director, or something like that, and you wouldn't have those people in the meeting." (3.11)

Another participant commented on the DOH representatives in the Gauteng PWG as follows:

> “They’re interested, they are very committed, but they are not the people who make decisions or think they can lead the way and forge the way.” (1.24)

The PWG held two quarterly meetings with the larger group, the first of which was dedicated to the research teams sharing the protocols for each study and receiving feedback from other stakeholders and discussing potential implementation challenges. In the second meeting, the research teams shared progress updates on the demonstration studies, followed by the study site coordinators, facility staff, and DOH officials sharing their feedback on how the studies were progressing. The agendas for these meetings were set by the PWG coordinator with sign-off from the DOH, but notably, participants could not recall who led the meetings. The meetings provided an opportunity for collective troubleshooting of issues as they arose and comparison of experiences between sites. As with the other two PWGs, most participants in Gauteng expressed that they found the PWG to be beneficial as a forum for troubleshooting and sharing experiences.

Only two quarterly meetings were held before the COVID-19 pandemic began – as across all three provinces, the pandemic disrupted health services, restricted in-person collaborations, and redirected human resources, all of which impacted the study timelines and the function of the PWG. Additionally in Gauteng, the PWG coordinator’s attention was pulled away from work for personal reasons for much of 2020 and the PWG suffered during that absence of leadership. There appeared to have been no contingency plan in place to handle this absence. In addition to these challenges, the DOH TB program experienced high staff turnover during this period. These challenges resulted in the Gauteng PWG effectively being discontinued after March 2020. As one participant noted:

> “There wasn’t enough firm structure to be resilient to individual champions leaving.” (3.1)

Even after the PWG ceased functioning, the study teams were able to complete the demonstration studies. Even with continued strong engagement from technical staff at the provincial DOH, it seems there was little to no engagement from higher-level officials. As with the beginning of the demonstration studies, there were also challenges at the conclusion of the studies, with one study being unable to validate the findings with the provincial DOH.

> “In Gauteng, the TB director and deputy director had been saying to me, ‘Where’s the data for Gauteng? What can we do to help you?’ They were very bought into the whole study, and it was disappointing for them too.” (3.1)

> "In Gauteng on the LINKEDin study, we had a terrible problem of DOH and city of Johannesburg freezing and not allowing us to validate data. So, for Gauteng we can't really make any conclusions and it took about two years of effort to finally get an acting Head of Department to agree and then he was meant to sign a release, and he never did. And you know, in that particular metropolitan [area] there were so many shifts of power and [individuals in interim roles]. So, in that sense, there was a failure at that level of buy-in by DOH." (3.1)

The TB Consortium's TOC emphasized the ongoing engagement of key stakeholders throughout the demonstration and scale phases, which the Gauteng PWG was unable to maintain. The Gauteng PWG was plagued with challenges related to continuity of personnel in roles, including the PWG coordinator and the DOH representatives. The disruptions caused by the COVID-19 pandemic were severe and unprecedented in terms of the impact on the health system, but without contingency planning for staff transitions within the TB Consortium and its subunits, the Gauteng PWG was unable to mitigate the associated risks. There is no evidence that any of the PWGs had contingency planning in place, but the Gauteng PWG faced the most severe consequences.

In summary, the Gauteng PWG did not function as envisioned and was unable to maintain alignment with a key aspect of the TB Consortium's TOC, which was ongoing stakeholder engagement. The discontinuation of PWG meetings, in addition to challenges related to lack of alignment with local DOH priorities, failure to engage the appropriate decision makers, and turnover of provincial and metropolitan DOH staff, contributed to the poor translation of evidence into practice. While it helped to initiate the demonstration studies in a collaborative fashion with all the stakeholder groups, the PWG could not sustain this level of engagement, nor could it sustain the engagement of critical stakeholders within the provincial DOH, especially with the prioritization of COVID-19 response. All three demonstration studies were completed in the Gauteng sites, but one study was not able to obtain approval from the DOH officials to validate the results, leading to a long delay in disseminating the results. Additionally, Gauteng did not lead in scaling up either of the two successful interventions (TUTT or LINKEDin), further suggesting that the PWG had limited success in contributing to the goal of the TB Consortium beyond facilitation of the demonstration studies.

KwaZulu-Natal Province

The KwaZulu-Natal PWG was largely perceived to be a highly functional PWG, led by a provincial DOH TB program official who was unanimously elected by the membership. The PWG initially met monthly starting in the middle of 2018 before shifting to quarterly meetings toward the end of 2018. The PWG had a defined terms of reference (TOR) that detailed the expectations and outcomes for the group, which seemed to be a helpful tool for operationalizing the TOC and ensuring that members were operating with a clear and shared set of expectations from the outset. We reviewed the TOR and minutes from two of the meetings to inform this case study. The meetings were scheduled to take place one to two weeks before the national-level TB Consortium meetings, so that the PWG coordinator would be prepared with updates from all the study sites and districts to report back to the steering committee. The initial meetings established working relationships between the various stakeholders, and issues that arose between meetings were addressed through emails and phone calls. The KwaZulu-Natal PWG had clear meeting agendas and minutes, similar to the Western Cape PWG. Several participants emphasized the value of regularly occurring PWG meetings, which were especially appreciated by DOH stakeholders, as the meetings were crucial for keeping all relevant stakeholders updated on the studies. The meetings served as a platform for feedback and problem-solving from the facility level up to the provincial level. Participants highlighted how the demonstration studies effectively integrated with DOH staff at the facility level, enabling them to work closely to ensure successful implementation. As one provincial DOH representative stated:

> "It was quite valuable, because [with] other studies, you find that the department is not that much involved. Even the meetings are not as robust as what was going on when we had this consortium work. Maybe they come when they introduce the study, and perhaps have another interim meeting to give feedback on progress, and then, lastly, share the results. But with the consortium we had these regular meetings which we were engaged and tracking the progress together." (4.4)

The PWG included strong participation from DOH representatives (from provincial, district, and municipal levels), senior-level health care workers from the study sites, and researchers. Interestingly, participants reflected that there was not as strong of engagement from implementing partners in KwaZulu-Natal. While senior-level officials in the provincial DOH were not involved regularly as part of the

PWG, they were informed at the outset, signed the TOR, and received a report at the end with the outcomes of the TB Consortium's work. As one researcher reflected:

> "If we raised an issue with KZN [KwaZulu-Natal], it was almost immediately resolved. Right at the beginning we realized that there was an issue with the testing protocol in KZN [that conflicted with our study protocol], so we raised it and we were given a go ahead from KZN Department of Health who then ensured that we could bypass the regional labs and go straight to the culture labs where they would split the specimen and do the Xpert and the culture." (3.2)

Aside from the coordinator, PWG members did not have expectations of how the PWG would function, and, for the most part, were pleasantly surprised at how useful the structure was. Researchers commented that the level of engagement from DOH for the demonstration studies was higher than they had experienced when conducting other research studies. The researchers found it to be a useful forum for two-way interactions between the study team and the DOH staff. The PWG meetings provided a forum to raise important operational questions and led to discussions about the feasibility of interventions and the practicalities of implementation issues that could be resolved. The high level of engagement and support from the DOH was seen as critical, with the department making time for meetings, assisting with project challenges, facilitating approvals, and sharing necessary data. The following two differentiators may have contributed to the KwaZulu-Natal PWG's success and continued alignment with the TB Consortium's TOC: (1) the coordinator of the KwaZulu-Natal PWG was a respected, well-placed representative of the provincial DOH, and 2) the PWG started with clear expectations and norms set out in the TOR. As one researcher commented:

> "It was really a partnership beyond what I expected. I think it was helpful to identify implementation challenges and to have people with experience, knowledge, and networks within the areas where the studies were being implemented come up with local solutions to address the challenges that were faced. They provided meaningful engagement to help move the project forward, as well as to extract from the [demonstration studies] to [contribute to] program strengthening." (4.2)

The KwaZulu-Natal PWG was perceived by all stakeholder groups – both those who were directly involved and those who observed from the outside – as being able to make decisions and act quickly. The meetings had a standing agenda, consisting of progress updates and discussion on the demonstration studies, and the PWG coordinator circulated the agendas before the meetings so that others could suggest topics for discussion. One DOH representative reflected on the effectiveness of the PWG as a decision-making forum, saying:

> "The turnaround time for decisions was quite good, maybe because it was a smaller group with the same goal, and it was streamlined and focused on the three studies. Unlike a big committee or big forum where we talk about anything and everything…here things were really well outlined, and it was easy to focus." (4.3)

The perception of the KwaZulu-Natal PWG as highly effective seems to be strongly linked to the perception of the PWG coordinator as a provincial DOH TB program official with the political will and authority to champion the work, make decisions, and resolve issues in a timely manner. As with the other PWGs, the coordinator was elected by the group, and the unanimous election of the DOH official in KwaZulu-Natal seemed fortuitous. The election process for coordinators of the PWGs is aligned with how the TB Consortium steering committee selected its chairperson and secretariat; however, it seems that the selection of a provincial DOH official as the coordinator would align with the TOC because it ensures more ownership over the process and outcomes. One participant found that the PWG was useful to an extent, but that some issues were better handled in smaller, or one-on-one, discussions.

Participants reported several challenges with the KwaZulu-Natal PWG. One researcher noted frustration around receiving input from the provincial DOH and other local stakeholders because they were beholden to the study protocol and responsible for executing the demonstration study. Additionally, from their perspective, the research teams shouldered a disproportionate amount of work, preparing reports for the PWG, presenting, and incorporating feedback. In contrast, most participants agreed that the PWG successfully operationalized the TB Consortium's TOC. As a researcher stated:

> "I learnt a lot. I learnt a lot about operationalizing some key questions that aim to address the gaps in the TB care cascade. The questions that were asked were very important and the operational challenges that impeded progress were also extremely real and spoke to the operational feasibility of much of the interventions. You have this idea that you want to fix the program, you go out and you test your idea, and then you get all these real-world challenges, and then you immediately start thinking, well, if these are the challenges, how feasible is this intervention that we are trying to implement? I found it extremely interesting, and it allowed or enabled critical thinking about solutions that could actually work and were implementable." (4.2)

With the onset of COVID-19, the shift to virtual meetings, and the reprioritization of focus, the PWG meetings in KwaZulu-Natal decreased in frequency. Participants reflected that the PWG did not serve as a forum for the dissemination of results, especially for the demonstration studies that finished later and whose findings might not have been disseminated thoroughly. Despite the lack of follow-through within the PWG structure, one of the interventions studied, LINKEDin, was championed for

implementation in KwaZulu-Natal in specific districts and is being implemented (as of 2024). KwaZulu-Natal also implemented the Targeted Universal Testing for TB (TUTT) intervention ahead of its rollout as national policy as part of quality improvement efforts based on the findings of the demonstration study. Overall, despite some unintended adaptations over time due to the repercussions of the COVID-19 pandemic, the KwaZulu-Natal PWG was generally successful at operationalizing the TB Consortium model of partnership at the local level to facilitate the strong implementation of the demonstration studies and build momentum for scale-up among key stakeholders. The leadership of the PWG by the provincial DOH representative and the setting of clear expectations at the outset in the TOR seem to be differentiators that laid the foundation for the PWG to contribute to the successful demonstration and scale-up phases of work in KwaZulu-Natal.

Western Cape Province

The Western Cape PWG was convened by a research institution and maintained strong function over time. Initially, the intention was to rotate coordination responsibilities among the three research institutions leading the demonstration studies in the province. However, a co-principal investigator from only one research institution continued in the coordinator role for the duration of the PWG. We identified the largest number of participants from the Western Cape PWG and reviewed documentation (meeting minutes) as an additional data source for this case study.

Meetings were initially held every one to three months starting in August 2018, with the first two meetings one month apart and the third meeting two months later. This frequency remained consistent until February 2020, after which the meetings shifted online due to the COVID-19 pandemic and became less frequent. The first online meeting was in June 2020, with the COVID-19 impact temporarily added to the agenda. After moving online, the frequency seemed to change to quarterly, ending with a final meeting in March 2021. Meeting agendas typically included presentations and feedback on the three studies, along with other agenda items such as discussions on TB messaging within the studies, national consortium updates, national research findings, and other planned TB research in the province. The meetings were used for discussion to troubleshoot problems, such as identifying a replacement facility for

a study site when the designated facility burned down and sharing lessons learned on the implementation of the studies.

While the Western Cape PWG coordinator noted that the environment of the PWG was not competitive, it did serve a function to keep the implementation of the demonstration studies moving on time. The PWG had an agreed upon TOR and it seems that clear expectations were set and followed through, with documentation of meetings and regular communications (i.e., sharing agendas and minutes). As the Western Cape PWG coordinator shared:

> "[We] level set that the [research teams] were expected to present every month and obviously you didn't want to come and present the same thing. You were kept on your toes and it kind of helps to push the projects gently along. The working group kept everybody going and up to date." (2.15)

The Western Cape PWG included representatives from research institutions, implementing partners, civil society, and DOH/government officials at the provincial, City of Cape Town, and district and sub-district levels. Although participants mentioned the majority of relevant stakeholders were present at the PWG meetings, it was noted that city officials attended most regularly, with provincial and district officials attending sometimes and other times sending delegates or not represented. Attendance started with 12 participants and peaked at 20 in 2019, just before the pandemic began. During the COVID-19 pandemic, meetings shifted online and attendance ranged from 16 to 19 participants. Participants had an overall positive view of the meeting coordination and utility, especially during the demonstration phase of work. However, as with the other PWGs, many participants reflected that it would have been beneficial for the PWG to continue meeting regularly throughout the dissemination and scale-up phase of work because it was a critical outcome of the TB Consortium's TOC.

> "Yes [the Provincial Working Group was successful] to a point, but there is still much work to be done. A lot of what was discussed is translating into policy which can be implemented now. It was groundbreaking and a success. It should be continued." (2.19)

The Western Cape PWG provided a collaborative space for planning, addressing gaps, and fostering integrative approaches to the demonstration studies. The PWG also facilitated smooth communication and access to government facilities when needed. There were implementation challenges due to the COVID-19 pandemic that affected the three studies differently, according to where they were in process. For the studies that finished earlier, the PWG facilitated the sharing of study findings and

learnings, but it disbanded before the third and final demonstration study was complete and was therefore not a platform for dissemination of the final results.

Participants noted that being part of the PWG and the TB Consortium amplified their work and lent more weight to their research, making it easier to implement their studies. Collaborating with multiple groups and organizations brought additional resources, experience, and insights, enabling broader engagement. For most participants, the presence of all relevant parties in one place streamlined information flow and allowed for cross-fertilization and learnings across the three studies and numerous study sites. However, not everyone agreed, as one researcher described:

> "I don't think there was a particular relevance to having the three [studies] together in a provincial working group. It was perhaps like a meeting of convenience, because there were three studies, and they were funded by similar funders, but they didn't really look at synergies between the studies or program in terms of taking the results forward. I don't think they actually came together as three studies towards a single goal. The platform was useful for each researcher to speak to the partners and the Department of Health, but I don't see that it was a platform that was used for the researchers to speak to each other." (2.5)

This sentiment may point to the need for more explicit expectation-setting at the outset of the PWG. Overall, most participants regarded the Western Cape PWG as a valuable entity and would use the working group model again if involved in similar multisite implementation research. Some also suggested that engaging within the province earlier in the process, to help shape the research design, would be a good use of the model. In general, the Western Cape PWG was a well-organized forum that provided a platform to share information, troubleshoot, and advance the implementation of the three demonstration studies across the province. The PWG also contributed to moderate success on the scale outcome as one of the interventions tested, LINKEDin, was championed for implementation in Western Cape and started rollout in 2024, even before TUTT began implementation.

APPENDIX 4. SUCCESSFUL INTERVENTION CASE STUDIES

Targeted Universal Testing for Tuberculosis

The Targeted Universal Testing for Tuberculosis (TUTT) demonstration study and intervention was led by principal investigator Dr. Neil Martinson, head of the Perinatal HIV Research Unit at the University of the Witwatersrand, in Gauteng Province. The intervention was developed based on emerging science from biomedical research at the time indicating that tuberculosis (TB) is not two distinct states (latent and active), but a continuum of disease states that can include a period of subclinical disease that was historically not diagnosed (104). The TUTT intervention as studied between 2018 and 2022 had two components: (1) testing all high-risk groups for TB using GeneXpert Ultra and mycobacteria growth indicator tube (MGIT) regardless of the presence of TB symptoms—including all HIV-infected individuals, those with a history of TB in the past 2 years, and those who had contact with adolescents or adults with TB in the past year; and (2) assessing the utility of an mHealth contact tracing application (38,105).

Intervention selection

The Consortium steering committee prioritized this intervention for study based on the estimates from Naidoo et al indicating that 18% of cases do not get diagnosed, and given the wide confidence intervals, this rate may be as high as 34% [(21)]. Additionally, the TUTT intervention leveraged existing tools (TB diagnostic tests) and facilities, which meant that it aligned with the Consortium's Theory of Change (TOC) in terms of selecting interventions for study that are feasible within the existing health system context.

Study design

The TUTT demonstration study benefited from stakeholder feedback on its design during the Consortium steering committee review. Notably, the requirement to consult with DOH stakeholders to determine whether the intervention was practical and relevant for study was recognized as an atypical but valuable feature. Additionally, input and expertise from other researchers informed the study design as intended in the Consortium's TOC, without it being a formal, high-stress peer review process.

> "Providing a structure and saying if you want to get this money you got to do it this way was very beneficial. Often times when I did other studies, I disregarded the requirement to include the public health system and disregarded the preliminary test of the public health people to say that if it was successful, [it would be feasible to] actually do. Also getting feedback from peers in a non-competitive environment was very important, indeed for the TUTT study we included people who had recently been diagnosed with TB as a risk group because of a presentation from another researcher showing modeling results that a large proportion of new patients with TB were patients who previously had TB." (3.2)

Demonstration study

The TUTT demonstration study was conducted in 62 facilities across three provinces (Western Cape, Kwazulu-Natal, and Gauteng). This broad geographic coverage was a key contributor of the consortium model, with the work in each province being led by a local institution, which was either another academic researcher or an implementing partner organization. The principal investigator of TUTT reflected that having implementing partners lead the studies at the provincial level was not ideal because the implementing partners were unfamiliar with the procedures for obtaining local study approvals. This was often because the individuals in the provincial Department of Health (DOH) were not the same as those they worked with on a regular basis. The TUTT demonstration study began in 2018 and ended in March 2020, due to the onset of the COVID-19 pandemic. Fortunately, it had already reached a sufficient number of diagnoses according to the power estimated and results could be analyzed. Ending the study at the beginning of the pandemic proved to be fortuitous for TUTT. While the other intervention study teams had to navigate setbacks, restrictions, and delays due to the pandemic, the TUTT study team could focus on analyzing the findings, which would then be ready for consideration for South Africa's National TB Recovery Plan.

The TUTT intervention required only minor adaptations across provinces and contexts, which made the results more generalizable. When the study team encountered a problem where their testing protocol, which required a specimen to be split for both Xpert testing and culture, conflicted with the standard protocol in Kwazulu-Natal, the DOH representative leading the provincial working group was able to obtain approval for the protocol to bypass the standard operating procedure. The Consortium platform for engaging with DOH stakeholders helped initiate and implement the demonstration.

Dissemination of results

TUTT also benefited from the Consortium model in terms of dissemination of the results. Since the findings were available early, they were fully disseminated through the provincial working groups and the steering committee. Additionally, at the same time the TUTT intervention was being studied, the TB Prevalence Survey in South Africa was underway. This study would ultimately find that a very high proportion (57.8%) of participants with TB did not report any symptoms at the time of the survey, and those who did experience one or more symptoms often delayed seeking care (19,20). These findings further reinforced the importance of an intervention such as TUTT for identifying more TB cases earlier. The Consortium also contributed to generating "surround sound" for the intervention, in terms of having multiple Consortium members who were not directly involved in the study speaking about it, sharing the positive results, and advocating for its uptake. Having provincial DOH representatives from the Consortium who were fully informed and supportive of TUTT ensured that it was a topic of discussion at the Ministerial and Member of the Executive Council Meetings (MINMEC), since no researchers or other external participants are invited to those meetings. Additionally, TUTT seemed to have benefited from ongoing support from provincial DOH in adopting the intervention.

> "[With the Consortium], you have people who immediately understand the study, in other meetings they attend, even if you are not present and they would represent the study in a positive light. And of course when it comes to the findings, I can just imagine someone in a province says this department of health wants us to do this damn TUTT what do you think, and then the person says 'I was involved I went to the meetings and I know this [study] and these are the results, I have a slide of the results I can show you.' And I can see that that sort of, I supposed "insider knowledge" would make a huge difference for the departments of health which are sometimes suspicious of novel research findings." (3.2)

Publication of the research findings was delayed due to the lengthy process of submitting and waiting for acceptance from journals before finally being published. However, the findings were actively shared through presentations at major conferences, webinars, and other meetings, ensuring that actions based on the findings were not necessarily delayed until the final publication date in 2023. When the principal investigator reflected on how TUTT compared to other studies he has conducted that yielded positive results, he said:

> "We also did another study with an interesting finding, and nobody knows about that study although it was published in a relatively decent journal. We did a home-based contact tracing household cluster randomized trial and essentially, we showed that if you

> give index patients a letter for each of their household contacts, it is as good as going to the household and testing everybody for TB and HIV and referring them on and starting IPT in the household. And no one [knows about it], if I talk about it, people look at me as if I'm crazy, saying 'of course household contact tracing is a good thing.' So, I think [the Consortium contributed to] a very different response to data." (3.2)

Informing policy

In early 2021, the TUTT findings were presented to the TB Think Tank, which is the entity tasked to "advise and assist the [national] DOH on policy and guideline development" [(83)]. The Think Tank played a crucial role in developing the TB Recovery Plans and the National Strategic Plan for TB, HIV, and STIs. From its inception, the Consortium intended to present the findings to the Think Tank, which was responsible for policy recommendations and policy development. However, participants observed that there was insufficient ongoing engagement with the TB Think Tank (and the national DOH) throughout the demonstration studies and the planning for later phases. The overlap in membership between the Consortium and the TB Think Tank was beneficial. However, with more deliberate planning for ongoing engagement and a clearer understanding of the transition and the potential role of the Consortium in later phases of knowledge translation, the rollout of interventions could have been more successful.

> "The Think Tank actually made the recommendation eventually to the National Department to implement TUTT based on the TUTT results. So there was quite good collaboration, I mean, at the Think Tank meetings these consortium projects were presented. They have also been presented as part of webinars that the Think Tank has been running, you know, like the digital technology one got results a bit later, so that one we presented as part of a webinar quite a lot later, not as part of the DISRUPT meetings. There was good collaboration between the Think Tank and the DISRUPT to make results available, to disseminate the findings, and also to push for the interventions to be implemented as well." (3.10)

Building on the excitement and support from the provincial DOH representatives who shared TUTT results in the MINMEC forum, the civil society organization involved in the Consortium also advocated for the scale-up of TUTT by leveraging their role.

> "We sent an advocacy later to the Minister of Health to advocate, from civil society's point of view, we really are prioritizing scaling up TUTT so we are very well aligned with the consortium that it's a priority." (2.18)

A perceived strength of the TUTT intervention was that it made incremental changes to existing protocol, which made it more appealing to policymakers and implementers.

> "TUTT was building from an existing policy on screening high-risk groups. TUTT was trying to now test those people regardless of their symptoms, not just screen them when they come to facilities. Maybe that's why it was well-received, because we are always trying to find new ways of finding cases within South Africa. It just aligned so well with everything and with current policy." (3.11)

Additionally, the timing was fortuitous because the national DOH was in the process of strategizing how to accelerate progress on TB outcomes after care was disrupted during the COVID-19 pandemic. This led to the timely inclusion, two years after the demonstration study concluded, of TUTT in the TB National Recovery Plan and the national DOH's updated TB Screening and Testing Standard Operating Procedure (SOP) (51,82).

Implementation

Once the TUTT intervention was incorporated into national policy, it was then implemented and rolled out at the provincial and local levels. Given the limited scope of this study, we were unable to assess whether or how it was implemented across all nine provinces in South Africa. Using Western Cape as an example, there was a full year between the publication of the national TB Screening and Testing SOP and the start of training for the provincial health system. KwaZulu-Natal, another province involved in the Consortium, began implementing TUTT locally without waiting for national directives. In a separate case study comparing the three provincial working groups within the Consortium, it was noted that the work in Kwazulu-Natal was championed by a provincial DOH official who was integral to the success of each phase of work. This example demonstrates the potential for a research consortium to act as a catalyst for the uptake of new interventions.

> "The KZN [Kwazulu-Natal] TB Director was fully on board with TUTT, so even with the early findings, she would go to facilities, show them the findings, engage with health workers. They created awareness super early about TUTT and that it is effective. I think her leadership is something that stood out. You can have a great pilot, and you can present it at a Consortium meeting, but if someone isn't a champion for TB, I don't know if it would make a difference." (2.18)

Although the three-year gap between the end of the demonstration study and the start of the intervention implemented at scale is shorter than other knowledge translation processes in South Africa, it still resulted in a loss of implementation experience due to staff turnover, and by the time implementation began, the provincial working groups of the Consortium had disbanded (84–86). Some participants felt they could have been helped by sharing lessons learned from the intervention during the demonstration

study, brainstorming ways to generate demand for testing, and supporting training of health care workers on protocol changes. One participant from a civil society organization suggested that the Consortium could have been leveraged to strategize for accelerated uptake at the provincial level.

> "I would have liked [the Consortium provincial working group] to have a discussion on how to overcome red tape that often happens at the provincial level. If at the national level, the recovery plan says we must do TUTT, but we're waiting for a province to have their own circular on TUTT, it can take 10 months. I would have liked that, but I don't know if that falls within the scope. But it has an impact, because now as an advocate, I was super excited when the TUTT policy was released. But, for example, in [one province], the circular isn't out yet, so health care workers aren't trained. We can't do community engagement because we can't create demand and then they go to the clinic, and it's not available. That is frustrating - because what good is the policy if there's unnecessary bureaucracy?" (2.18)

Ultimately, the Consortium seems to have facilitated the knowledge translation process of the TUTT intervention (Table 9) in multiple ways throughout its lifecycle, from conception to implementation. This success story, however, also highlights opportunities for research consortia to play a role in knowledge translation, especially in the later stages of implementation planning, training, and change management.

Table 9. Timeline of TUTT knowledge translation process

Date	Milestone
March 2019	TUTT study started enrollment
March 2020	TUTT study completed (stopped 6 months early due to COVID-19 pandemic restrictions)
February 2021	National TB Prevalence Survey results presented to TB Think Tank
April 2022	Included in the DOH National TB Recovery Plan (through March 2023)
June 2022	National DOH published TB Screening and Testing Standard Operating Procedures
June 2022	First manuscript submitted for publication (published May 2023)
March 2023	Implementation of TUTT in Western Cape endorsed as part of the Provincial TB Recovery Plan
July 2023	Training sessions start for TUTT in Western Cape

LINKEDin

The LINKEDin study was led by principal investigator Dr. Anneke Hesseling at the Desmond Tutu TB Centre at Stellenbosch University in Western Cape Province. This intervention encountered more challenges than TUTT from the outset. The intervention aimed to leverage the laboratory information

system to generate lists of individuals who tested positive for TB to spur initiation of treatment. These individuals have accessed health care services and have a laboratory-confirmed diagnosis of TB, but they have not been linked to a TB treatment facility for registration and initiation of treatment. The LINKEDin study evaluated the effect of two interventions to reduce initial loss to follow-up at hospital and primary health care facility levels: (1) a hospital-based recording system that linked people with TB to standard hospital management and referral processes, and (2) an alert and response patient management system at the primary health care level to reduce initial loss to follow-up among individuals diagnosed with TB. Initial loss to follow-up was defined as individuals diagnosed with TB (Xpert MTB/RIF positive) for whom there was no evidence of linkage to a public TB treatment facility for registration and treatment within 30 days of the date of diagnosis.

Intervention selection

The Consortium steering committee prioritized this intervention for study because, in 2017, an estimated 17% of individuals diagnosed with TB in South Africa had not started treatment (21). The Consortium steering committee rightfully prioritized initial loss to follow-up as a critical gap that required research on novel interventions to address it. However, the Consortium aimed to prioritize interventions that could be implemented in the context of the existing health system. While one province had the necessary data system infrastructure in place for LINKEDin as intended, the other two provinces were not well-equipped. The steering committee selected the intervention, but the national DOH's vision of a project that would improve data integration did not ultimately materialize. In Western Cape, the intervention leveraged the provincial health data center, which harmonizes all electronic patient data from all facilities and services across the province, to identify patients who had been diagnosed but had not yet started treatment. In Gauteng and Kwazulu-Natal, the intervention leveraged Xpert Alerts, weekly lists of people newly diagnosed with TB sent by the National Health Laboratory Service. These lists were reviewed by study staff and manually compared to TIER.NET, which houses the TB treatment register at the facility level, to identify individuals who were diagnosed but not linked to care within 30 days.

> "LINKEDin, I think, in retrospect may have been too complicated for its objective and I think that those complexities of the LINKEDin study [were] a disadvantage." (3.2)

This meant that the LINKEDin intervention was adapted across the three provinces according to the available data infrastructure, and the adaptations made in the two provinces without linked data systems rendered the intervention largely manual and human resource intensive.

Study design

The Consortium steering committee weighed in on the study design and protocol, ultimately strengthening it with peer reviews from other researchers as well as diverse perspectives from DOH representatives and implementing partners. The Consortium approach also led the LINKEDin study team to amend the study protocol in two ways based on discussions of interim findings with the other members and stakeholders within the Consortium. The amendments included adding an interaction with newly diagnosed patients before their discharge from a hospital in Western Cape. In this step, a member of the study team met with the newly diagnosed patient to ensure they understood their diagnosis, where and how to access care once they left the facility, and to answer questions about treatment. The second amendment to the protocol aimed to determine whether intensified efforts to find and counsel individuals who were lost to follow-up would lead to a greater reduction in initial loss to follow-up. This involved using study resources to augment the standard referral and follow-up system, including unlimited airtime and data to contact individuals by phone, and physically driving to their recorded addresses to locate them. Notably, the increased level of resources and effort to find those lost to follow-up did not lead to more individuals being linked to care. Neither the successful hospital-based interaction nor the unsuccessful intensified follow-up adaptations were adopted during the intervention. These amendments, however, demonstrated that the Consortium model can adapt to an intervention while it is being studied, in order to respond to local context and priorities.

Demonstration study

The LINKEDin demonstration study began in October 2018, with three months of baseline data collection and a 12-month intervention, ending in December 2020. In Western Cape, the LINKEDin study progressed smoothly from the start, given that the technical infrastructure was in place to identify patients who had been diagnosed with TB but not yet linked to care. There was strong engagement from the provincial, district, and City of Cape Town DOH officials, who reviewed the interim results and were engaged in amendments to the study protocol along the way (as described above).

The adaptation of the intervention across various contexts was an integral part of how the Consortium added value and was a crucial element of its TOC to improve the research translation process, but it did not contribute to the generalizability of the results. In Kwazulu-Natal, the LINKEDin intervention was much more manual for the reasons noted earlier, but the intervention demonstrated its effectiveness. In Gauteng, the intervention did not decrease initial loss to follow-up as it did in Western Cape and Kwazulu-Natal (39). The study team was unable to secure validation of the data from the provincial DOH, delaying finalization of the results. The challenges in Gauteng were likely due to a combination of factors, including high staff turnover in the DOH, absence of a champion, and the lack of linked data systems to support the intervention.

> "The LINKEDin intervention in Gauteng really struggled. They struggled to get the information from hospital clinics." (3.4)

Dissemination of results

The results of the LINKEDin demonstration study were presented to the TB Think Tank and disseminated, although not as widely as the TUTT findings, possibly because of the differentiated results by province. The results were disseminated before the publication of findings in peer-reviewed journals, with the findings on the primary study aims published in December 2023 and sub-aims published between 2021 and 2022 (39,106–109)]. The findings from LINKEDin informed the development of the National TB Recovery Plan, but the intervention was not specifically included (51). For better or worse, the LINKEDin intervention did not require national policy change in order to be implemented, so no further action was taken at the national level. Since the intervention was context-dependent, the relevance of the results varied by province and did not receive equal levels of national-level attention.

> "The results for LINKEDin and TB-MATE were not so positive, it wasn't like this is the solution. For LINKEDin, the solution only worked in one province. It was too cumbersome to easily implement in the other provinces where the systems were not working together." (4.1)

Implementation

In the Western Cape and Kwazulu-Natal districts where the demonstration studies took place, the intervention continued the study ended, with no delay in implementation. While this may seem ideal , without centralized guidance or directives (even at the provincial level) and the attention and resources that accompany them, implementation in other districts that had not been part of the demonstration study

was inconsistent. The study team was invited to share the study findings and train staff on the intervention in Western Cape and Kwazulu-Natal, but the Consortium model was not leveraged to guide the implementation or handle change management.

In Kwazulu-Natal, where a DOH champion supported implementation and sustainability of the LINKEDin intervention, the original sponsor of the Consortium provided funding to strengthen the data infrastructure.

> "They tried to set up a similar data center in KZN [Kwazulu-Natal] with additional funding from Gates. I think it's been stopped altogether. It wasn't something that they were able to get off the ground for a number of different reasons." (1.4)

Additionally, after the demonstration study staff left Kwazulu-Natal, the health system staff could not sustain the manual process of reviewing lists of diagnosed patients and comparing it with those on the TB treatment register, making the intervention unsustainable. Even in Western Cape, the formal adoption of the automated advanced data system took another two years, occurring in 2024.

Although an intervention that does not require national policy change may appear to have an easier knowledge translation pathway, that is not necessarily true. This case study demonstrates that a research consortium can play a crucial role in ensuring an intervention is suitable for its purpose and context, adapting it and the study protocol as needed, and supporting change management, training, and implementation of a novel intervention.