

Contextual Factors Influencing Implementation of HIV Treatment Support Strategies for Female Sex Workers Living With HIV in South Africa: A Qualitative Analysis Using the Consolidated Framework for Implementation Research

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ABSTRACT

Background: Female sex workers (FSWs) face a confluence of multilevel barriers to HIV care. In South Africa, 63% of FSWs are living with HIV and <40% are virally suppressed. The objective of this analysis was to identify implementation determinants of 2 HIV treatment support strategies.

Methods: The Siyaphambili trial tested a decentralized treatment provision and an individualized case management strategy aimed to support FSWs living with unsuppressed HIV viral loads. We identified a nested sample of trial participants using maximum variation sampling (n = 36) as well as a purposively selected sample of implementors (n = 12). We used semistructured interview guides, developed using the Consolidated Framework for Implementation Research (CFIR) and deductively coded the transcripts using CFIR,

systematically assessing the strength and valence of implementation. We compared construct ratings to determine whether any constructs distinguished implementation across strategies.

Results: Across 3 CFIR domains (innovation characteristics, inner setting, and outer setting), 12 constructs emerged as facilitating, hindering, or having mixed effects on strategy implementation. The *relative advantage*, *design*, *adaptability*, and *complexity* constructs of the innovation characteristics and the *work infrastructure* construct of the inner setting were strongly influential (± 2 or $+2$). While the majority of construct valence and strength rating (9–12) were not distinguishing across strategies, we observed 3 weakly distinguishing CFIR constructs (*relative advantage*, *complexity*, and *available resources*).

Conclusions: Given the potential benefits of differentiated service delivery strategies, identifying the relative importance of implementation determinants facilitates transparency and evaluation, supporting future strategy design and implementation. Optimizing implementation will support addressing inequities in HIV care and treatment services.

Keywords: HIV; female sex workers; women; implementation science; qualitative research; South Africa

BACKGROUND

Globally, over two-thirds of new HIV infections in 2022 were estimated to be among key populations and their partners.^{1,2} Within low- and middle-income countries, female sex workers (FSWs), adult women who sell sex as their main source of income, have 13 times higher odds of HIV infection³ and face a confluence of multilevel barriers to HIV treatment access and adherence.⁴⁻⁷ Antiretroviral therapy (ART) is safe, effective, and freely available in South Africa; the country with the largest HIV treatment program in the world.⁸ Treatment is offered across facilities and within the community for adults consistently engaged in care and virally suppressed.⁹ Yet, among the approximately 8 million South Africans living with HIV, heterogeneous treatment outcomes exist, particularly among FSWs.⁸ HIV prevalence among FSWs is upwards of 63%, less than half are on treatment, and <40% are virally suppressed. Substantial unmet HIV treatment needs among FSWs exist in South Africa, where the sale and purchase of sex is illegal as of 2024,¹⁰ having individual and population-level implications. Tailored, cost-effective strategies are needed to support FSWs to live at optimal health and to alter the HIV epidemic in the country.^{8,11-15}

Differentiated service delivery (DSD) has been increasingly recognized by the World Health Organization, International AIDS Society, and South African Department of Health, among others, as a means to maximize effectiveness of and address inequities in HIV care and treatment.¹⁶ DSD includes patient-centered implementation strategies that are designed and implemented to provide efficient, targeted support for ART access, adherence, and retention. The expansion of DSD services to address marginalized population needs and preferences has expanded in the past decade, but often without sufficient testing of models to identify how best to tailor the approaches and implement within specific settings. Examining implementation determinants, defined as empiric or hypothesized factors influencing implementation of a strategy or intervention,^{17,18} helps to understand implementation and associated outcomes. Ultimately, scalable DSD strategies must not only be cost-effective but acceptable to implementors and feasible to implement alongside existing HIV and/or clinic-based services.

The Siyaphambili study, which was conducted from 2018 to 2022, aimed to improve HIV treatment outcomes for FSWs living with HIV. The study used a sequential multiple assignment randomized trial (SMART) design, testing 2 HIV treatment support strategies' effect on retention and viral suppression (<50 copies/mL) among FSWs living with HIV in Durban, South Africa. The tested DSD strategies were community-based and codesigned and implemented in partnership with the sex worker community in Durban. It was a pragmatic trial, implemented within an ongoing HIV treatment and prevention program for sex workers. We conducted this qualitative analysis to characterize the implementation determinants of the HIV support strategies tested in Siyaphambili¹⁹ and to explore whether barriers and facilitators differentially influenced strategy implementation using a determinants framework known as the Consolidated Framework for Implementation Research (CFIR).^{20,21}

METHODS

Study Setting

Siyaphambili was a pragmatic trial, embedded within the existing TB HIV Care program that offers HIV services to FSWs in the Durban metropolitan area through a drop-in center and 2 mobile vans since 2012. TB HIV Care is a not-for-profit organization and one of the largest PEPFAR HIV treatment and prevention implementing programs nationally for FSWs. All research staff and implementors were employed by TB HIV Care, and non-research-related programmatic staff were knowledgeable about the study and passively supported study activities, when needed, through clinic-based ART dispensing or linkage of participants to the research team.

Study Sample

This qualitative analysis used a nested subsample of FSWs from the Siyaphambili trial, as well as key informant interviews with implementors. The trial's protocol has been described.¹⁹ In brief, a total of 777 adult, cisgender FSWs living with HIV ≥ 6 months with an unsuppressed viral load (≥ 50 copies/mL) were initially randomized in a 1:1 ratio to 1 of 2 HIV treatment support strategies and then rerandomized at 6 months in a 1:1 ratio based on response to the initial strategy exposure, for a total of 18 months of follow-up time. The strategies tested against one another were a decentralized treatment provision (DTP) and individualized case management (ICM), both layered on top of the existing standard of HIV care services.^{19,22,23}

From March 2021 to January 2022, we conducted in-depth semistructured interviews with a subset of trial participants ($n = 36$) at 12–21 months after enrollment into the trial; all were retained at the end of the 18-month trial. We used maximum variation sampling, ensuring cases captured heterogeneity in strategy exposure, treatment end point outcomes, and sex worker/venue characteristics. In addition, trial implementors and program providers ($n = 12$) were purposively selected for key informant interviews, interviewing as many implementors across strategies and key roles within the study and program. Inclusion of strategy deliverers and recipients provided a more holistic understanding of implementation determinants.

The study was approved by the University of the Western Cape Biomedical Research Ethics Committee in South Africa, the Johns Hopkins School of Public Health Institutional Review Board in the United States, and the eThekweni Municipality and KwaZulu-Natal Provincial Departments of Health. All participants provided written informed consent both for the quantitative and qualitative data collection.

Semistructured Interviews

Interviews were conducted in-person in a private space in the TB HIV Care mobile van or drop-in center, lasting approximately 45–60 minutes. A research assistant trained in qualitative methods, who knew about, but was not involved with trial implementation, conducted the interviews in Zulu using semistructured interview guides informed by the CFIR.²⁴ All participants spoke Zulu or English (i.e. no further translation was needed). Relevant constructs across the 5 CFIR domains were identified, and open-ended questions and probes were developed based on the selected constructs. The guides were developed and translated; the guides were reviewed in detail and piloted by the TB HIV Care team, ensuring coherence in the translation into Zulu. The interviews were audio-recorded, transcribed, and then translated into English. The interviewer completed a rapid analysis form within 24 hours, summarizing key components of the interview. All FSW participants were reimbursed 100 ZAR (~\$7) for their time.

Analysis

To investigate the strategy implementation determinants, we conducted a qualitative analysis using the CFIR.^{20,21} The CFIR systematically assesses multilevel factors related to implementation barriers and facilitators across 5 core domains: innovation characteristics, implementation process, outer setting, inner setting, and individual setting.²⁴ Within each domain, there are a number of associated CFIR constructs.

The author (C.C.) and 2 other research assistants coded the transcripts in ATLAS.ti.²⁵ Coding was deductive, initially using the CFIR (V1.0) and including all 5 CFIR domains and relevant associated constructs.²⁴ A third of transcripts were coded by all 3 coders, and the remaining were independently coded. Throughout, discrepancies were discussed and resolved during weekly analytic meetings. During the coding and through the use of narrative summaries and data matrices, emergent constructs, themes, and illustrative quotes were identified. Coding was reorganized for this analysis using the CFIR (V2.0), which was newly published and offered additional coding clarity,²¹ and included the 3 domains innovation characteristics, outer setting, and inner setting. We focused on these 3 domains and 12 associated constructs as they emerged as relevant determinants to the implementation of the Siyaphambili strategies, using joint displays and side-by-side comparisons.

Rating the CFIR Constructs and Interpretation

We rated the implementation *valence* and *strength* of the CFIR constructs within the 3 domains of interest (i.e. innovation characteristics, outer setting, inner setting).^{20,26} *Valence* assessed where the construct facilitated (+influence), hindered (–influence), or had a mixed effect (\pm) on strategy implementation, and *strength* assessed the magnitude of influence on implementation. The degree of influence was rated: +2, +1, –1, and –2, with ± 2 representing the strongest influence on implementation. We used a consensus process to assign ratings to each construct, based on the level of agreement between participants and implementors across interviews, the use of language, and concrete examples. We rated all 12 constructs overall, as well as for the strategies independently. Using data matrices and emergent themes, we compared construct rating across strategies to determine whether any constructs distinguished implementation. In this study, distinguishing implementation (i.e. defined as strongly, weakly, or not distinguishing) assessed construct heterogeneity across strategies. For example, “not distinguishing” meant the valence and/or strength of the CFIR construct as an implementation

determinant did not differ across strategies. The complexity construct was reverse-coded, with a negative valence indicating strategy complexity hindered implementation.^{20,27,28}

RESULTS

The mean age of Siyaphambili FSWs participating in the in-depth interviews (n = 36) was 35 years old (range: 18–61 years), the majority (88%) operated from indoor sex work venues, and experience with the strategies over time varied (see Table 1, Supplemental Digital Content, <https://links.lww.com/QAI/C331>). We conducted 12 key informant interviews with program and research implementors and study staff, including positions of nurses, peer case managers, peer navigators, drivers, and research study leadership. The majority were female implementors (83%), and two-thirds were older than 35 years.

Across the 3 CFIR domains, 12 constructs of importance emerged in the interviews as barriers or facilitators to strategy implementation (Fig. 1). A detailed description of implementation determinants is presented in Table 1 (and additional illustrative quotes in Table 2, Supplemental Digital Content, <https://links.lww.com/QAI/C331>). Below, we present the results in the context of the 3 CFIR domains of study, focusing on constructs with a significant degree (± 2) of influence on implementation across strategies; note constructs from the outer setting domain are not detailed below as they did not emerge as sufficiently strong (± 2) determinants.

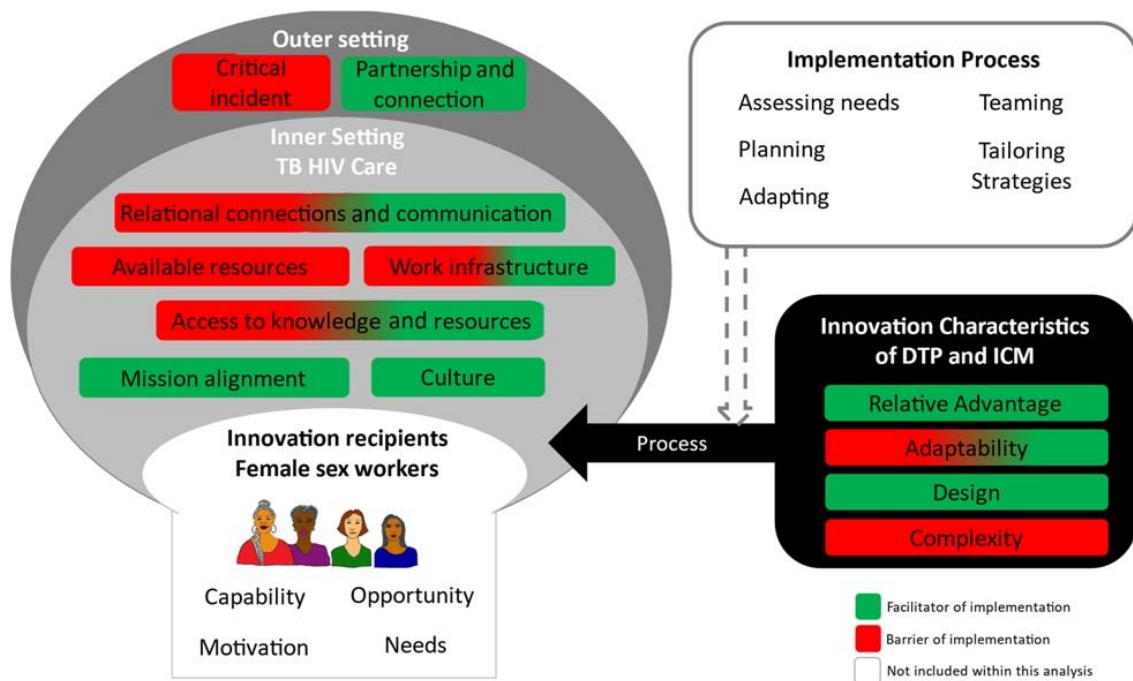


FIGURE 1. Implementation determinants organized by the Consolidated Framework for Implementation Research domains and constructs. The figure presents the 5 CFIR domains and relevant associated constructs. The 3 CFIR domains of focus in this analysis and the 12 constructs of importance emerged in the interviews as barriers or facilitators to strategy implementation are illustrated in color.

TABLE 1. - Qualitative Themes and Illustrative Quotes Reflecting Barriers and Facilitators of the Implementation as Experienced by Those Receiving and Implementing the HIV Treatment Support Strategies for Female Sex Workers Living With HIV in Durban, South Africa, in 2018–2022

CFIR Domain and Construct	Implementation Determinant*		Key Theme	Illustrative Quotes
	Overall Valence	Overall Strength		
Innovation characteristic: Relative advantage				
	Facilitator	+2	The strategies addressed treatment-related barriers that clinic-based care could not	<i>Receiving it is way better because there are no neighbors that look at you and you avoid standing in those ridiculous long queues at the clinic, it literally takes less than 20 minutes.—FSW receiving the DTP (then DTP+ICM), IDI-08</i>
Innovation characteristic: Design				
	Facilitator	+2	Strategies were acceptable to implementors and FSW participants	<i>[ICM]...felt like I was talking to a sister... she would motivate me and give me ideas of how to tackle certain situations... I have had the same case manager throughout the study...she attended to all my needs....—FSW receiving ICM, IDI-09</i>
Innovation characteristic: Adaptability				
	Facilitator	+2	Strategy implementation was tailored to FSW needs and available resources	<i>I'd buzz when I didn't have airtime and they'd call me back fast. I'd explain what I needed and they would help me.—FSW receiving ICM (then SoC), IDI-01</i>
	Barrier	-2	Modifications to strategy implementation caused bottlenecks in implementation	<i>...due to the nature of my work, I moved and lost contact with the people from the study. After a few months they found me and continued to bring the treatment to me at my new work place.—FSW receiving DTP (then DTP+ICM), IDI-06</i>
Innovation characteristic: Complexity				
	Barrier	-2	Strategies were challenging to deliver as designed	<i>With <u>outdoors [venues]</u>, most of the participants are on the streets. When we try to stop next to the participant a client's car will come and stop in front of you and take the participant with them. We then have to make a plan to come back because we won't wait for her while we have to attend to other participants... [but with <u>indoor venues</u>] Most of the time we call the clients to the car. Sometimes the client [FSW] will refuse to come to the car. In that case, you'll have to assess for yourself whether it is safe for you to go in there. There are sites where you will have</i>

				<i>to go to their rooms if they are tired after a long night at work.—Implementor, KII-03</i>
Inner setting: Culture				
	Facilitator	+1	TB HIV Care's reputation, FSW sensitization, and recipient centeredness supported implementation	<i>TB HIV Care... caters to the sex workers' needs... [FSW] feel free to come to us.—Implementor, KII-07</i>
Inner setting: Mission alignment				
	Facilitator	+1	Strategy implementation aligned with the overarching commitment, purpose, and goals of TB HIV Care	<i>...the program is similar to the research... sex workers already know TB HIV Care so the research was just an added benefit for them. There wasn't a difference in the services and there's still that professionalism and respect and everything else that goes with it...—Implementor, KII-10</i>
Inner setting: Work infrastructure				
	Facilitator	+2	Staffing composition, responsibilities, and collaboration supported implementation and associated activities	<i>Being from the streets made me familiar with the sites we work in. It helped me with learning how to follow up on participants and how to feel safe while doing it. Also knowing how to communicate with different people helps.—Implementor, KII-07</i>
	Barrier	-2	Staffing levels and the overlapping responsibilities of implementors challenged functional performance	<i>DTP is not something that is easy to implement... It's a small team with a lot of [FSW]. The whole study design of the drop off is correct but... there needs to be multiple teams delivering to different people for the intervention to be effective.—Study team member, KII-11</i>
Inner setting: Available resources				
	Barrier	-1	Implementation activities and FSW retention limited due to resource constraints	<i>At times the mobile clinics would break down and couldn't be on the road... There should be other alternatives available for us.—Implementor, KII-01</i>
Inner setting: Access to knowledge and resources				
	Facilitator	+1	Strategy-specific and team-based trainings and resources were sufficient to support implementation	<i>We had a thick bible sized manual that we referred to during training. We also had slides that we used during training. We also did role-play during training.—Study team member, KII-13</i>
	Barrier	-1	Administrative, technical, and refresher trainings were needed to facilitate strategy implementation	<i>I think more training needs to happen and regular supervision.... More reporting and accountability are also needed... I think some people were scared to say that they don't understand what they were trained on.—Study team member, KII-11</i>
Inner setting: Relational connections and communication				

	Facilitator	+1	Collaborative, but disorganized networks and communication structures within and between research and program implementors at TB HIV Care existed and supported strategy implementation	<i>They [the program and the research] link well together. We assist [FSW] whether they are part of the study or not when we are out in the field. The same goes for the program staff, they assist the [FSW] that are a part of the study as well when they can. The communication and link is always there because we are under one umbrella which is TB HIV Care...—Study team member, KII11</i>
	Barrier	-1	Limited structured opportunities for communication within and between research and program implementors at TB HIV Care challenged implementation	<i>If some of the staff just communicated better, I think the research would have been a lot more successful.—Implementor, KII-10</i>
Outer setting: Critical incident				
	Barrier	-1	COVID-19 pandemic hindered implementation as new safety protocols were implemented, FSW venues closed/changed hours of operation, and FSW travel occurred unexpectedly	<i>... it was difficult because a lot of precautions had to be taken. All the COVID protocols had to be adhered to before seeing the participants. COVID created a lot of admin. I think COVID was also strenuous on both the staff and participants.—Study team member, KII-12</i>
Outer setting: Partnerships and connection				
	Facilitator	+1	TB HIV Care's network with external entities, including other nongovernmental organizations and facilities, facilitated strategy implementation and supported need-based referrals beyond the scope/capacity of implementors	<i>We would refer people to these... organizations... who would help with stress, depression, and abuse... We'd refer them to the police station or even take them there ourselves. We'd also refer them to the psychosocial team... The site team helped [FSW without homes] find shelter...”—Study team member, KII-11</i>

*Valence rating: (+) facilitated the implementation of strategies, (-) hindered the implementation of strategies, and (±) both facilitated and hindered (mixed effects) implementation. Strength rating: +2, +1, -1, and -2, with ±2 representing the strongest influence on implementation.

Innovation (DTP and ICM) Characteristics

Within the innovation characteristics domain, we identified 4 constructs that strongly (± 2) influenced implementation: *relative advantage*, *design*, *adaptability*, and *complexity*.

Relative advantage, the extent to which the strategies tested were better than the standard of HIV care in South Africa,^{29,30} emerged as a strong facilitator to strategy implementation. The majority of DTP recipients expressed that treatment delivery addressed barriers to ART access, including transportation costs, long clinic-related wait times, discriminating and/or unsupportive clinic staff, and anticipated stigma from staff and other community members at the clinic. Participants found DTP less disruptive to sex work activities and more discrete and convenient, in comparison with clinic-based care. The case manager's tailored support and attention emerged as a key advantage for many ICM recipients. FSWs felt open and able to speak freely, without judgment, with their case manager, which was something they noted was not possible with clinic-based nurses/staff. A few participants cited ICM offered education, encouragement, and adherence support not available at clinics. The *relative advantage* of the strategies in comparison with clinic-based care emerged to largely facilitate implementation.

The *design* of the strategies, including how the strategies were packaged, assembled, bundled, and presented,²¹ emerged as a facilitator to implementation. Overall, the majority of DTP recipients liked the quality of DTP nurse-led care. Almost all valued the packaging of ART in tissue and brown bags, as it made it hard to identify the parcel as HIV treatment, and most were accepting of the community-based location where and day/time when DTP occurred. Some DTP recipients also expressed their appreciation for the bundling of services alongside ART, including condoms, pain medicine, contraception, and STI treatment. Almost all ICM participants found the quality of case management and the attributes of their case manager acceptable. ICM recipients described their case manager as a nonjudgmental, caring, and kind woman who provided them with education, adherence support, motivation, referrals, and life-related problem-solving surrounding homelessness, violence, suicide ideation, food insecurity, and drug use. Case managers were patient and generous with their time. The acceptability of the strategies among FSW recipients, particularly the packaging of strategy sessions and bundling of support-related services, emerged to strongly facilitate strategy implementation.

The *adaptability*, or extent to which the strategies could be modified, tailored, or refined to fit local context or needs,²¹ depended on the implementors' ability to identify FSW's needs and, thus, had mixed effects on implementation. Specifically, when implementors were able to remain in contact with participants over time, adaptation and tailoring were possible. DTP deliverers could adapt the drop-off location, the day/time of delivery, and/or other services bundled alongside ART per FSW request. ICM deliverers could adapt the location, day/time of sessions, session content, and referrals per FSW request. Addressing FSW needs emerged to strongly influencing engagement with the strategies, and thus, ability to identify FSW needs resulted in the *adaptability* of strategies having a mixed effect on implementation.

In addition, the *complexity* of the strategies, reflected by strategy scope and complexity to implement,²¹ emerged as a strong implementation barrier. Many FSWs and implementors detailed the extensive efforts made to retain participants over time, including a combination of phone-based communication and community-based visits. Temporary or permanent mobility for personal or work-related demands, as well as challenges with sustained phone-based contact (because there was no phone or it was lost, stolen, sold, or replaced), emerged as a barrier to strategy implementation. Venue-level dynamics also complicated strategy implementation. At

some indoor venues, pimps/venue managers acted as gatekeepers and were, oftentimes, fickle with access to the venue and participants. Across venues, client demands always took precedence, resulting in implementors needing to wait or return later to deliver the strategy. Another few venues were unsafe or inaccessible at certain times of the day. Furthermore, incarceration of some FSWs complicated sustained communication and implementation. Across strategies, the inability to sustain long-term communication between deliverers and recipients complicated and hindered implementation.

Inner Setting

Within the inner setting domain, 7 constructs were identified that influenced implementation of the 2 strategies: *culture, mission alignment, work infrastructure, available resources, access to knowledge and resources, and relational connections and communication*. *Work infrastructure* within TB HIV Care emerged to have a strong mixed effect on strategy implementation (± 2). The staffing and distribution of roles and responsibilities of strategy implementors as well as the collaboration between implementors at TB HIV Care resulted in the *work infrastructure* having a mixed effect on strategy implementation. Strategy implementors were specifically hired, trained, and sensitized to support HIV care and treatment among FSWs, and peer case managers, in particular, had sex work experience and many were living with HIV. There were a large number of recipients allocated to each implementor, and staff turnover, unexpected or extended leave, further challenged implementation. Other programmers at TB HIV Care supported strategy implementation when needed, providing ART at the clinic or linking the participant with strategy deliverers. Yet, all case managers had roles beyond ICM, supporting FSW recruitment, engagement, and retention across strategies, and the DTP nurse supports blood draws and rerandomization. The diversification of roles and responsibilities facilitated strategy implementation but also challenged implementation as implementors had to balance strategy implementation, other study-related needs, and the technical components of their role (i.e., technology, scheduling, data entry, and reporting).

Construct Heterogeneity Across Strategies

Of the 12 CFIR constructs analyzed, there was generally high consistency in the importance of constructs across both DTP and ICM arms; however, 3 distinguishing constructs emerged across the strategies (DTP vs ICM): *relative advantage, complexity, and available resources* (Table 2). The *relative advantage* was slightly negative (-1) for DTP as some participants opted to receive ART from the clinic. A few participants refused treatment drop-offs, avoiding implementors due to venue-based anticipated stigma or discrimination. As a result, some implementors used smaller vehicles with no TB HIV Care branding. Other FSWs opted to pick up their ART from the clinic due to their geographic proximity to the clinic or to retain personal autonomy of their treatment pickup. The DTP strategy was also slightly more *complex* due to HIV clinical care provision and complications related to long periods of strategy disengagement. This complexity was compounded by high levels of resistance to first-line ART among some FSWs. TB HIV Care is not registered to provide second-line ART; FSWs identified with resistance had to be referred to a Department of Health facility for second-line therapy. One implementor explained, “If the viral load is [consistently] greater than 1000 mL it might indicate that the person is resistant to medication... We need to know if delivering medication to their doorstep is helping with adherence. The only thing that can give us the correct indication is their viral load... How can you monitor someone's [clinical care] when you've lost them for so long?” (KII11) This lack of *available resources*, i.e., the unavailability of second-line ART, differentially influenced DTP implementation. The ICM recipients

identified as resistant to first-line therapy were able to continue to receive support from their case manager, who facilitated second-line provision at external clinics if requested by the participant.

TABLE 2. - Valence and Strength of Innovation Characteristics, Outer Setting, and Inner Setting Constructs by Siyaphambili Strategies (Decentralized Treatment Provision and Individualized Case Management) Implemented Among FSWs Living With HIV in Durban, South Africa

CFIR Domain	CFIR Construct	Valence and Strength*			Distinguishing Construct Between DTP and ICM
		Overall	DTP	ICM	
Innovation characteristics					
	Relative advantage	+2/-1	+2/-1	+2	Weakly
	Design	+2	+2	+2	Not
	Adaptability	+2/-2	+2/-2	+2/-2	Not
	Complexity	-2	-2	-1	Weakly
Inner setting					
	Culture	+1	+1	+1	Not
	Mission alignment	+1	+1	+1	Not
	Work infrastructure	+2/-2	+2/-2	+2/-2	Not
	Available resources	-1	-2	-1	Weakly
	Access to knowledge and resources	+1/-1	+1/-1	+1/-1	Not
	Relational connections and communication	+1/-1	+1/-1	+1/-1	Not
Outer setting					
	Critical incident	-1	-1	-1	Not
	Partnerships and connections	+1	+1	+1	Not

*Valence rating: (+) facilitated the implementation of strategies, (-) hindered the implementation of strategies, and (±) both facilitated and hindered (mixed effects) implementation. Strength rating: +2, +1, -1, and -2, with ±2 representing the strongest influence on implementation.

DISCUSSION

This analysis identified the strongest CFIR constructs influencing the implementation of both the Siyaphambili DTP and ICM strategies, which were the *relative advantage*, *design*, *adaptability*, and *complexity* of the innovation characteristics domain and the *work infrastructure* of the inner setting domain. Barriers to strategy implementation arose from the following constructs: *strategy complexity*, *available resources* within TB HIV Care, and COVID-19 *critical incident*. The facilitators to strategy implementation arose from strategy *design*, *mission alignment* and *culture* at TB HIV Care and the *partnerships and connections* extending beyond TB HIV Care. Several constructs exerted mixed effects on implementation, including the *relative advantage* and *adaptability* of the strategies as well as the *work infrastructure*, *access to knowledge and resources*, and *relational connections and communications* within TB HIV Care.

There is an increasing call for DSD services to address the needs of those who are not being effectively reached and retained in current, ongoing HIV treatment programs.³¹⁻³⁵ However, the implementation of DSD services is challenging, particularly in real-world settings, given differing contextual considerations. The Siyaphambili treatment support strategies, as well as strategies and FSW programs in other settings that use drop-in centers and mobile van service delivery,³⁶⁻³⁸ are DSD models with sensitized staff outside of government clinics. Such

targeted DSD models have been shown to empower FSWs, strengthen peer support, address structural determinants, and increase service utilization, including condom use, HIV testing, and STI treatment.³⁹⁻⁴³ However, as seen in the Siyaphambili and SAPPH-IRE trials,⁴⁴ FSW-targeted DSD efforts have not been sufficient to achieve needed clinical outcomes among FSWs, even when strategies are tailored through formative research with local FSWs and stakeholders.¹⁹ Moving forward necessitates identifying feasible-to-implement DSD components, which sufficiently support sustainment of viral suppression.

Using the CFIR aided in systematically assessing implementation barriers and facilitators across and between strategies tested in Siyaphambili. This framework provided the scaffolding for the exploration of implementation determinants and the provision of generalizable insights for further DSD strategy optimization and implementation. Heterogeneity in strategy or intervention outcomes due to contextual differences across studies has been documented.^{17,45-49} These data, taken together, highlight that often implementation is not happening as planned. Unintended implementation challenges resulted from the intersection of innovation characteristics and complexities playing out within the inner and outer settings of this study. Furthermore, this analysis emphasized that the ability to tailor strategy implementation based on FSW needs and preferences was only possible through sustained communication and engagement, reiterating experiences seen elsewhere.⁵⁰⁻⁵² These underlying individual and organizational factors influenced the consistency of implementation across strategies. We hope by identifying and positing the barriers and facilitators to strategy implementation, we have increased implementation transparency and facilitated comparative evaluation of these findings within South Africa and potentially beyond.⁵³

Of note, although structural-level barriers to HIV treatment access and adherence have been documented among FSWs in this setting,^{54,55} few policy-related implementation determinants related to sex work criminalization emerged within this qualitative analysis. We believe this was largely due to the framing of the semistructured interview guides, which focused predominantly on the strategy characteristics and setting in which they were implemented. Related to COVID-19 *critical incident*, a few FSWs noted venue closures related to associated lockdowns that resulted in FSW mobility within or outside of the Durban metropolitan area. However, as reported elsewhere,^{56,57} access to and engagement with HIV DSD services offered via the Siyaphambili trial and TB HIV Care remained largely stable throughout the COVID-19 pandemic.

Limitations

We recognize the limitations of this qualitative analysis. First, in-depth interviews were conducted among a subset of Siyaphambili trial participants retained at the end of the trial. We used maximum variation sampling to capture a diversity of strategy exposure and participation over time, as well as HIV treatment outcomes. Yet, the perspectives and experiences of trial participants lost to follow-up are not reflected and may be different. The introduction of bias through a concurrent trial and qualitative data collection was possible. We took the following steps to minimize this possibility: (1) We recruited an equal number of FSWs from both strategies and interviewed all supporting both strategies and program activities, (2) we ensured participation in the qualitative research had no implication on trial activities for FSWs or employment for implementors, and (3) we employed a qualitative interviewer who was familiar with the trial but not directly involved with the trial's implementation. Finally, the coauthor (C.C.) led this analysis and was the US-based study coordinator for Siyaphambili, and personal biases and experiences could have influenced the analysis. Yet, we believe intimate knowledge

and experience with the trial's implementation were advantageous and supported the analysis and interpretation of implementation determinants.

CONCLUSIONS

The South African National Strategic Plan for HIV, TB, and STIs 2023–2028 has committed to a new and urgent focus on addressing inequities in care and treatment services and highlighted the need for tailored services for key populations.⁵⁸ To better support the unmet HIV treatment needs of FSWs in South Africa, understanding what works and what does not work is central. Even when DSD strategies, such as DTP and ICM, are designed, tailored, and implemented in partnership with the prioritized community, notable barriers can arise that challenge implementation. This analysis aids in identifying the relative importance of implementation determinants, facilitating transparency and evaluation by other researchers and programmers planning to design and implement strategies among key populations such as FSWs. Moving forward, exploring how to account for the influence of context and its interaction with the underlying mechanism can give insights into how and why certain implementation outcomes are achieved. Further evidence on how implementation outcomes lead to clinical outcomes of retention and viral suppression for FSWs living with unmet HIV treatment needs is needed.

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