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Geographical, social, and political contexts of tuberculosis control and intervention, as reported by mid-level health managers in Uganda: 'The activity around town'

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Abstract

Training district-level health officers and other mid-level health system managers revealed multiple contextual factors across political, administrative, and social axes affecting tuberculosis (TB) and TB control in Uganda. Individual relationships between local health, political, and media leaders affect efforts to inform the public and provide services, yet greater administrative coordination between national-level logistics, implementing partner funding, and local needs is required. Social challenges to TB control include high population mobility, local industries, poverty with high-density living and social venues, and misinformation about TB. Capitalizing on implementation knowledge and sharing data can overcome social geographic challenges to TB-prevention planning through strategic healthcare capacity-building at the district level.

Keywords

Uganda; Tuberculosis; IPT; HIV; DHO; Management

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Contributors

JJP led qualitative data analysis and interpretation, literature search, and writing of the manuscript. GC, CC, and CSC contributed to the writing and review of the manuscript. EK, CC, MRK, DVH, and GC contributed to study design. CSC, CC, CA, FA, and DK contributed to data collection and interpretation, and writing of the manuscript. All authors had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Declaration of competing interest

We declare no competing interests.

1. Introduction

In Uganda, about 1.4 million people are living with HIV (PLHIV) (UNAIDS, 2022). Several large trials in the 1990s, including one in Uganda, showed that isoniazid preventive therapy (IPT) effectively prevents tuberculosis (TB) and that PLHIV could tolerate the drug regimen (Whalen et al., 1997). By looking only at mortality rates and individual-level rather than community-level recruitment in these studies, later researchers failed to consider additional benefits conveyed by IPT (Grant et al., 2010). Despite the proven efficacy of IPT to lower TB incidence in PLHIV by 40% and WHO guidelines to provide IPT for all PLHIV, uptake in Sub-Saharan Africa (SSA) remained low (Bucher et al., 1999; Mosimaneotsile et al., 2010; WHO, 2020; Wilkinson et al., 1998). While Botswana introduced country-wide IPT in 2004, overcoming provider reluctance to prescribe IPT for fear of increasing multi-drug resistant (MDR)-TB and concerns over drug toxicity in combination with antiretroviral therapy (ART), other countries in Southern and Eastern Africa have not followed suit (Mosimaneotsile et al., 2010). TB, thus, remains the top cause of death of PLHIV in SSA (Craddock, 2012; Gupta et al., 2015).

In Uganda, the 135 local District Health Officers (DHOs) are the highest-ranking health officials based in the field and outside the capital, Kampala. To scale up the provision of IPT among PLHIV in the context of Uganda's decentralized healthcare system, DHOs and their teams – the policy-implementation link between the Ministry of Health (MoH) and local community clinics – have needed strengthening. The SEARCH-IPT trial was designed to address underlying impediments to IPT uptake at the district level by spreading knowledge and data about IPT amongst DHOs and their teams by adapting messaging around prescribing additional pills to PLHIV who might object to an already challenging pill burden and by promoting accountability between DHOs and frontline workers despite geographic and infrastructural challenges (Kakande et al., 2022).

In 2019, while the SEARCH-IPT trial was ongoing, as part of a requirement for continued support by PEPFAR (United States President's Emergency Plan for AIDS Relief) Uganda launched a 100-day national IPT push (Kiggundu, 2019). The rollout of IPT during the 100-day push was about equal in SEARCH-IPT trial control and intervention districts, but the trial intervention districts showed greater sustainability in IPT provisioning after the 100-day push ended (Kakande et al., 2022). The following year, the trial was also affected by the nationwide COVID-19 lockdown of 2020, but higher rates of IPT initiation continued in the intervention groups (Kakande et al., 2022).

Though often overlooked in the literature, all study trials take place within a geographic and social context that can have profound effects on both intervention and control activities. Uganda is geographically diverse, with wetlands, forests, mountains, and lakeshore providing resources for industries spanning fishing and subsistence agriculture in the East to gold mining and commerce in the Southwest. Ethnic groups are geographically distributed despite widespread individual migration, with Bantu speakers in the eastern part of Uganda, such as the Soga, Gwere, Gisu, Nyore, and Samia; and in western Uganda the Toro, Nyoro, Kiga, Nyankore, Amba and Konjo. Nilotic speakers in the northeast of Uganda

are represented by Japhadhola, Kumam, Teso, Karamojong and Sebei. Across the Nilotic tribes, the Itesots and Karamojong are typically pastoralists having a nomadic lifestyle, while the other tribes (including eastern and western Bantu tribes) practice sedentary agriculture combining crop and animal rearing. Along Uganda's borders and rural areas, the population experiences high mobility and frequent migration due to the search for employment opportunities and the obligations of family ties (Camlin et al., 2019; King et al., 2021; Leonardi et al., 2021; Nyanzi et al., 2004; Schuyler et al., 2017). The range of occupations has sometimes had detrimental health effects on the population, ranging from infectious disease exposure to mercury poisoning, while the diverse terrain introduces challenges in ensuring equitable access to health services for all Ugandans (Omara et al., 2019; Serwajja and Mukwaya, 2020, 2021) The healthcare system is also often reliant on outside or implementing partners (IPs) for financial support (Whyte, 2016), Spiritual beliefs among the population include vigorous and expanding Pentecostal and Evangelical movements (Jenga, 2020; Loue and Bajunirwe, 2021; Mugisa, 2021) and both Christian and traditional beliefs in witchcraft (Leonardi et al., 2021; Solomon, 2020), any of which, being embedded in social networks, can influence people's health beliefs and behaviours. Such beliefs often cut across ethnic groups, with most holding a strong belief in ancestral spirits who are not only revered but are typically also the first point of contact for any need, whether socio-economic, conflict-, or health-related. Certain tribes believe every health condition has a moral cause beyond the biomedical condition (Buregyeya et al., 2011). Further, most tribal groups practice a communal sharing of meals and drinks, and alcohol is mainly consumed in groups through shared vessels. The Nilotics drink around one pot (malwa) while sharing a straw to draw the alcohol from it, while in western Uganda, the tendency is to drink from the same drinking calabash, passing it from one person to another (Buregyeya et al., 2011).

To better understand the broad context in which the SEARCH-IPT trial took place, this paper offers a high-level view of the barriers, facilitators, and contextual factors that influenced trial implementation. We examine what participants from both the control and intervention groups of the trial had to say about the social, political, and healthcare administration contexts in which the intervention was implemented, including the natural and built environments, national and subnational politics, human geography, and societal change. By 'human geography' and 'social geography,' we mean the relationships people and communities have with and across natural, built, and social environments. While some mention of the intervention effect is noted, the principal focus in this paper is a broad contextual overview of the human geography surrounding the trial intervention.

2. Methods

2.1. Intervention study context

The SEARCH-IPT trial launched in 2017 in three regions of Uganda: the Southwest, East, and East-Central Regions. The trial randomized 14 pair-matched, geographically adjacent clusters of districts (n = 82) in each region. Pair-matching criteria included region, number of adults in HIV care, urban vs rural similarity, and presence of a previous (between 2013 and 2017) SEARCH-study participant community. Cluster selection was chosen because the

intervention was delivered to groups of managers. Detailed methods, rationale, and main trial results have been published elsewhere (Kakande et al., 2022).

The package of interventions used in this trial was based on the PRECEDE model for behaviour change (Green, 1991), which posits that 'predisposing,' 'enabling,' and 'reinforcing' factors facilitate successful implementation of public health interventions. In this study, *predisposing and reinforcing factors* involved collaborative meetings with DHOs and District TB and Leprosy Supervisors (DTLSs) from each of the intervention districts, with meetings in the Southwest Region and combined meetings for the East and East-Central districts. These meetings occurred twice annually for three years (two years for Eastern districts due to the nationwide COVID-19 lockdown in 2020, with an additional meeting at 2–3 months during the beginning of the intervention), during which we conducted a total of four focus-group discussions (FGDs) with seven to 11 managers per FGD. At these meetings, facilitated by an Ugandan expert in TB and HIV, leaders from the pre-established district clusters met to discuss challenges in their districts with respect to TB care and evaluate longitudinal data provided by data dashboards. *Enabling factors* to strengthen the intervention included annual leadership and management skills training taught by international business consultants. A final enabling factor included a two-way mobile phone SMS system designed to ease communication between the DHOs, DTLSs, other members of district health teams, and frontline providers. A *reinforcing* factor was up-to-date data "dashboards" that provided feedback during collaborative meetings regarding quarterly IPT initiation, isoniazid (INH) stocks, and other TB control measures.

2.2. Participants and data collection

As part of the intervention evaluation, we conducted twelve in-depth, semi-structured interviews with key informants (KIIs) from control sites, either with DHOs or DTLSs, between February and August 2019 and September and December 2020. We compared these KIIs to results from the FGDs held in February 2019 and January 2020 with the intervention assigned DHOs and DTLSs, who had conveniently gathered to participate in the intervention activities. All were invited to the FGDs, but attendance was optional. KIIs lasted an average of 37 min, while FGDs lasted an average of 111 min. All KIIs participants were male; the FGDs had two female participants. This reflects the overall sex distribution among district leadership (Kakande et al., 2022). Most interviewees were middle-aged, with 1 younger participant in their 30s in each group. 2 participants, one in each group, were still relatively new to their position, having held it for less than two years. We did not conduct FGDs with control participants because we purposefully did not convene collaborative meetings in the control arm. Since the intervention was collectively performed, however, FGDs were appropriate for this group. The FGDs contained similar prompts to the KIIs (with the addition of some intervention-specific prompts) and followed a semi-structured format. Topics covered in both FGDs and KIIs included TB incidence and TB control efforts in the relevant district, patient perspectives on IPT, stakeholder engagement, resource acquisition and allocation, and clinical protocols. Perspectives on the intervention content and impact were discussed in the FGDs only. All participants provided written informed consent. Transportation reimbursement was provided for FGD participants; researchers travelled to KII office locations.

2.3. Data analysis

The KIIs and FGDs, which were conducted in English, were audio-recorded, transcribed verbatim, and then analyzed using a Rigorous and Accelerated Data Reduction (RADaR) technique to identify how participants felt about the national approach to IPT scale-up and their own district leadership skills (Watkins, 2017). Preliminary reduction uncovered thematic groups, which we divided into 'context,' 'structure,' and 'management.' This paper presents a deeper dive into sub-themes within the 'context' group: political actors and IPs, clinical-administrative observations, and social geography.

3. Results

Participants mentioned multiple co-existing background relations informing their local district conditions. These contexts can be loosely grouped around 1) the political sphere, which includes political influencers, IPs, and other stakeholders in the system; 2) local healthcare administrative processes (clinic protocols, resources, and logistics); and finally, 3) geography, architecture, and society. Mid-level health managers' descriptions of the influence of spiritual beliefs and stigma on patient perspectives and health behaviours, in addition to provider-patient cross-communication, form subsets of this social environment.

3.1. The political context and role of implementing partners

Within the immediate context of geography and society, several overlapping political networks operate, all of which informed the intervention rollout. These ongoing networks include both governmental actors at national and district levels and non-governmental implementing partners. They combine synergistically with local knowledge resources to create a healthcare system ecosystem, as articulated by two control district supervisors (DHOs and DTLSs):

> "Another motivator is working with implementing partners, the first one being government – our government leaders respond very fast, including our district leadership."
>
> DHO Control (Southwest)

> "We have the personalities, we have the political wing, we have technical people, and we have the multi-sectoral approaches, we cannot work in isolation. … We have three centers of authority, and one is knowledge, another one is finance, and another one is empowerment. … All are important."
>
> DHO Control (Southwest)

This synergistic alliance between politicians (authority), technocrats (expertise and implementation), and funding sources facilitates the interface between the healthcare system and the society it serves:

> **I:** What are other practices that you are doing to ensure that you prevent TB in East Region?
>
> **R:** The first one is that we do community sensitization on radio and even in the council (local government meetings). Secondly, we do trainings of Health workers

> under the support of [the implementing partner] in management of TB. The third one is that we are doing contact tracing."
>
> DHO Control (East Region)

Politicians provide venues for education, experts deliver the knowledge via radio and town hall, and the implementation partners support ongoing training for additional personnel, each providing a distinct channel for engaging the local 'lay' population. However, the influence of local political leaders can either help or hinder these outreach efforts, and not all DHOs have good relations with local political leaders. In contrast to one DHO who remarked that "The other motivation is that I have a team of politicians who don't so much interfere with my work, so I have a good relationship with them," another from the same region noted,

> "In this era of decentralization, we have got a lot of political interference and that is quite discouraging. You want to do things in a certain way, and without any reasonable reason somebody who doesn't even know what he is talking about wants you to do things just to suit his political interests. … it is a common problem we have with local governments."
>
> DHO Control (East Region)

The centre of authority in the district can sometimes overreach its area of competence and constrain the health sector to serve explicitly political or cosmetic ends at the expense of larger strategies serving the common good.

Implementing Partners.—Although one participant in the FGDs highlighted the complications that over-reliance on external funders presents, IPs … who may or may not be funders themselves … still play an ongoing role in the context of the Ugandan health care system and its ability to reach the people:

> "But we also have other facilities who are supported by the IPs. If we are to succeed, we need to move together as a team, look at our strengths as different partners, and basically work together to increase knowledge. We need to use the politicians; we need to use other players so that this information sinks into the people; it is taken up and is supported."
>
> DHO Intervention (Southwest)

Working in solidarity as a team to support population health requires an explicit acknowledgement of the complementary roles each actor brings to the table. Yet just as politicians may help or hinder implementation policies, the same can be said for IPs, since IPs do not always follow through:

> "When the IPs came they told us that they were supporting both HIV/AIDS and TB – but then the activities of TB were [the] least supported."
>
> DHO Control (East Region)

> "Since we are just facilitated by NGOs to carry out TB control activities … when the facilitation [financial support for TB control activities] is low, we don't reach many TB cases; but when it is fairly okay, we get many cases of TB."
>
> DTLS Control (East Central Region)

The IPs are not always the most upstream factor causing this lack of follow-through. IPs themselves sometimes depend on funding from their own donors. This means IP support for local programmes can unexpectedly dwindle, having downstream repercussions:

> "You know IPT is like a programme for IPs, and some have wound up. So, introducing and teaching staff new tools is a problem because I do not have transport means to reach out to all Health facilities. Even when the facilities have tools to use, getting reports also becomes hard. We still need funding to do support supervision and intensify screening for [IPT] eligibility, because in some facilities where they have low staff, they do not bother to screen to get eligible clients for IPT."
>
> DTLS Control (Southwest)

Lack of staff or resources for transferring responsibilities from IPs to local personnel once an IP has reached the end of its term explains some of these effects. Additionally, when funding dwindles or gets delayed, challenges with transport and training facilitation are not the only repercussions: sometimes frontline workers come to expect funding for integrating screenings as part of normal care. This, in turn, creates attitude challenges among local clinic staff during DTLS outreach:

> "Much as we have tried to sensitize the lower facilities, we still have a challenge with it because most people associate most of these diseases with money. And then the level of suspicion keeps going down because at some time there used to be some organization that supported TB before I came into the office of DTLS, and that aspect of money has made my work very difficult. Other programs: there is money. But TB: there is no money."
>
> DTLS Control (East-Central Region)

Lower-level personnel feel incorporating what used to be an IP's responsibility should come with increased compensation, even when the IPs were meant only to spearhead a refined standard of care. The instability of IP support led the intervention group to report learning to be 'scrappy' and creative, as one participant described with reference to the IPT intervention specifically:

> "Although we are complaining with facilitation, this has made us use the resources that we have …"
>
> – DTLS Intervention (East-Central Region)

That 'scrappiness' was generally only shown in the intervention districts, which had been both trained to communicate their needs differently to front-line providers and empowered to use their networks to collectively solve such challenges.

Other stakeholders.—Participants voiced disagreement over government efficacy. These disagreements were expressed in the context of deeply caring about and wanting to improve the system.

> "We are using the policy and guidelines, and those are two different things, and when you are guided, you follow what has been given, and it has worked. For me, I think as ministry and government, we are on the right track."
>
> DHO Control (Southwest)

> "The SEARCH IPT project came in to synergize the government efforts. But I personally realized that the system the government is pushing is a weak system. So after that mobilization, it was good – but we have kind of gone back to the past."
>
> DHO Intervention (Southwest)

This contradiction between being on the right track but with a tendency to slip back into the status quo means vertical (MoH to DHO) guidance is not enough; horizontal support is also needed. Because of the common desire to create a robust healthcare system, both control and intervention districts attempted to engage all stakeholders, including local peer (i.e., patient) educators, in their efforts and outreach:

> "We are involving all categories of people, including peer educators who are also living with HIV. Experience is the best teacher; that is why I was saying it is not for only health workers but for everyone. … Have you ever seen those drugs? They make you turn dark, the urine is red, so these people (peer educators) are the best, they should be our champions."
>
> DHO Control (Southwest)

> "From that [mini-collaboration] meeting, I remember there was an over-asking (sic; over-arching) need to engage various stakeholders at the district levels, especially when there is something new or something you really want to improve on, so there was demand for us to improve not only awareness but the general engagement of general stakeholders when we want to produce change."
>
> DHO Intervention (East-Central Region)

In addition to the channels which lead to and from the MoH and government, outward movement to peer educators and other stakeholders led to broader buy-in for changes the MoH wanted at the local level.

3.2. Clinical and administrative perspectives

When discussing the severity of TB in their region, district teams observed patients were not well-informed about TB partly due to stigma, which resulted in the desire to keep silent about something disquieting and partly because other factors help drive the spread of TB. While providers were forthcoming about the severity of TB in their districts, they reported a range of patient perspectives. Overall, the relationship of TB to HIV appears to be well known, but stigma continues to be associated with both diseases. Some patients migrate to avoid being stigmatized for having TB:

> "If I say that I am concentrating [TB screening] in one place, it means the others can be left out because we have migrations. You know TB is a stigmatized disease, just like HIV [was when it] began. So if you concentrate in one location, some people may relocate and in that case we have to do contact tracing."

DHO Control (Southwest)

TB-related stigma means that educating the populace has two effects which move in opposite directions: people initially become more aware of a stigmatized condition, leading to avoidance of care; then later, increased health literacy diminishes stigma. Hand-in-hand with stigma, an additional factor mentioned exclusively in the East concerned the association of TB with supernatural causes and spiritual cures:

> "The second challenge is on perception; sometimes when we are talking about conditions like TB and HIV which people previously believed were associated with witchcraft, we are only going to catch patients when they have already tried visiting spiritual witch doctors; in due process TB is spreading. So while the health education is continuing, we still have it as a challenge. So to me, getting behaviour to change is a gradual process."

DHO Control (East Region)

> "The other problem that we do have, there are so many mushrooming churches which preach nonsense. They tell people … we have found these people and put them on treatment, and they tell them to stop the treatment and pray because they will get all right. And in the process, they are creating for us a much bigger burden outside there. They take these patients … and a number of patients have died – I don't know whether I should call them shrines or whatever – because these people take them to their prayer houses and say they are praying, and people are dying."

DHO Control (East Region)

The lag time in health education means people engage with co-existing belief systems during the overlapping period before new medicines are adopted, while TB continues to spread or worsen. For those who opt for care, frontline providers noted challenges in initiating people on IPT due to pill burden, especially when prophylaxis is not well understood. Patients who already face a pill burden from HIV medications, often given together with Septrin, feel the addition of IPT is yet another medication for them to take for no apparent reason, and so they refuse:

> "The challenge that we have this side is what I have told you, convincing the patients to take the IPT; that is the report that I got. Because I was asking why we were not consuming what we have, and they told me that people just do not want to take it."

HC-IV Control (Southwest)

> "When we do not un-package well the benefits of IPT, the patients always assume we are after something else; we are adding them more medicines which are uncalled for. So you find patients with excuses of, for instance, saying; "let me first finish the medication I have been on before I can opt for IPT.""

DTLS Control (Southwest)

Thus, in terms of attracting people to the healthcare system, the challenge ultimately becomes one of persuasion. Persuasion, however, is difficult when the target population

is mobile, their work promotes the spread of infectious disease, and the terrain places people out of reach of clinics.

3.3. Geography and society

Participants reported that other drivers of TB severity in their region include the livelihoods and geography of the area. The geography of Southwest, East, and East-Central Uganda, and the resulting social contexts, differ. While all are predominantly rural, the eastern control groups, mostly situated around the regional crossroads of Mbale and several urban areas, presented one particular dynamic of movement and settlement:

> "Now the challenge is getting the TB contacts because it also depends on the location of both the district and where the patient is coming from. The districts near the lakes, most people there are immigrants, so you find that the primary person is coming from the landing site and tracing the contact becomes very difficult."
>
> DHO Intervention (East Region)

> "… [This city] is a regional hub. Many people from neighboring districts are always in [this city] and we diagnose TB [here] for even other districts, but within the region. – We have peri-urban areas and the housing is not good. Those kinds of places breed a lot of TB."
>
> DTLS Control (East Region)

When mobile persons arrive in an area, they go in search of employment, social contacts, or family – making contact tracing difficult. As a regional hub with varied opportunities for social activities, in fact, the area has attracted migrants and seen both increased population and poverty in recent years:

> "Staffing took place so many years ago, and you realize during that period of time, so many technologies have come on board. The number of people in the community have increased – that tallies with increased attendance numbers in the registers of the facilities – yet staff have not been increased."
>
> DHO Control (East Region)

> "Then, of course, the other thing is the poverty situation within the district. Families are actually very poor; sometimes they cannot afford food and when you get a patient and put them on [TB] treatment they need to eat well, but the family cannot afford to provide that person with the food that he or she should have had. So we end up with people defaulting, and of course, when they default they end up transmitting and spreading the disease."
>
> DHO Control (East Region)

As a solution, a control group participant suggested addressing food insecurity by increasing immediate household resources through building home gardens in the agricultural East:

> "Many of these TB patients default because they don't have food. If we could start a program of supplementary feeding for these TB patients. We actually one time used to make even gardens for these patients and I think that was quite a good

practice which I think we can still do. But we make the gardens in their homes, not in our facilities so that they are able to harvest whatever little they have."

DHO Control (East)

While migrants come in search of improved conditions, food insecurity, a risk factor for developing TB and for defaulting from care, can also increase. While some providers promote subsistence agriculture as a safety net, the growing population has increased crowding among the people, who continue to socialize or seek work at various venues:

I: You talked about the activity around town as being another factor contributing to the increase of TB cases in [this Eastern] district What did you mean?

P: … You have a bus park, a taxi park; you have a big market, you have betting places and people converge and they can easily catch TB in those areas. But also, if you can look at the slums around [this city] where people are drinking left and right and sitting in crowded areas."

DTLS Control (East Region)

"I want us to do some studies and one of the studies that should be done is mainly to do with our social habits and cultural practices. The habit of us sitting at a malwa pot (a local brew) and sharing a drinking straw. And then the habit of us getting into big crowds to dance during the circumcision seasons."

DHO Control (East)

These cultural practices are not confined strictly to the East; participants from the rural South mentioned similar gatherings. Thus, the built environment, including the living situation and principal professions in the Southwest, contribute to the spread of TB:

"These are actually gold miners here in [the Southwest] and this is where TB is more prevalent because they are kind of institutionalized where they are working and they spread the diseases among themselves. The kind of activities that they do are the ones that have actually led to the spread of TB – more so in HIV patients. Majority of the HIV patients come from those mines within [this town in the southwest]."

Health-Centre-IV Provider, Control (Southwest)

"Depending on the setup of the communities and also the structure of households, all these factors complement the spread of TB. For instance, the poor ventilation in people's houses as well as their social life – the way … those who drink gather together in one place while drinking, this also stimulates the spread of TB."

DTLS Control (Southwest)

A single silver bullet will not solve the challenge of TB transmission. In contrast to the East, however, the Southwest borders three other nations, which leads to a degree of mobility into and out of the district by people sometimes considered of questionable political or social standing (e.g., sex workers, black marketeers, drug and human traffickers, military from break-away groups in neighbouring countries):

> "We have border countries [viz Rwanda, Democratic Republic of Congo (DRC), and Tanzania] and you know that our borders are porous. People come – and most of them, I might not want to mention."
>
> DHO Control (Southwest)

> "For us here, most of our cases go outside the district and when their situation worsens, that is when they come back into the district. So we are not able to detect them early."
>
> Health-Centre-IV Provider, Control (Southwest)

People move for work, often to areas with increased healthcare infrastructure. When work is seasonal, people migrate, returning to the district's known health centres to seek care only once a disease, previously ignored, has worsened.

The movement also depends on transportation infrastructure. The quality of roads in the mountainous and hilly Southwest is an ongoing concern, as mentioned by several participants, who tied the construction of new roads to the power of community mobilization:

> "The improvement that we see for example if you see the tarmac road that is going to District 3, it is because of the outcry of the community, that road going to District 4, it is because of the outcry of the community. So for us we shall keep on saying that we have a gap here."
>
> DHO Intervention (Southwest)

The lack of tarmac roads means mobile populations rely on the more nimble bodaboda drivers, who can navigate rougher conditions between urban and rural areas. They can also be sources of health literacy, discussed below.

3.4. Intervention approaches to socio-geographic factors

Participants identified patient refusal of medication, patient mobility, and geographic barriers as potentially militating against the success of the intervention. While the intervention could not address building infrastructure nor change the livelihoods of the district population, several elements of the intervention did show success. Through the intervention, providers learned how to get patient buy-in:

> "… We also need to package our services. If we are not speaking the same language, I may have stock here and the other side they do not have, so we have to come together as a team to have key words to use, because different people use different brands. But we have to explain to the patients that this brand is not different from the other one and our clients will keep on coming."
>
> DHO Intervention (Southwest)

> "I always try to reflect on the gaps which we have been having. It has resulted in a kind of unisex [model] where there is training of health workers on external tuberculosis and contact tracing, which were not supported before. So we used it as an advocacy tool. Then also to understand our issues at a facility level … In every

quarter, we attend the regional performance meeting where we sit and look at our data and mainly focus on the research gaps."

DHO Intervention (East-Central Region)

Persuasive messaging was not the only takeaway. Recognizing the challenge of patient mobility between districts, the intervention DHOs collectively identified how they could work together, free up funds, and coordinate with other districts:

"We have a lot of MDR-TB [multi-drug resistant TB] in [this] district … but these patients move. … There is one patient we tracked from [this district] to [another district] and from there, he went to Kampala and from Kampala, we caught up with him in [yet another city in the north]. We did that tracking on social media and the DTLSs of all those districts were following and for us the DHOs, we were there to mobilize the funds. If he is in [this district], get in touch with the IP; get a vehicle and fuel it. The DTLS jumps on a vehicle to go and follow this guy until we caught up with him. So this is one way of doing things but also thinking outside of the box, that we can coordinate things and do them in a manner that is not the ordinary and things move."

DHO Intervention (Southwest)

"These meetings have broken the barriers; they have broken through those walls. … we realize that these diseases do not know borders, they don't know that District 1 starts and ends here, District 7 ends here while District 5 ends here but rather, this is a more regionalized group and if we are going to break through, we need to work together. You do not see that come out as one of the first things that you can see, but underneath it is working and is very good."

DHO Intervention (Southwest)

Such systemic coordination came about through the business training and professional networks brokered during the intervention mini-collaborative meetings. Although the challenge of mobility was identified, inter-district cooperation was not manifest in the control groups. These skills, having been implemented, did not fade after the training, as evidenced in the continued higher performance of intervention groups in enrolling PLHIV in IPT after the national IPT push ended (Kakande et al., 2022).

Finally, the study intervention's goal of promoting collaboration among district mid-level health managers – another example of horizontal support – succeeded:

"[SEARCH IPT study] has a lot of consultative approaches that is like if I see how [two neighboring districts] do work I get challenged and I would want to see whether I can duplicate what they have done. I also discuss whether what has brought improvement on their side can equally bring it on another's side as well."

DHO Intervention (East-Central Region)

In the same FGD as the above participant, a DHO noted the role the natural environment in East-Central Uganda plays in TB transmission and outreach, and how this related to seeing how his own district was performing:

> "[Seeing the data tables] for me, it was a wake-up call because when we look at our initiation of clients to IPT, we were doing poorly. So when I was in that meeting, I was majorly challenged with [nearby] districts because they are in a high land, it is scattered with a lot of water and [nevertheless] people who are in this environment were doing well."
>
> DHO Intervention (East-Central Region)

The friendly competition evoked by the data dashboards (with collaborative and district-specific data) was by design; what was not by design was reinforcing the on-the-ground recognition by DHOs of the geographic and terrain challenges each district faces and how if one district facing greater terrain challenges was able to overcome them, another district with more accessible territory should be able to do so, too.

4. Discussion

During this qualitative study of mid-level health system managers in a cluster-randomized trial to increase the uptake of IPT, multiple participants shared perspectives on contextual factors they saw as driving TB in the region and impacting the trial intervention's efforts. Despite these challenges, health managers in the intervention group reported an ability to apply the skills they developed in the intervention training to manoeuvre into a space of greater and more sustainable influence over IPT uptake.

The multiple challenges managers faced fell along political, administrative, and social axes. Politically, the individual relationships mid-level health managers have with local political and media leaders serve either to facilitate or hinder public health efforts to inform the public and provide much-needed services in an effective and targeted manner. At the administrative level, informants noted much work is dependent on IP engagement and funding, which creates an expectation on the part of providers that they will be given money when directed to widen their scope of standard-of-care practices. At other times, greater coordination between national-level logistics and local needs is required, a factor noted in other studies (Whyte, 2016). Social challenges included local settings which promote the spread of TB, such as crowded housing conditions and drinking venues, as well as regionally distinct employment opportunities often entailing both long- and short-distance mobility. Industries in the East and East-Central districts by the lakes attract migrants, while the Southwest's gold mines not only attract migrants from multiple countries and regions within Uganda but also provide an opportunity for TB transmission, a scenario also known in South Africa (Churchyard et al., 2000). These challenges are further affected by additional population mobility around regional hubs and international border crossings in often rural-to-urban directions. Misinformation about what TB is and how it can be effectively addressed added to these challenges.

Political factors can aid public health efforts or stymie them. The decentralization of the healthcare system in Uganda has meant not only that DHOs are responsible for more decision-making than before but also that local political leaders have a freer hand in how those policies get implemented. This is the case even when the politicians have no background in medicine, epidemiology, or other systematically evidence-based disciplines.

Other researchers have noted political interference in other fields (Ampaire et al., 2017) and identified this detrimental side-effect of decentralization on physician satisfaction and under-5 child mortality (Croke, 2012; Luboga et al., 2011).

On balance, the effect seems to tip negatively, though data from our sample indicate this depends on the degree of social capital a DHO has vis-à-vis a politician or local community, in line with findings from previous research (Bossert, 1998). While some control districts had good relations with their local politicians and were able to coordinate stakeholders, others were not. One recommendation to tip the balance towards helping would be explicit guidance from the central government on the limits of politician versus "technocrat" or DHO responsibility. Another recommendation would be workshops which engage TB experts, IPs/NGOs, media, and politicians to help align public health and political actors and to disseminate findings and validate results (Ampaire et al., 2017). Control groups were particularly keen to use local media, such as radio channels, to get the message out; intervention district managers used but did not focus on this method. Rather, intervention district managers targeted *the stakeholders who would need engagement* if IPT scale-up was to be successful and sustainable. More important, some intervention groups saw engaging political and IP stakeholders as a way to ensure the public becomes aware of TB, IPT, and potentially other health-related conditions with available treatments.

Such approaches may reinforce or create patron-client relationships between local politicians and health leaders – a potential problem in light of the expertise DHOs have, and politicians lack (Bossert, 1998). National leadership around limits may be called for to redistribute the decision-making space that has been overtaken by local political leaders. However, retaking the reigns of decision-making without training mid-level managers may lead to falling back to the status quo rather than sustaining an advance, which indeed we found when the national IPT push ended (Bossert, 1998; Kakande et al., 2022). Additionally, a sustainable approach drawn from Tanzania's example in lowering under-5 child mortality at a significantly faster rate than Uganda, is having appropriately trained policymakers and researchers both within and outside the government (Croke, 2012). Increasing the breadth of a policy network, not only by educating politicians using outside organisations but by placing health policy experts within the government itself, seems advisable to infuse longer-term strategic planning into politics, nudging political leaders to think about longer-term, rather than solely short-term, returns (Ampaire et al., 2017).

Within the healthcare system at the district level, control groups saw the need for greater communication with colleagues but seemed more atomized and less able to gather lessons from other districts. Control groups were challenged in messaging to front-line providers without the additional incentives provided by IPs and funding, whereas intervention groups indicated they were able to get buy-in by identifying key personnel to develop. Intervention groups learned to be 'scrappy' and use the resources already at hand without looking for additional funding as a first resort. Intervention groups thus circumvented some of basic infrastructural challenges that hinder the ability to use IP donations (e.g., donated laptops can only go so far in clinics without reliable electricity). Intervention groups still went to IPs; but they improved the efficacy of their own systems first. Creating collaborative groups and reviewing group progress with TB control efforts (both as a group, and by individual

district) also prompted participants to hold themselves accountable for keeping up with other nearby districts in more challenging situations, tailoring those practices to their own situation.

Other researchers have reported similar health-system challenges, ranging from poor management to staffing shortages, electric outages, and a sense of lack of ownership (Ampaire et al., 2017; Luboga et al., 2011). This challenge is partly a result of having to mobilise social capital in the presence of highly variable and vulnerable civic institutions (Bossert, 1998). That vulnerability is exacerbated by an unstable population base of seasonally mobile populations. (Omara et al., 2019). However, literate travelers like bodaboda men and students might mitigate this by spreading knowledge to passengers and new areas as they go about their work (Nyanzi et al., 2004; Schuyler et al., 2017). TB messaging should be wrapped in with HIV-literacy messaging to bodaboda drivers, since through them information will reach those who travel from hard-to-reach and less affluent areas.

Control and intervention participants mentioned two different strategies to address patient misbeliefs. While control DHOs worked via radio and media to spread a broad message, intervention DHOs opted for personal counselling during clinic visits for a more targeted approach. Through investment in media programmes, control districts fought misinformation about the treatability of TB which led patients away from other avenues for approaching TB etiology (e.g. witchcraft) and cure (e.g. prayer) (Solomon, 2020). Intervention districts addressed patient questions within the clinic and sensitized patients on the need to take TB preventive therapy. This direct provider-to-patient messaging may have contributed to the more sustained uptake of IPT after the national 100-day push ended. Neither group mentioned alternative literacy events like community workshops, theatre, or oral literature performances in drinking venues, though other studies use these means to disseminate their findings. The three approaches in combination may be particularly effective, should they be coordinated with sensitizing front-line providers on the importance of IPT. Providers themselves sometimes have some misconceptions about IPT, which the intervention sought to overcome, as mentioned in other papers from this study (Kakande et al., 2022; Mosimaneotsile et al., 2010; Whalen et al., 1997).

The area least amenable to change through the intervention was associated with social factors like population mobility, livelihood, and the way industry shapes local ecosystems to create a feedback loop encouraging migration while setting up conditions for the spread of infectious disease. Poverty and the development of infrastructure (or its lack of) often drives mobility (Luboga et al., 2011; Schuyler et al., 2017). In a not exclusively rural-to-urban pattern, different factors attract people to specific industries and opportunities, sometimes with seasonal regularity (King et al., 2021; Nyanzi et al., 2004; Serwajja and Mukwaya, 2020). The mineral deposits throughout Uganda, with their potential employment opportunities, draw people from other countries like Rwanda, DRC, and South Sudan, yet unregulated extraction has begun to degrade the environment (King et al., 2021; Omara et al., 2019; Serwajja and Mukwaya, 2020). Crowded conditions during the wet season in mining camps coupled with a lack of sanitation, electricity, and potable water supplies (Serwajja and Mukwaya, 2020), the habit of going to taverns (and fighting over sex workers)

(King et al., 2021; Omara et al., 2019), as well as silicosis (common in larger-scale mining) further set up conditions for ill-health (Churchyard et al., 2000). Shifting weather patterns provoke movement between rural and urban areas depending on whether it is rainy or dry or whether the ecosystem has been degraded by unenforced regulations (e.g. wetlands encroached on dry up the land, topsoil erosion leads to less viable farming and cattle ranching), and many young people seem driven by the desire to leave agriculture behind for more lucrative employ (Nyanzi et al., 2004; Omara et al., 2019; Schuyler et al., 2017). Dividing time between rural and peri-urban areas, as is common for those having families in one area, and work or gardens in another, can spread infectious diseases acquired in urban settings to rural areas which previously were buffered by their distance (Camlin et al., 2014; King et al., 2021; Nyanzi et al., 2004).

Finally, healthcare staff also recognize stigma's role in motivating movement – whether HIV, TB, or pregnancy (and abortion) (Nyanzi et al., 2004; Schuyler et al., 2017). The intervention districts learned to coordinate their contact tracing efforts, recognizing TB does not stop at district borders. In this respect, a policy coalition of climate action groups (broadly concerned with infrastructure, water, crowding, and sanitation) in concert with health officers could work both within government and outside to drum up policy recommendations within a one-health framework which acknowledges the drivers of mobility while also seeking ways to maintain continuity of care within seasonal migration patterns.

Limitations.

Apart from nearly all participants being men, a key limitation is the different data collection methods between the KIIs and FGDs. Although we purposefully chose different methods in order to mirror the collaborative effect of the intervention cluster and avoid creating a similar collaboration amongst the control group managers, the dynamics of each method differ and could lead to some information being given greater weight in the FGDs as opposed to KIIs (or the reverse). We also discussed the intervention in the FGDs, which the KIIs did not include. Nevertheless, although geographic descriptions were incidental to the main focus of the KIIs and FGDs, the fact that these factors continually reappeared during our interviews is a testament to their importance for DHOs who try to fulfil their professional mandate effectively. Similarly, the intervention was designed to increase professional capacity at the district level; it was not intended to address these larger contextual factors, and the guides we used for the KIIs and FGDs reflect that. Despite this limitation, participants reported using skills developed in the intervention trainings to confront and solve many of the larger challenges presented by political, social, and geographic contexts.

5. Conclusions

The geography of districts, social contexts and mobility of the patient populations concerned, political and implementing partner variability, and local clinical gaps interact together to create the health ecosystem. Although healthcare delivery is vulnerable both in the context of reliance on external funders because of their siloed approaches to providing

care, and at the district level to what one participant called “political interference” (Ampaire et al., 2017; Croke, 2012; Luboga et al., 2011), the SEARCH-IPT trial sought to make a measurable change in this ecosystem through training local mid-level managers in ways to identify clinic oversights, communicate their needs to local stakeholders and the benefits of IPT to patients, and share insights on less malleable features of the natural and built environments with other colleagues.

Despite the variety of regimens for tuberculosis prevention therapy (TPT) developed to help prevent tuberculosis in PLHIV, contextual factors remain salient to the development of any holistic intervention. The geographic and societal situation of rural Uganda presents ongoing obstacles and opportunities not just for the SEARCH-IPT trial itself, but also for centralized national health campaigns within Uganda more generally. Recognizing that diverse social and environmental contexts within the country can be affected by capitalizing on implementation knowledge and the benefits of sharing collectively-held data is essential for sustainable TB and other infectious-disease prevention planning in the region. These contextual factors should be acknowledged and included in strategic healthcare capacity-building efforts at the mid-management level.

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Data sharing

A complete de-identified dataset sufficient to reproduce the primary study findings can be made available upon request to the corresponding author, following approval of a concept sheet summarizing the analyses to be done.

Data availability

The data that has been used is confidential.

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