Pivoting Youth HIV Service During the COVID-19 Pandemic: Evaluation of Phone Delivery of an Adolescent Transition Package in Kenya

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Abstract

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The global burden of HIV attributable to young people aged 10 – 24 years living with HIV is significant and approximates 2 million youth. The reality of HIV along with the vulnerability associated with being a teenager makes this population one worth paying close attention to given poor HIV outcomes associated with youth living with HIV (YLH). Maintaining engagement in care is critical, especially for older youth aged 15 – 24 years who experience worse HIV-related outcomes than adults or younger adolescents. The risk of loss-to-follow-up is high among YLH transitioning from pediatric to adult HIV clinics. Among youth, mHealth technology has demonstrated the ability to bridge gaps in utilizing health services that are common in this age group, including improving engagement and retaining in care. During the COVID-19 pandemic mHealth was invaluable for HIV clinics as it supported remote access to health services. The Adolescent Transition to Adult Care for HIV-infected Adolescents in Kenya (ATTACH) study

which tested an Adolescent Transition Package (ATP) to support YLH transition pivoted from in-person delivery to phone delivery of the intervention. We sought to assess implementation of the ATP using phones to identify best practices for use beyond the pandemic.

The first study used qualitative data from providers who work with YLH at public HIV clinics in Kenya to identify barriers and facilitators associated with phone delivery of the ATP intervention. We gathered data enumerating the number of phone calls and the success of each call as far as reaching youth and discussing a chapter of the ATP was concerned. The use of mobile phones was high in the early stages of the pandemic but quickly declined once movement restrictions were lifted. Initially, the providers were less successful at reaching youth until after restrictions were lifted. Using the Consolidated Framework for Implementation Research we found that salient factors influencing acceptability, feasibility and reach were related to the technical simplicity of phone calls, relative convenience, and efficiency of using phones (intervention characteristics), and to inner setting characteristics such as the presence of collaborative teams, individual and collective efficacy to complete tasks, availability of information and resources, and compatibility with the providers' existing responsibilities. Determinants related to patient needs and resources and community, specifically low phone ownership among youth, and the youths' relationships, were important.

The second study applied the Framework for Reporting Adaptations - Implementation Strategies (FRAME-IS) to characterize provider-led adaptations to mobile phone delivery of the identified from qualitative data collected during Continuous Quality Improvement meetings. Adaptation of phone delivery was a feasible and effective way of addressing challenges with

continuity of care for YLH during the COVID-19 pandemic. Most adaptations were derived from changes to the strategy's context and majority were introduced to increase the feasibility of phone delivery. Most adaptations were either incorporated into routine workflows (47%) or tested again (47%). Adaptations were primarily context adaptions. We found that FRAME-IS was apt for describing adaptations. We propose other uses of FRAME-IS for providers engaged in quality improvement work.

The third study used a convergent mixed methods approach to compare youth satisfaction with phone delivery versus in-person delivery of the ATP. We identified higher satisfaction with both options; however, the preference was for receiving in-person delivery compared to phone call delivery of the ATP. Privacy and confidentiality, patient-provider relationship and connection, convenience, and averted time and financial costs were notable drivers of YLH's perspectives that may be important to consider when designing service delivery strategies for YLH.

This dissertation contributes to much needed implementation science research on mHealth in relation to the care of youth living with HIV and underscores factors for consideration when implementing mHealth for this target population. As new efforts emerge to address poor HIV outcomes among YLH, providers and policymakers will require a nuanced understanding of implementation barriers and facilitators, and adaptations. This work also highlighted the importance of evaluating YLH experiences with health services to better match delivery strategies to client preferences and needs.

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DEDICATION

I dedicate this dissertation to my parents, Mzee Walter Mangale Ombeva and Helen Jahenda Mangale aka 'the Manager', who have inspired me to pursue a life of service to others regardless of the professional path I choose to take.

Dad, thank you for all the hard work and commitment you put in to ensure that your girls are healthy, educated, and ready to take on the opportunities the world has to offer.

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Chapter 1. INTRODUCTION

More than three million adolescents and youth globally are living with HIV, with 72% located in sub-Saharan Africa (SSA).[1] Despite global gains in uptake of antiretroviral therapy (ART) among the youth, rates of poor outcomes such as HIV-related mortality remain high with a three-fold rise since 2000.[1,2] This is attributed to nonadherence to medication, high loss to follow-up among older adolescents, and high rates of virologic failure.[2–5] These poor outcomes are common when youth living with HIV (YLH) transition from pediatric to adult HIV care while experiencing significant developmental changes, and can partly be attributed to poor engagement with HIV services.[2,6,7]

Digital health interventions such as mobile health (mHealth) have demonstrated the potential to mitigate barriers to YLH navigating the health system.[8–12] For example, mHealth applications create the ability to access health information anonymously; provide 24-hour access to health services and HCW via support lines; and improve the accessibility of services by reducing costs associated with travel to hospitals and receiving in-person care.[10,11,13] mHealth interventions enable HCW to focus on one client at a time, creating opportunities to build and sustain rapport with YLH, and to personalize care to adolescents.[13–15] mHealth interventions can be targeted to marginalized adolescent groups to decrease disparities in health outcomes.[16,17] In addition, mHealth can provide training and supervisory support for HCWs who interact with adolescents to address provider-level contributors to health navigating barriers.[18] Despite these benefits, the adoption of mHealth by HCWs has been low. Factors like the lack of technological resources,

limited skills among providers and resistance to change that impede mHealth implementation have been highlighted.[10,18,19]

During the COVID-19 pandemic, mHealth was useful for maintaining the HIV continuum of care. However, like in the pre-pandemic era, low utilization of these technologies was still common.[20–22] To optimize the potential of mHealth for YLH in a post-pandemic world, it is important to examine implementation patterns and identify determinants of mHealth use. The ATTACH trial in Kenya sought to test the effectiveness of the Adolescent Transition Package (the ATP).[23] This intervention combined HIV disclosure and care transition support tools to improve the readiness for transition of eligible YLH aged 15 – 24 years. During the pandemic, in-person, clinic-based delivery of the intervention was halted, and the study was forced to pivot to mobile phone use. Using Implementation Science, qualitative and mixed methods, we sought to examine the mobile phone delivery of the ATP to identify gaps and opportunities for improvement.

To meet my research objective, I addressed the following three aims: 1) to identify the determinants of mobile phone delivery of the ATP, 2) to characterize adaptations proposed by HCWs during continuous quality improvement meetings, and 3) to evaluate the comparative satisfaction of mobile phone versus in-person delivery of the ATP from the perspective of YLH. The findings of this research may advance access to HIV care for ~140,000 YLH in Kenya, where mobile phone penetration is estimated at 80%, during and beyond global crises.[24]

Chapter 2. QUALITATIVE RESEARCH TO IDENTIFY DETERMINANTS OF PHONE CALL DELIVERY OF THE ADOLESCENT TRANSITION PACKAGE IN KENYA

2.1 ABSTRACT

Introduction: The COVID-19 pandemic accelerated the use of mHealth interventions to preserve the continuity of care while maintaining movement restrictions and social distancing rules to reduce the risk of SARS-Cov2 transmission. Despite the benefits of mHealth adoption by providers during the pandemic, implementation was limited or inconsistent. An examination of mHealth implementation during the pandemic is critical for stimulating its use among providers in feasible, acceptable, and sustainable ways during and beyond global emergencies adoption among providers. This study aimed to identify determinants of phone delivery of the Adolescent Transition Package (ATP), an HIV care transition intervention, to understand utilization patterns and identify factors influencing implementation in a hybrid 1, cluster randomized clinical trial designed to assess ATP effectiveness.

Methods: To evaluate the determinants of phone delivery we conducted in-depth interviews with frontline healthcare workers who worked at HIV clinics attended by youth living with HIV preparing to transition from pediatric to adult HIV clinics. We applied the Consolidated Framework for Implementation Research (CFIR) to conduct a directed content analysis. Additionally, we collected data enumerating phone calls made by providers, as well as

demographic information from in-depth interview participants. Quantitative data was summarized using descriptive statistics.

Results: The providers' experience delivering the ATP by phone was generally acceptable and feasible. Key influences on perceived acceptability, feasibility, and reach were identified mainly within intervention characteristics and inner setting domains of the CFIR. Frequently reported challenges were the limited ability to assess youth comprehension on phone, the inability to share pictures in the ATP booklet in real-time, limited access to phones at the clinic, and missing or inaccurate contact information for youth. The composition and organization of clinic teams, and confidence to implement enhanced phone call feasibility, while intervention characteristics like the ease, convenience, improved acceptability. Determinants related to patient needs and resources and community were also important to the reach of phone calls. Low phone ownership among youth, and the youths' relationships were the main examples, with the former acting primarily as a barrier and the latter having both positive and negative effects. There were mixed views about sustaining phone calls beyond the pandemic; among those supporting phone calls, establishing long-term access to clinic phones and other resources was important.

Conclusion: The implementation of phone calls was acceptable and feasible, and dependent on factors primarily in the intervention characteristics and inner setting constructs of the CFIR. The lack of phones among youth, and mediating effect of youths' relationships with caregivers or spouses on the reach of calls highlighted the need to pay closer attention to community or relationship factors in planning for mHealth interventions for this group. Future use of phones will require a sufficient supply of the resources required for implementation.

2.2 INTRODUCTION

During the COVID-19 pandemic, the benefits of mHealth were undisputed, significantly mitigating SARS-Cov2 transmission and maintaining continuity of care for people living with HIV (PLHIV) and other chronic diseases.[25–27] By limiting physical contact between patients and providers, mHealth effectively reduced the risk of hospital-based transmission while increasing the convenience, speed, and ease of disease-tracking efforts and supporting remote delivery of health services, with cost savings to the health system.[20–22,28] Despite these benefits, mHealth adoption by providers during the pandemic was not as widespread as expected, and where present, implementation was inconsistent, and reasons for this are still being documented. [20,29–32] Interrogating and documenting the implementation of mHealth, including factors influencing success, is an essential first step in stimulating its use in feasible, acceptable, and sustainable ways during and beyond global emergencies like the COVID-19 pandemic.[33]

Some studies have documented the influences of mHealth adoption at different health system levels.[34,35] For instance, health systems in low-resource settings often lack critical elements of implementation readiness. A lack of motivation and perception that technology adoption adds extra tasks to their typical responsibilities are familiar sources of provider resistance.[35] However, when interventions are easy to use, providers show improved willingness to implement.[18] Readiness for implementation, e.g., through the availability of training, also influences the adoption of mHealth and has been shown to vary by cadre of healthcare workers or type of stakeholders within the health system.[35–37] Technological issues within the broader system, such as limited bandwidth, fluctuating network coverage, and stable power supply, are hallmarks of hospitals in LMICs and are especially problematic in rural areas.[20,34] Although literature describes

mHealth adoption determinants, there are still gaps in our understanding of how these determinants differ pre- and post-pandemic.[20,21,30] Specifically, before the pandemic, mHealth mainly supplemented, not replaced, in-person health services, and at present, the literature seldom distinguishes between optional versus mandatory mHealth use and the associated implementation factors. Laws and policies or mandates governed movement and access to various public amenities, provider redistribution within hospitals, and budget infusions to support the rapid roll out of mHealth initiatives, and likely encouraging fast adoption, especially in the early phases of the pandemic.[20,21,34] However, it is unknown how mHealth implementation and its determinants differed under optional use conditions during the pandemic.

In this study we sought to understand the utilization of mHealth and what factors drove the level or pattern of use when providers had the flexibility to pivot back and forth between in-person clinic visits and phone delivery. We applied qualitative methods to identify determinants influencing phone calls for delivering a youth transition support intervention, the Adolescent Transition Package (ATP), to youth living with HIV (YLH) during the COVID-19 pandemic in Kenya. Phone calls were an alternative approach to intervention delivery, and providers had the flexibility to pivot back and forth between in-person and phone delivery of the intervention. We enumerated the frequency of phone call use and the degree of success with this strategy defined by calls that reached YLH. We then examine providers' experiences to identify barriers and facilitators influencing phone use by applying a metatheoretical determinants framework, the Consolidated Framework for Implementation Research (CFIR), which is commonly used in Implementation Science to evaluate implementation determinants.[38] This study offers additional

perspectives on adopting phone calls and other mHealth applications, offering practical solutions for minimizing breaks in the continuity of HIV care for YLH and other key populations.

2.3 METHODS

2.3.1 *Study design*

This study applied qualitative methods to identify determinants of phone call use for the delivery of the ATP. Phone use was implemented between June 2020 to February 2021, although COVID-19 restrictions were relaxed in October 2020. Interviews were conducted post-trial to identify associated with phone implementation.

2.3.2 *Theoretical Framework*

The analysis of barriers and facilitators was guided by the Consolidated Framework for Implementation Research (CFIR), a determinants framework that is useful for identifying factors influencing implementation outcomes, and guiding process evaluations.[39,40] This framework supports systematic organization and interpretation of factors influencing implementation within dynamic, real-world settings. It offers a common language for describing determinants, supporting comparability of emergent determinants across different studies, contexts, and thematic areas. The CFIR consists of 39 constructs grouped into five domains. We hypothesized that salient determinants would emerge from the intervention characteristics (relative advantage, adaptability, and complexity), characteristics of individuals (knowledge and beliefs about the intervention), and inner setting domain (implementation climate, readiness for implementation), and thus focused the development of question guides on these domains. The CFIR then served as a backbone for initial drafts of a codebook developed to guide a directed content analysis of the interview data.

2.3.3 *Setting and population*

The ATTACH study was conducted in Kenya in Nairobi (n=3), Homabay (n=3), Kajiado (n=2), Narok (n=1) and Nakuru (n=1), with estimated HIV prevalence of 3.8%, 19.6%, 4.6% and 3.0%, respectively.[24] The study took place at twenty government-sponsored clinics which were selected based on location, size (>500 clients in care, and ≥ 50 AYLHIV in care), use of electronic medical records (EMR), and willingness to participate. Using restrictive randomization to balance clinic-level variation in facility characteristics, ten clinics were randomized to receive the ATP intervention while ten maintained the standard of care. Intervention sites were mainly sub-county hospitals or health centers, and prior to the pandemic, most had used phones for client engagement, primarily for client visit reminders. Additional information describing intervention sites has been published elsewhere.[23,41]

2.3.4 *The Intervention and implementation strategy*

The Adolescent Transition Package (ATP), comprising disclosure and transition tools, was built around two primary resources: 1) the Namibia comic book for disclosure, and 2) the Got Transition tool kit. [42,43] The disclosure tool kit comprised the comic book, readiness, and tracking tools, and a HCW training module. The transition tool kit included a transition flipchart, readiness assessment, and transition progress tracking tool. A set of training materials to support implementation was also integrated into the packet. Intervention exposure was continuous, with benchmarks for assessing progress at each chapter. During the pandemic, HCWs delivered the ATP via phone call following a monthly cadence. Calls took a maximum of one hour and were initially scheduled during regular clinic hours. Calls began with HCW introduction and brief inquiry to check if YLH were able to talk. HCW then discussed relevant sections of the ATP. Phone delivery was

subject to a continuous quality improvement exercise to optimize implementation for a period of six months.

2.3.5 *Sampling*

All intervention facilities were included in the tracking of phone calls related to implementation of the ATP. For interviews to assess determinants of implementation, we sampled from all HCWs participating in the study who were recruited from among clinic staff working with youth living with HIV at all intervention sites. Cadres of HCW included medical officers, nurses, clinical officers, counselors, social workers, and peer mentors. At each site 5 HCW were selected to participate in in-depth interviews, to meet a minimum sample size of 50 interviews across all sites.

2.3.6 *Data collection*

HCW documented all calls including those that did not reach YLH. Call data were documented in an electronic Redcap-based form and included the following variables: facility name; provider id; date and time of call; if call reached YLH; if their phone was charged and whether they were in a conducive environment; whether the call was successful; the ATP chapter discussed; call duration; and where relevant, reasons why calls were not successful. We conducted in-depth interviews from March to May 2021 using open-ended semi-structured guides. We assessed overall perceptions of the phone strategy, experiences with disclosure and transition over the phone, barriers, facilitators, and recommendations for future implementation of phone-based ATP delivery. To meet this goal, we used open-ended, semi-structured questions with probes to

illicit overall impressions and determinants of implementation delivery. The guides were developed in line with a limited number of CFIR constructs. Guides were validated by study staff who used mock scenarios to pilot test the tools, examining suitability of content and testing different ways presenting probes. Interviews were audio-recorded and took 45 minutes to 1 hour. Discussions were held in English, Kiswahili or the providers' preferred language and were audio recorded. Participants filled a brief survey collecting socio-demographic data, background information on experience providing clinical care, assess intervention training, uptake of tools and perception of tools, before the interviews began.

2.3.7 *Data analysis*

We used descriptive statistics (counts and proportions, medians, and interquartile ranges [IQR]) to summarize characteristics of phone calls. We also summarized call characteristics such as duration, rate of adoption per week, and chapters of the ATP was discussed during a call.

Interview data were analyzed using directed content analysis, applying a mix of inductive and deductive approaches.[44] An initial codebook with an extended list of determinants from the CFIR, including a selection of newly proposed constructs from a recent systematic review that assessed the use of the framework in low- and middle-income countries (LMIC) was made (DM).[45] The codebook was tested on a few transcripts to identify areas for improvement. (DM, KBS, CM) Additional codes reflecting other themes not already represented were inductively added, and definitions clarified before repeat testing (e.g., disclosure, transition, recommendations). Once the codebook was finalized, a team of coders participated in consensus coding to standardize application of the codebook (DM, NC, MM, CM, KBS). Transcripts were then divided amongst

the coding team for independent coding, ensuring that each transcript was double coded. Consensus meetings were held to evaluate consistency of code application, identify disagreements, and refine the codebook as needed. Group consensus was used to resolve discrepancies in coding. All analysis was conducted in Atlas.ti.[46] Queries and code co-occurrence tables were used to summarize findings, identify key determinants, messages and quotes associated with relevant CFIR constructs.

2.3.8 *Research Ethics*

The study population included Data collection will be done at several time points during the study. The study is a partnership between the University of Washington, Kenyatta National Hospital (KNH), and University of Nairobi (UoN). Participating HCWs were provided written consents.

2.4 RESULTS

2.4.1 *Characteristics of phone call implementation*

We enumerated a total of 1,444 call attempts across all sites, 82% of which successfully reached the respective youth being contacted, and 79% of which included exposure to the ATP booklet (Table 1). Out of all calls reaching youth, phones were almost always charged (99% of calls), and youth were frequently in locations conducive for completing the call (97% of calls). The median number of calls made per week was 14 (IQR: 6 – 31) while the median duration of the calls was 15 minutes (IQR:10 - 20). However, over time, there was considerable fluctuation in

call attempts and ability to successfully reach youth throughout the observation period. Figure 1 summarizes the number of calls made per week across all sites.

Table 2.1. Summary of phone call implementation

Call characteristics	**N, % or median, IQR**
Enrolled youth (n)	603
Call attempts (n)	1444
Weekly median attempt (median, IQR)	14 (6 - 31)
Duration in minutes (median, IQR)	15 (10 - 20)
Call attempt reaching (n, %)	1180 (82%)
Phone was charged (n, %)	1176 (99%)
Conducive environment (n, %)	1148 (97%)
Successful calls with completed ATP (n, %)	1137 (79%)
Chapter 1	142 (12%)
Chapter 2	291 (26%)
Chapter 3	266 (23%)
Chapter 4	247 (22%)
Summary	143 (13%)

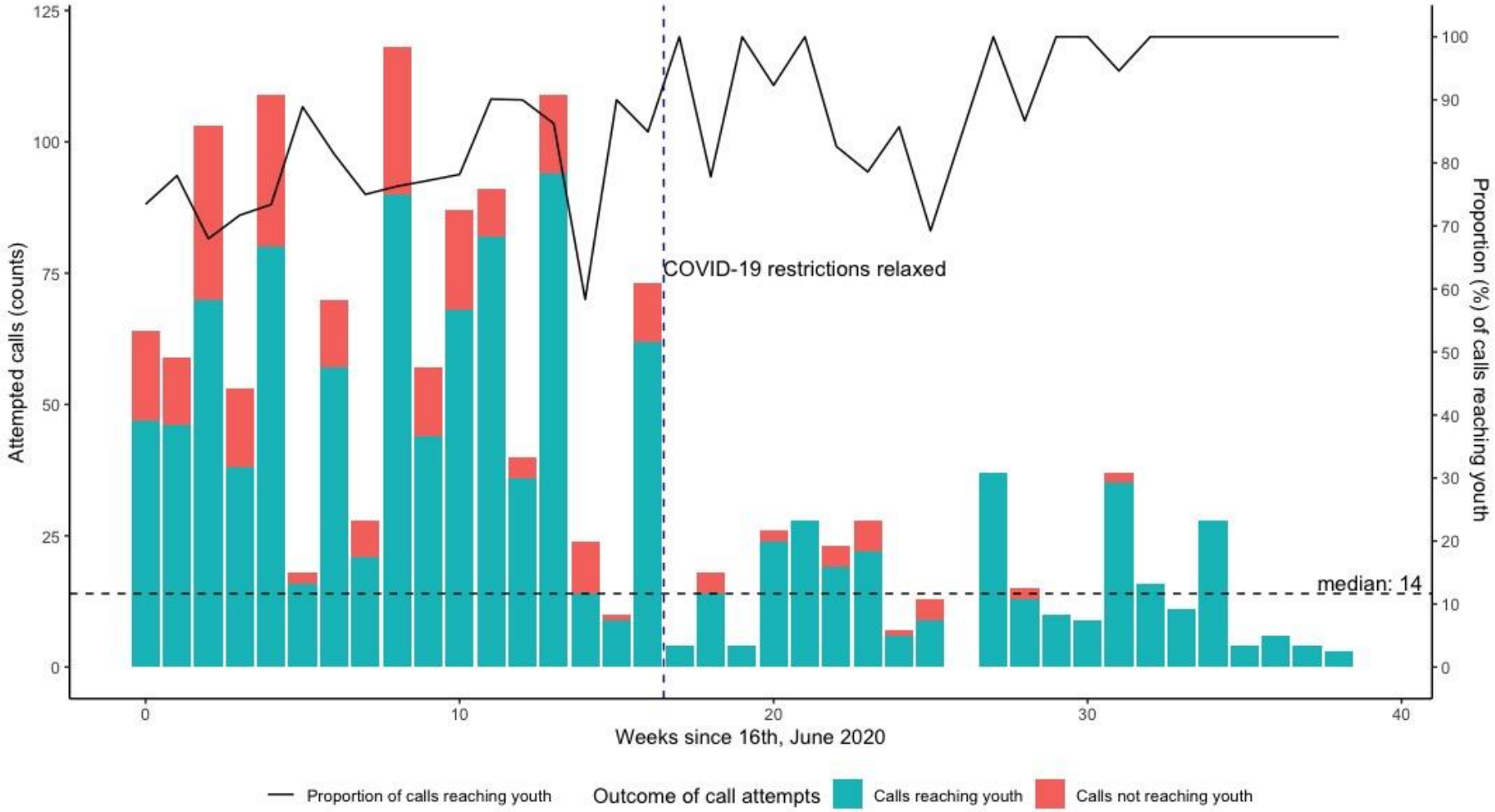

Figure 2.1. Summary of implementation of the phone call strategy

2.4.2 *Characteristics of providers participating in interviews who contributed in-depth interviews*

We interviewed a total of 50 providers. Providers were mostly female (68%, n=34), with a median age of 35 (IQR: 30 - 44), and with a polytechnic or college level education (56%, n=28) (Table 1). Most providers had been providing HIV care to youth for a median of 6 years (IQR: 3 - 8) and were primarily located in the comprehensive care clinic (CCC) at their respective facilities.

Table 2.2. Characteristics of providers participating in interviews

Characteristics(n=50)	**N, % or median, IQR**	
Sex		
Female	34	68%
Age (median, IQR)	35	30 - 44
Cadre		
Clinical officer	5	10%
Nurse/Nurse counsellor	7	14%
Counsellor	10	20%
Peer counsellor/Youth champion/Mentor	17	34%
Records and linkage officers	5	10%
Other	6	12%
Number of years of education (median, IQR)	15	12 - 16
Highest level of education		
Primary	1	2%
Secondary/High school	16	32%
Polytechnic/University/College	28	56%
Other	5	10%
Primary location of work		
Comprehensive care clinic (CCC)	35	70%
Other	15	30%
Years worked at the clinic site (median, IQR)	4	2 - 6
Years providing HIV care (median, IQR)	6	4 - 10
Years providing HIV care to youth (median, IQR)	6	3 - 8

2.4.3 *Qualitative findings*

All providers interviewed reported experience delivering the ATP by phone and felt phone delivery was generally acceptable and feasible. Despite a range of study locations, identified determinants of ATP implementation were consistent across all sites. Key influences on perceived acceptability, perceived feasibility, and reach were identified mainly within intervention characteristics and inner setting domains of the CFIR (Table 3). Specifically, the most influential barriers were related to complexity, readiness for implementation, and community, while the most influential facilitators included relative advantage, adaptability and patient needs and resources constructs. Providers had mixed opinions about continuing with phone delivery of the ATP after the pandemic.

Design quality and packaging, relative advantage and patient needs and resources constructs were primary drivers of phone delivery acceptability

Most providers reported persistent challenges with delivering the ATP by phone, which negatively impacted the acceptability of the phone strategy. First, due to their limited ability to assess youth comprehension and engagement during phone calls (design quality and packaging), inability to curate or safeguard youths' environment during calls (patient needs and resources) and problems maintaining their engagement throughout the discussion session (executing, complexity). Without visual cues, providers were left to speculate about whether clients were actively listening and understanding the material.

> "Sometimes you can call someone; she hears you but you wonder whether she is understanding anything because she is not responding, she is just quiet, you wonder 'does she really understand what I am teaching her?'"
> 35-year-old, female link person, site G

> "From my side we are able to do quality work when adolescents attend the clinic, yeah, because just the way I said, you are able to see adolescents' reactions, their feelings when you are one on one with them, unlike when you are doing it via phone calls, yes."
> 31-year-old, male counsellor, site D

Providers underscored that acceptability of the phone delivery strategy was further complicated by the inability to share pictures in the ATP booklet in real time, barring effective communication and comprehension during sessions. However, this was not a universal concern for all adolescents. Providers noted that calls with youth with more understanding or who were more open were easier than calls with youth lower literacy levels or were fearful or unwilling.

> "I: So, in your experience, the use of phones is dependent on the client. With some clients, it is easy to do transition over the phone, but with others it is not easy.
> R: It is not.
> I: Does this depend on the factors you had mentioned previously? If they have disclosed, or if they have time?
> R: Yes, it is. Also, the understanding, you may be calling and tell them this is this and they keep saying yes, but if you ask them, they haven't really gotten it." 26-year-old female youth champion, site A

In contrast to these identified challenges, many providers felt that phone calls granted some youth greater freedom and anonymity (relative advantage), encouraging greater openness from, and authentic interactions with certain youth. Providers noted that some youth revealed more intimate information about their lives and the challenges they were facing at home via phone when compared to in-person. This allowed providers to personalize care for individual youth and laid ground for stronger provider-client relationships, promoting the acceptability of phone calls.

> "We were able to reach our adolescents, we were even able to bond with them like that adolescent I was talking about, when he come to the clinic he insisted that he just want to be seen by X [provider's name mentioned] because he knows there is something he disclosed that the others don't know. I want to be seen by someone specific they are even free right now. So, if an adolescent comes and has already been seen by a clinician and still insists on seeing one particular person they are simply directed to that so and so. So, we created bonds with them and we have had small psychosocial groups within us, so we are able to assist each other as a group and move ahead." 26-year-old female youth champion, site F

Providers noted that phone calls were efficient, allowing them to call "quite a number of adolescents within a very short time" and to dedicate additional time to other clients as needed. When compared to in-person clinic visits, phone calls also provided an advantage because they were fast, required only a few steps, and could be done at "any time" and from any location (relative advantage). In addition, many providers felt like ATP delivery by phone was technical simple and easy to do (complexity). Most providers viewed phone delivery as being aligned with pre-existing clinic goals and activities (compatibility). Phone calls provided an avenue for enhancing patient follow-up and establishing continuity of care beyond existing mechanisms at the facility (knowledge and beliefs about the intervention). Thus, they were motivated to make calls to ensure that youth received their medication, support to maintain viral suppression, and to be retained in care.

> "To me that [phone calls] is the way to go because I am looking at these adolescents, we are giving a TCA [time to clinic appointment] of 3 months, who is monitoring them within these 3 months out there. But if I can even make a follow up call twice in a month, once in a month, at least that one keep them engaged."
> 47-year-old, female counsellor, at site E

Providers perceived that phone implementation aligned with differentiated service delivery of HIV care and was therefore worth continuing to implement post COVID-19.

> "[P]art of our HIV implementation of care, we have something called differentiated service delivery. We don't want out clients to keep coming all the time to the clinic unless it is necessary, …….So for us we would really like to continue using the mobile phones so that our adolescents continue with their normal lives, they don't come to the clinic frequently because adolescents are curious."
> 32-year-old, female counsellor, site I

Available resources, compatibility, and team characteristics influenced perceptions of ATP phone delivery feasibility

Perceived feasibility of phone calls varied based on the availability of client contact information (readiness for implementation - access to information), access to clinic phones, and sufficient airtime (readiness for implementation - available resources). Providers indicated that they were often, particularly in the earlier phases of implementation, unsuccessful at delivering the ATP by phone because they did not have accurate and current contact information for youth. Where contact information was available, youth tended to be available in the evenings for a limited time when their caregivers were home, which was incompatible with provider work schedules (compatibility)

> "First, the adolescents don't have phones, so they have to use the parents. So that was a challenge because the phone is not theirs and time is limited. When you are free, they are not free. So, you must squeeze in their time. When they are free is when you do the session. And because you are using their time, you wouldn't have a quality session, because you have something else." 46-year-old female peer counsellor, site D

In addition to incompatibility of the phone strategy with providers' work hours, each site only had access to one phone, limiting the time when each provider could make calls (readiness for implementation: available resources). Lack of phones introduced coordination challenges and limited feasibility at some sites.

> "….[W]e were using one phone and you find that if a colleague has the phone now you have to cut his or her sessions in order to access the phone, it was a bit challenging. So there was conflict of interest concerning the phone. Some could think that maybe you were accessing the phone for your personal use and yet you were doing some sessions with the clients, yes."
> 30-year-old, male clinical officer, site D

> "No, there are not enough phones. There is only one phone. I may have made appointments for 7pm and another one for 8pm, and my colleague has also made an appointment for 8pm on the same day. So, you'd find that we'll miss an opportunity because there is only one phone. So, if there were additional phones, we would be very happy and that would make the provision of service better."

42-year-old, female peer counsellor, site I

Given these challenges, a few providers felt that implementing calls "was too tedious". There were those who felt that delivery of the ATP via phone should stop but the phone should be kept for other uses like providing clinic visit reminders, urgent messages about viral load results or medication pick-up. Others recommended including material in the discussion about sexual risk behaviors and integrating adequate planning activities like calling or text-messaging in advance to prepare the youth in advance of the ATP discussion session.

The ability to tailor how and when they delivered ATP content, (adaptability) together with good pre-existing relationships and communication between provider teams (networks and communication), helped overcome feasibility barriers. For example, to overcome the challenge of having one phone per facility, providers in several clinics created call schedules, delineating when each provider would have access to the clinic phone.

> "Yeah. It changed how we organized ourselves on how we were going to use the phone. For instance, if I take the phone today, I use it for a certain duration and give it to my other colleague...Like now we don't interrupt. When I start my session there's no, and then like a specific adolescent whom I'm assigned to, now it is my interruption responsibility to organize myself with them on how we're going to handle our session. So there is no interference with the other healthcare workers, like our colleagues"
> 34-year-old, female counsellor, site I

Facility-level characteristics like the presence of diverse collaborative teams (team characteristics) with established communication networks and accountability (networks and communication), who felt capable to use the phone strategy (collective efficacy) were linked to improved perceptions about feasibility. Providers felt that care teams, comprised of individuals with clinical and non-clinical expertise, who felt confident to make calls, were able to work

collaboratively, and consistently communicated implementation goals and challenges were likely to find phone delivery more feasible.

Patient needs and resources and community factors mediated the reach of phone calls by influencing access to phones and willingness of youth to receive calls

In addition to limited provider access to phones, many youth also did not own their own phones (patient needs and resources). Youth often relied on borrowed or shared phones, owned by their treatment supporters (primarily caregivers or spouses), which placed restrictions on when and how providers could reach the youth.

> "Number two, some adolescents were not able to be reached on the phone. Maybe you call and the persons phone is off or other time you call and it's their guardians phone number that you are using, they are using as well so you have to wait for the parent to go back home so that you can call then you take the adolescent through the book." 30-year-old, male clinical officer, site B

Providers described situations where negative relationship dynamics between the youth and treatment supporter resulted in them being denied or delayed access to a phone.

> "Most adolescents had bad rapport with their caregivers. So they were giving wrong numbers. So when you call you find that a different person picks. On the PMTCTs [prevention of mother to child transmission] side, most of them gave their spouses' phone numbers. So when you call you find the spouse, yet I have no business with the spouse" 25-year-old, male counsellor, site A

Some HCWs described specific instances where spouses or caregivers who would refuse to grant the youth privacy during calls.

> "At times you will call the parent and the parent would put you on loudspeaker, because the parent also wants to know how this thing goes…."
> 38-year-old, male counsellor, site A

Anticipated stigma, relationship conflict or rejection from caregivers or spouses following disclosure of HIV status (community) also pushed youth to refuse or postpone phone calls, negatively impacting the reach. Specifically, lack of disclosure of HIV status posed barriers to reaching youth who were only available via a shared phone. A provider described an example where a youth's HIV status was unintentionally disclosed to their spouse when they received a call from the providers. However, this did not cause the relationship to end, but instead resulted in HIV testing of the previously undiagnosed partner.

> "In fact, they give us their partners numbers and they've not disclosed their status. I'd say that was a very big challenge on us because you are calling and then, 'I'm calling you from FITC dispensary.' 'Hospital, she was in hospital?' so it becomes…they start suspecting…yes but something funny, it was so positive the partners had to come with the client, so it was a positive on us because we tested more. It was a positive on us."
> 30-year-old, female counsellor, site G

Despite potential benefits of providing continuity in care, limited access to clinic phones negatively influenced perceptions of continued longer-term implementation.

Table 2.3. Determinants influencing implementation of phone calls with representative quotes

Outcome influenced	Domain and construct	Determinants (Example with relevant quote)
Barriers		
Acceptability	Intervention characteristics: Complexity, design quality & packaging	Inability to properly assess youth "…On the phone there is no that visual thing so you can't tell whether the person has understood what you guys are talking about" 35-year-old, female nurse at site H
	Intervention characteristics: Complexity, design quality & packaging	Limited ability to curate or safeguard youths' environment "But using mobile phones may sometimes be a challenge. You may call and the adolescent is not in a conducive environment, so they want to give you a time that is convenient to them which may not be convenient to you." 30-year-old, female clinical officer at site F
	Intervention characteristics: Complexity	Maintaining engagement of youth during calls "But when you start talking about HIV you may start feeling as if that person is not there they don't want to be told such stories. They don't want but you can start with different stories explain to them that's when you can start talking about HIV." 26-year-old female peer counsellor at site I
	Intervention characteristics: Complexity	Inability to share the ATP pictures in real time "You know they don't see the pictures, so you see now it was just hard. It was very hard, we just tried It was not easy because you are telling them there is a bad guy, "I have a book here I am teaching, there is a bad guy here" and he doesn't see this bad guy, "this bad guy is killing the good the body soldiers who are the good guys for you" but he doesn't see. So, it was not easy." 40-year-old, female mentor mother at site H
Feasibility	Outer setting: Technological environment	Poor/fluctuating network connectivity and limited access to charging stations "Sometimes there are those who travelled to the rural home; when you call them there is a network problem. So it reached a point we couldn't get to many of them" 38 year old female mentor mother at site G
	Outer setting: Patient needs and resources	Variable phone ownership: lack of or shared phone ownership "We might want to continue using the phone but the challenge is that most of the adolescents here don't have their own personal phones, so it is still going to be a challenge." 38-year-old, female mentor mother 46-year-old female peer counsellor at site D
	Inner setting: Readiness for implementation: Access to Knowledge and Information	Missing, outdated or incorrect YLH contact information (feasibility and adoption and reach) "Weeeh! Wrong numbers…wrong numbers. They don't give us correct numbers. And during that time so many people lost their jobs so they had to vacate from XYZABC to somewhere where there's no internet, they have given you a wrong number so you can't get hold of them, and then the CHV does not know…has never even heard of that kind of a person living in a certain area. So those were the challenges we had the biggest challenges we had." 30-year-old female counsellor at site G
	Inner setting: Readiness for Implementation: Available resources	Providers had limited access to phones and finite amount of airtime to make calls "Another disadvantage was that we used to share one phone. Everybody could scramble for that phone in order to talk to the client, yes." 30-year-old male clinical officer at site D

Outcome influenced	Domain and construct	Determinants (Example with relevant quote)
Barriers		
Feasibility	Inner setting: Compatibility	Incompatible schedules/scheduling preferences "First, the adolescents don't have phones, so they have to use the parents. So that was a challenge because the phone is not theirs and time is limited. When you are free, they are not free. So, you have to squeeze in their time. When they are free is when you do the session. And because you are using their time, you wouldn't have a quality session, because you have something else." 46-year-old female peer counsellor at site D
Reach	Outer setting: Community	Poor relationships with treatment supporters "some of these caregivers are not that friendly with the adolescent, it is just a picture created to fool you maybe in the clinic but at home it is a different case. So you may call wanting to assess the adolescent but because of some unreported issues they don't to be disclosed they may lie or they may insist that the adolescent talks to you in their presence." 35-year-old female counsellor at site E
	Outer setting: Community	Lack of disclosure, fear of unintended disclosure and anticipated relationship conflict "Now the numbers we are having, they don't belong to the person who is taking ARVs to us, belongs maybe to the partner. This lady is 21, she is married and the partner has never known whether they are using ARVs or not, so if you have to call and introduce yourself and you call yourself a counsellor in a certain facility, already it has raised eyebrows." 30-year-old female counsellor at site G
Facilitators		
Acceptability	Intervention characteristics: Relative advantage	Better capacity to offer personalized care "The other thing is that you use it at the adolescents' convenience and comfort once you agreed on the time. We would ask them, 'when can I call you?' but at the clinic here you know there is a queue, you may not entertain many questions yeah for a particular client because you are competing with time. So the phone is more personalized" 48 year old female counsellor at site F
	Intervention characteristics: Design, quality, and packaging; Relative advantage	Conferred anonymity to youth leading to comparatively higher openness and authenticity of youth " it made you to have some information that you never had before because adolescents opened up, and now you were able to understand them more and offer them better services" 44 year old male peer counsellor at site E
	Characteristics of individuals: Other personal attributes	Provider motivation/willingness "To me that [phone calls] is the way to go because I am looking at these adolescents, we are giving a TCA of 3 months, who is monitoring them within these 3 months out there, but if I can even make a follow up call twice in a month, once in a month at least that one keep them engaged." 47 year old female counsellor at site E
Feasibility	Intervention characteristics: Relative advantage	Expedient, easy, convenient, efficient, and time saving (acceptability and feasibility) "It was convenient because I could use it at any time I am free as compared to physical appearance with the client. It was time effective, yes. I could take less time and do a small session with a client and they understand the whole process" 30-year-old male clinical officer at site D

Outcome influenced	Domain and construct	Determinants (Example with relevant quote)
Facilitators		
	Outer setting: Community characteristics	Presence of, and relationship with treatment supporters who offered access to phones and encouragement to providers to continue "But now we took the parents through the session on why we need to have these children when they cannot attend their clinics, there is that provision of the online in that we can talk over the phone, I've gotten around three parents that have acquired these simple mobile phones for their adolescent." 38-year-old male counsellor at site A
	Intervention characteristics: Adaptability	Flexibility of the strategy to overcome implementation challenges "It gave us time because sometimes when we do it one on one and there is also queue that we need to push, usually we do rush so that we can attend to the next person, but just as I had told you, we used to deliver it at our own free time. We could now go through all of it and even as if they had any additional question and they would say that they did not have. So we had enough time with them and it also gave us time to do other things in the afternoon…and again, we also used to call even at night because there are some adolescents who use the caregivers' phones." 30 year old male nurse at site E
Feasibility	Inner setting: Compatibility; complexity	Good fit with existing workflow, capacity and responsibilities: small to no changes in were required "For me I don't think it changed the work flow because at that time we had planned becausae if Covid, that is the direction we were taking. So during that period it didn't change the work flow, the only thing is that we shared to every health care workers some number of adolescents whom we supposed to make calls to, come back, sit down and share the experience then do the follow up after maybe two weeks and share the experience. But in terms of the workflow, it remained the same." 36-year-old, male nurse at site D
	Characteristics of individuals: Self-efficacy	Providers were confident of their abilities to implement the calls, while addressing many youth preferences " When I start my session there's no..interruption and then like a specific adolescent whom I'm assigned to, now it is my responsibility to organize myself with them on how we're going to handle our session. So there is no interference with the other healthcare workers, like our colleagues could understand and the adolescent could understand" 34 year old female counsellor at site I."
	Inner setting: Team characteristics, collective efficacy, networks, and communication	Diverse collaborative teams with established communication networks and accountability, who felt capable to use the phone strategy "But after we sat down, we knew the challenge. So that is how we planned ourselves. You when you have your clients scheduled tell us we give you the phone. I: Okay. R: And you should not schedule two people at the same time." 30-year-old, female clinical officer at site F
Reach	Outer setting: Community	Fear of unintended disclosure and anticipated stigma " It cannot because those mothers the phones are not theirs and you may not know why the husband has not bought for her the phone. You cannot know the reason for her to lack the phone." Yes the spouses start suspecting…but something funny, it was so positive the partners had to come with the client, so it was a positive on us because we tested more. It was a positive on us" 30-year-old female counsellor at site G

Outcome influenced	Domain and construct	Determinants (Example with relevant quote)
Facilitators		
	Patient needs and resources	Youth cooperation and openness "What I liked about using the mobile phone is that adolescents were free, they talked so freely and they could tell you anything, but when you are face to face sometimes they would feel shy but on phone you know you are not seeing each other. " 46-year-old female peer counsellor at site D
Sustainability	Intervention characteristics: Perceived sustainability, resource continuity	Potential long-term approach for managing stigma for youth fearful of coming to clinic "It really affected because during the times when there was no COVID, every adolescent would attend the clinic on his or her appointment date. But now with COVID, others travelled, others went back home, so finding them became difficult. Unless now you talk to them over the phones. Others, their parents lost their jobs and forced them to go back to the rural homes. Others say they don't have fare because they've lost their jobs. So it has really affected. Appointment keeping-some were not keeping their appointments." 30-year-old female counsellor at site G

Figure 1 summarizes salient determinants of phone delivery of the ATP identified by providers by relevant CFIR domains.

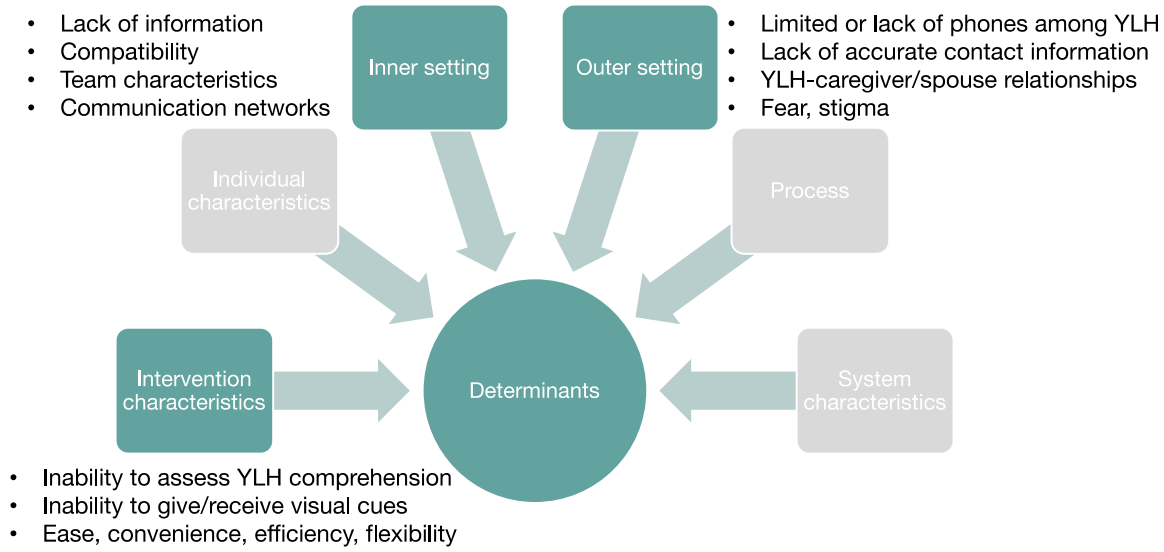

Figure 2.2. Summary of key determinants of phone delivery of the ATP, highlighting the main CFIR domains emerging from the IDIs

2.5 DISCUSSION

This study explored the utilization of phone calls by providers to deliver the Adolescent Transition Package and identified determinants of implementation in the context of the COVID-19 pandemic where the providers had the flexibility to decide between delivering the ATP via phone or defaulting to in-person visits. The application of CFIR as an organizing framework supported our understanding of the providers' experience implementing phone calls and positions our work well within the implementation science literature describing how and why mHealth strategies succeed or fail. The main findings indicate that implementation of phone calls was generally acceptable and feasible. The technical simplicity of phone calls, relative convenience, and efficiency (intervention characteristics) they offered were facilitators of implementation success. Inner setting characteristics such as collaborative teams, individual and collective efficacy to complete tasks, and compatibility of phone calls with the providers existing responsibilities also played a role in driving implementation. Limited phone ownership among youth (patient needs and resources) and a lack of up-to-date contact information (implementation readiness), and the inability to properly assess youth during calls or obtain visual cues (intervention characteristics) were identified as critical barriers.

The use of CFIR to evaluate mHealth facilitated the exploration of multi-level determinants of phone call implementation. Other studies have used the same framework to explore the link between implementation factors, digital health technologies and outcomes.[47–49] A scoping review examining factors associated with global telehealth implementation from sixty-four qualitative and mixed-methods studies using CFIR identified specific inner setting attributes like the availability

of resources, goals & feedback, leadership engagement, readiness for implementation, and implementation climate, to be most influential for implementation success.[47] On the other hand, the outer setting determinants (patient needs and resources, laws and policies) had the least influence. Most of the studies reviewed described implementation of mHealth in specialty clinics providing clinical care rather than patient education, disease surveillance, or behavior change support, and majority focused on mental health. In contrast our study focused on HIV care for YLH and mHealth was used for patient education. Different from the review, we identified that intervention characteristics played a prominent role in determining implementation success, followed closely by inner setting characteristics. Intervention characteristics emerged as crucial for the providers in our context because ease and convenience may have been important for motivating or demotivating them, and actualizing workplans given the other complexities they were facing at the time such as the abruptness with which the use of phone calls was introduced, competing tasks, and operating in high-burden, low-resource clinics and having a low technological skills-base. Additionally, the urgency of mitigating breaks in the continuity of care for YLH may have driven the prominence of intervention characteristics like ease, speed, and convenience, as the providers scrambled to reach clients for other purposes like organizing for medication refills, evaluating adherence, and re-establishing care among those who had missed clinic visits.

In our study, the providers benefited from the ease, convenience, flexibility, and expedience offered by the phone calls, but expressed concerns about the reach and overall effectiveness of phone calls for teaching YLH. While they were able to attempt calls easily and quickly, a low rate of phone ownership among youth, and the inability to observe visual cues or

share pictures associated with the ATP material were disadvantages and were the main reasons why several providers would sometimes revert to inviting clients back to the clinic. The adaptability of phone call implementation was impactful, offering opportunities to make adjustments that overcame some implementation barriers, and improving acceptability and feasibility over time. This may explain the improvement in adoption of phone calls over time. Our study also showed that the anonymity that phone calls conferred to youth was perceived to beneficial, resulting in youth being more open about their challenges, and strengthening of the provider-patient bond.[50,51] This also supported the providers to offer more personalized care. The contribution of phone calls and other forms of mHealth towards personalized medicine for YLH in sub-Saharan Africa is an interesting prospect that warrants exploration.

Like other studies, we identified strong determinants within the inner setting.[47] It was easy for the providers to integrate phone calls into their workplans, and the connection it established with youth supported the implementation of differentiated delivery of HIV care following policies that restricted access to clinics. The composition and collaboration of the implementation teams, and individual and collective self-efficacy with the phone strategy further supported implementation by positively influencing feasibility. Some studies have noted the opposite whereby providers report low confidence in their ability to implement mHealth because of limited skills or a lack of training.[21,34] Related to the inner setting, limited access to phones, missing or wrong contact information and insufficient airtime were resource constraints identified in the study, and except for the lack of contacts, were consistent with literature reporting barriers influencing the feasibility of mHealth.[37,47,52]

Unlike other studies, the influence of specific telehealth policies did not come up during the providers' interviews.[34,49,52] Instead, we learned that overall, COVID-19 movement restrictions served to both support and limit implementation. On the positive side, the closure of institutions ensured that youth were at home and more readily available to have discussions with providers over the phone than if they were occupied at school or at work. On the other hand, the massive shutdown of society resulted in the abrupt relocation of some youth and their families to rural areas where phone access, network connectivity and electricity were absent or unreliable. This exacerbated equity issues that were also emerging from the challenge of low phone ownership among youth. While many studies have identified this problem, a practical solution that also supports the need for autonomy among youth is still elusive.[53–55]

The social context of youth appeared to be a significant factor associated with the outer setting. Our results showed that the presence of treatment supporters like caregivers or spouses often interacted with other determinants to influence implementation of calls. We noted the influence of negative relationship dynamics, perceived and anticipated stigma and fear of unintended disclosure in reducing the reach of the strategy despite providers' attempting phone calls. In contrast the presence of supportive relationships between youth and their caregivers or spouses, and youth having disclosed their HIV status mediated access to phones and contributed to the promotion of supportive conditions which encouraged youths' engagement with providers via phone. These and other similar dynamics have been discussed in the youth HIV literature.[10,54,56–59] Lastly, we observed that providers were primed to recognize and respond to YLH needs to the best of their ability (patient needs and resources). This is suggestive of a youth-friendly practice at participating facilities and is encouraging considering previous reports

describing significant challenges in establishing youth friendly care in sub-Saharan Africa.[3,60,61] Provider sensitivity towards youth needs coupled with the flexibility of the phone strategy for implementation drove the introduction of provider-led adaptations to mitigate implementation barriers.

Our results can inform future implementation of mHealth for youth in sub-Saharan Africa. The barriers and facilitators identified here could be used to guide facility-based assessments at all phases of implementation but especially in the pre- and early implementation phases to improve the acceptability, feasibility, and reach of similar strategies. For example, in retrospect, an evaluation in the pre-implementation phases would have revealed that most clinics did not have accurate or up-to-date contact information for YLH registered at their clinics. An early audit of potential determinants would have also gauged mobile phone ownership among youth, identified suitable treatment supporters and accounted for other patient preferences for learning via phone calls. Future initiatives that seek to apply phone calls and other forms of mHealth in a similar way may focus on establishing implementation readiness via ensuring adequate training and resources are available, including enough phones, clear guidance for providers on how to teach or discuss about HIV with youth on phone and how to incorporate elements that support comprehension and retention among youth. It will also be critical to explore new initiatives targeting caregivers, spouses, and other treatment supporters, to better equip them on best practices for facilitating YLH engagement in care.

Some strengths of this study include the use of in-depth interviews to gather extensive information from multiple perspectives to enrich our understanding of implementation. This

enabled us to compile comprehensive information. Regarding the application of CFIR, the common language used to classify determinants supported the comparison of this study results with similar examples in the literature. Additionally, this paper adds to the body of knowledge demonstrating application of CFIR in LMICs. Lastly, we present an analysis of barriers and facilitators across facilities funded and managed by the Kenya Ministry of Health although the intervention was delivered in the context of a research study. The pragmatic design of the trial however adds to the generalizability of our findings as we engaged with real hospitals, providers, and clients.

This study had several limitations. Although plans had been made to quantitatively assess implementation outcomes to match perceived feasibility and acceptability, abrupt shifts in the study to accommodate COVID-19 restrictions at the onset of the pandemic curtailed this effort. Nonetheless, we can lean on the rich qualitative data to assess the perceived acceptability and feasibility of implementing phone calls from the providers' perspective. Second, while it was of interest to compare the use of phone calls and determinants influencing implementation between high and low performing sites, we were unable to so because the choice to implement phone calls was flexible and at the discretion of providers and the study did not establish a uniform metric of measuring implementation success. We were unable to determine a uniform denominator which would have allowed us to define success and properly assess differences in performance. However, our analysis of CFIR determinants showed that salient factors were consistent across sites. Furthermore, providers' documentation of calls excluded information linking calls to individual youth. Therefore, we do not know if multiple calls were being made to the same clients or if different clients were being reached each time a call was made. Some sites also had challenges

consistently reporting implementation given other responsibilities at the facility and some sites struggled to report their data in a timely fashion. During the study, implementation of phone calls was affected by the relaxation of COVID-19 restrictions. At this point, most providers across all reverted back to scheduling clinic visits and mHealth implementation declined at some sites. Despite this, we included all sites and all implementation reports in this analysis to assess how providers' behavior might change considering the added flexibility to return to normal service delivery via in-person clinic visits. Our evaluation of mHealth implementation was retrospective therefore we likely missed some information capturing real-time experiences. In addition to interviews and quantitative data, future studies may benefit from longitudinal use of time and motion studies to observe in real-time the experiences of providers, while documenting all elements of the inner setting at play in a single interaction. Time and motion observations will also provide data to support estimation of costs associated with mHealth strategies.

Despite these limitations, our results suggest that mHealth has great potential. For future implementation success, providers recommended improved access to the required resources and information, i.e., phones, airtime, and better network coverage. Better supervision of mHealth implementation efforts and integration of reporting into existing methods for record-keeping including existing electronic health records systems may encourage sustainment. Expansion to the use of WhatsApp may be necessary and is an eventuality given the growth in smart phone usage and its popularity as a communication platform that supports interactions via audio, video, text and sharing of graphics.[62–64]

2.6 CONCLUSION

We collected data on implementation of phone calls and interviewed providers of HIV care to YLH to examine associated barriers and facilitators during the COVID-19 pandemic in a context where the providers had flexibility to decide between scheduling in-person visits or engaging with youth remotely. The use of phone calls was acceptable and feasible, and where providers could make changes, they leaned on the flexibility of the implementation strategy to overcome hurdles. Determinants of implementation were consistent across sites. The characteristics and/or capabilities of phone calls relative to the goal of teaching YLH about the requirements of HIV care transition, availability of resources and information, the youths' access to phones and their relationship contexts, and team characteristics and workplans were important influences on the acceptability, feasibility and reach of phone calls. For the success of future mHealth initiatives, it is imperative that consideration be given to these factors to improve implementation success.

Chapter 3. CHARACTERIZING PROVIDER-LED ADAPTATIONS TO MOBILE PHONE DELIVERY OF THE ADOLESCENT TRANSITION PACKAGE (ATP) IN KENYA USING THE FRAMEWORK FOR REPORTING ADAPTATIONS AND MODIFICATIONS TO EVIDENCE-BASED IMPLEMENTATION STRATEGIES (FRAME-IS)

3.1 ABSTRACT

Introduction: The COVID-19 pandemic resulted in disruptions to routine HIV services for youth living with HIV (YLH), provoking rapid adaptation to mitigate interruptions in care. The Adolescent Transition to Adult Care for HIV-infected Adolescents (ATTACH) study (NCT03574129) was a hybrid I cluster randomized trial testing the effectiveness of a healthcare worker (HCW)-delivered disclosure and transition intervention – the Adolescent Transition Package (ATP). During the pandemic, HCWs leveraged phone delivery of the ATP and were supported to make adaptations. We characterized real-time, provider-driven adaptations made to support phone delivery of the ATP.

Methods: We conducted continuous quality improvement (CQI) meetings with HCWs involved in phone delivery of the ATP at 10 intervention sites. CQI meetings used plan-do-study-act (PDSA) cycles and were audio-recorded. Adaptations were coded by two-independent coders using the Framework for Reporting Adaptations and Modifications to Evidence-based Implementation Strategies (FRAME-IS). Adaptation testing outcomes (adopt, retest or abandon)

and provider experience implementing the adaptations were also recorded. We summarized adaptation characteristics, provider experience and outcomes.

Results: We identified 72 adaptations, 32 were unique. Overall, adaptations included modification to context (53%, n=38), content (49%, n=35), and evaluation processes (13%, n=9). Context adaptations primarily featured changes to personnel, format, and setting, while content and evaluation adaptations were frequently achieved by simple additions, repetition, and tailoring/refining of the phone delivery strategy. Nine adaptations involved abandoning, then returning to phone delivery. HCWs sought to increase reach, improve fidelity, and intervention fit within their context. Most adaptations (96%, n=69) were perceived to increase the feasibility of phone delivery when compared to before the changes were introduced, and HCWs felt 83% (n=60) of adaptations made phone delivery easier. Most adaptations were either incorporated into routine workflows (47%) or tested again (47%).

Conclusion: Adaptation of phone delivery was a feasible and effective way of addressing challenges with continuity of care for YLH during the COVID-19 pandemic. Adaptations were primarily context adaptions. While FRAME-IS was apt for characterizing adaptations, more use cases are needed to explore the range of its utility.

Contributions to the literature:

This paper illustrates how team-based learning sessions in the form of CQI meetings can be utilized by frontline healthcare workers to systematically develop and apply adaptations to quickly adapt

to changing context (i.e., COVID-19). This is useful for researchers studying methods for integrating dynamic adaptation into routine healthcare worker workflow in constrained settings.

This paper demonstrates the retrospective application of FRAME-IS to characterize adaptations, highlighting an approach to further advance our understanding of implementation through the study of adaptation types and their characteristics.

This paper adds to the literature on the use of qualitative methods for studying adaptations and underscores the potential for framework or rapid analysis of qualitative data to quickly identify and characterize adaptations or adaptation traits associated with improved implementation outcomes in real time.

3.2 INTRODUCTION

The COVID-19 pandemic presented one of the most challenging health emergencies in recent history.[65] Disruptions were widespread, and movement restrictions posed unique challenges to health facilities around the world, particularly in low- and middle-income countries (LMICs).[66] Vulnerable populations, including adolescents and young adults (AYA), were especially at risk of prolonged service disruptions.[67] AYA are also disproportionately affected by the HIV epidemic, making up 30% of incident HIV globally.[1] Interferences to HIV care due to COVID-19 posed a threat to HIV outcomes within this age group, especially older AYA aged 19-24 years who demonstrate worse outcomes than their younger counterparts.[68,69] Strategies were urgently needed to avoid or mitigate service disruption to HIV care for this group. The use of digital technology to support provision of remote or virtual HIV services via mHealth (including telemedicine or

telehealth) emerged as a common and important strategy for addressing pandemic-related service disruptions.[25,70–74] This offered a unique opportunity to examine implementation of mHealth and its determinants when introduced to safeguard access to health services during emergencies.

The specific benefits of mHealth for adolescent HIV services are well known but how these interventions are implemented is less studied.[75–78] In the pandemic, the deployment of mHealth solutions was rapid, sometimes without guidelines, prior assessments of suitability to the context, or adequate formal training of healthcare workers (HCWs) to guide implementation. This kind of rapid implementation necessitated iteration of products or services to fit provider and client needs, as well as the context. Adaptations are formally defined as planned and purposeful changes made to the interventions or delivery strategies while maintaining the integrity of the core components or processes associated with the relevant effectiveness outcomes.[79,80] Adaptations differ from modifications which are typically viewed as unplanned or spontaneous changes.[81] Although adaptations are intended to introduce improvements, when forced or introduced hurriedly, they may compromise service delivery and effectiveness by lowering feasibility and fidelity of implementation.[82] Studies have shown that HCWs are sometimes not systematic in the development of planned adaptations.[83–86] This is common where cultural adaptations are required to meet diverse needs but evidence on core components of the intervention or strategy is unknown.[86] Many adaptations generated during the pandemic, especially those targeting healthcare workers were ad-hoc, making replication and comparison of adaptation procedures across implementation units challenging.[25,32,87,88] Furthermore, the rapid nature of adaptation development may render the adaptations difficult to identify or test and may have a negative impact on implementation fidelity.

The importance of methodically detailing and understanding adaptations has been underscored in recent literature.[89–91] More recently standardized frameworks and language describing ways to develop, document and describe adaptations have become available.[92–96] These tools offer ways to group and study adaptations by important elements such as the motivation, level of rationale, change idea involved, and targeting of core versus peripheral components of interventions or strategies. Lack of or partial characterization and comprehension of adaptations limits our ability to identify and prioritize sustainable changes and impedes the advancement of evidence on how mechanisms of change associated with specific services or interventions lead to outcomes.

The Adolescent Transition to Adult Care for HIV infected adolescents (ATTACH) study was a cluster randomized trial (NCT03574129) that tested the effectiveness of an Adolescent Transition Package (ATP) in 20 HIV clinics in Kenya.[41] The ATP aimed to prepare youth with HIV as they transition to independent care by increasing HIV knowledge and self-management skills required for independent care.[23] In this trial, frontline HCWs applied continuous quality improvement (CQI) meetings and plan-do-study-act (PDSA) cycles to develop dynamic, provider-led adaptations to phone delivery of the ATP following the onset of the COVID-19 pandemic. In this paper we characterize the adaptations using the expanded Framework for Reporting Adaptations and Modifications for Implementation Strategies (FRAME-IS).[96] FRAME-IS provides a consistent approach for describing adaptations. FRAME-IS is derived from FRAME, which specifically focuses on categorizing adaptations to interventions, and can applied to guide the adaptation process.[93] It comprises four core models that are key to describing adaptations and

three optional models. The modules document: 1) a description of the evidence-based intervention, the implementation strategy and adaptation; 2) a description of what was modified to obtain the adaptation; 3) the nature of the modification and whether it maintains fidelity to the core components; 4) the goal of the adaptation and the level of the system that had most sway in selection of the adaptation; 5) when in the phases of implementation the adaptation occurred, and if it was planned; 6) specification of individuals or groups participating in the decision to adapt; and 7) the spread of the adaptation within the context of implementation.[96] This paper tests the applicability of FRAME-IS for describing context-specific adaptations made during a pragmatic trial and demonstrates how the framework's classification system may support identification of patterns in adaptations selected. We also summarize feedback on implementing the adaptations after a brief testing period. Describing adaptations to the use of digital technology may highlight changes that can inform future actions, in analogous scenarios.

3.3 METHODS

3.3.1 *Setting & Study Design*

This sub-study combines qualitative and quantitative data from the ATTACH study, which was a hybrid cluster randomized controlled trial (RCT) conducted in 4 counties in Kenya (Nairobi, Homa Bay, Kajiado and Nakuru).[24] Participants were recruited at 20 HIV comprehensive care clinics (CCCs) selected based on clinic location, size (>500 clients in care, and ≥ 50 YLH in care), use of electronic medical records, and approval of facility leadership. CCCs are sites for the delivery of coordinated HIV care for adult, adolescent, and pediatric populations. Adolescent HIV care at participating sites is provided free of charge and the CCCs were typically staffed by clinical

officers, medical officers, nurses, adherence counsellors, link officers, among others.[97] Ten clinics were randomized to receive the intervention, the ATP, while ten maintained the standard of care.

The ATP includes HCW tools to support the transition process, including a booklet (Taking Charge) designed to guide patient education and empowerment sessions during YLH clinic visits and a tracking tool to document YLH progress through the booklet. The intervention was designed to be delivered in-person by CCC HCWs. HCWs were trained to walk through the booklet step by step to facilitate YLH learning. After each exposure to the booklet, progress was noted in the tracking tool. The trial tested the effectiveness of the ATP and found that those receiving the intervention had significantly higher overall transition readiness scores and higher scores in HIV literacy domain compared to those in the control arm.[23] When COVID-19 social distancing and movement restrictions were put in place, the study pivoted from in-person to phone delivery of the ATP. HCWs made phone calls to YLH once a month for up to one hour to deliver the contents of the ATP. Calls were to be made during work hours at a time determined by each individual HCW. During calls, HCW introduced themselves and checked if YLH were ready to talk. HCW then read through and discussed relevant sections of the ATP.

This study was a partnership between the University of Washington, Kenyatta National Hospital (KNH), and University of Nairobi (UoN). Research ethics approval was granted by the University of Washington Institutional Review Board (UW IRB) and the Kenyatta National Hospital/University of Nairobi Ethics and Review Committee (KNH/UoN ERC). The study protocol is available online (https://pubmed.ncbi.nlm.nih.gov/33268417/). Findings in this paper were reported in accordance with Standards for Reporting Implementation Studies checklist.[98]

3.3.2 *Participants*

HCWs were recruited from among clinic staff who work with YLH at all intervention sites. To enhance representativeness of the study, we purposively sampled individuals from various cadre including clinical officers, nurses, physicians, counselors, and psychologists. All HCWs involved with the care of YLH at each selected to participate. Willing HCWs provided written consent, emphasizing voluntary participation and the option of opting out at any point without repercussions. HCWs joining clinic sites or clinic activities after the trial began were informed about the study and provided written consent.

3.3.3 *Data Collection*

We collected qualitative data to identify and characterize adaptations and quantitative data to describe the CQI meeetings and participation. We facilitated CQI meetings using PDSA cycles to optimize ATP implementation by phone at ten intervention sites between June 29th and 19th October, 2020. Twice monthly CQI meetings were conducted over 4–5-months with each site completing at least 5 CQI cycles by the end of the adaptation period. A final CQI meeting was held to review all adaptations and gather HCW perspectives on the feasibility, ease, and success of implementing the adaptations. CQI meetings were led by study staff. During meetings, CCC HCWs identified changes to phone delivery of the ATP, evaluated previous adaptations (if any), reflected upon adaptation effectiveness, and decided to adopt, adapt, or discontinue an adaptation (adaptation outcomes). The meetings were audio-recorded, and study staff completed PDSA worksheets during meetings to document key elements of the discussion.

We also collected quantitative data to describe implementation of the phone strategy. For each call made to an adolescent, the following data points were recorded in a call log: when the call was made, who the call was made to, what time the call was made, in what environment the call was received, what chapter of the ATP was discussed and whether the call was successful.

3.3.4 *Data Processing*

Adaptation data were extracted from audio files by a primary analyst and entered in a REDCap-based form which mirrored modules of FRAME-IS. Specific modules included: 1) what is being modified, 2) the nature of the modification, 3) the main goal and rationale for the modification, 4) timing, 5) participants involved in decision making about the adaptation; and 6) the spread of the adaptation. Where audibility was a challenge, we utilized CQI facilitator notes and CQI recordings from each site's final CQI meeting during which all changes made by each site underwent a final review. PDSA worksheets were also consulted in a few circumstances where audio recordings were of poor quality. Most meetings concluded with the identification of one adaptation but some sites selected multiple adaptations per cycle. Two independent primary coders (DM and NC) reviewed each adaptation, classifying adaption characteristics according to framework domains. Together, analysts reviewed the agreement in their coding and discussed convergence and divergence in their understanding of the adaptations. We also categorized adaptations based on whether they focus on the implementation strategy (phone delivery), the evidence-based intervention (the ATP), or both.

3.3.5 *Data Analysis*

We used descriptive statistics to summarize CQI occurrence and duration, call characteristics, adaptation features and adaptation outcomes using medians and ranges for

continuous variables, and sums and proportions for binary or categorical variables. To analyze the adaptation data, we categorized the qualitative data and quantified it. We reported number of adaptations to phone ATP delivery reported overall and by site, the feature or aspect targeted for adaptation, adaptation types, reasons for adaptations, level of rationale for the adaptation, and the groups targeted by the adaptation. We summarized the adaptation characteristics and the proportion of adaptations focused solely on the implementation strategy (phone delivery), the evidence-based intervention (the ATP) or both.

3.4 RESULTS

Over a four-month period following introduction of phones for delivery of ATP, 59 CQI meetings were held to facilitate the adaptation process (average of 6 per facility) (Table 1). Meetings included a median of 5 (range: 4-10) frontline HCWs per site at each meeting, and involved a variety of cadres (nurses, clinical officers, peer educators, mentor mothers/fathers, adherence and HIV testing counsellors, nutritionists, link officers and records officers) primarily from CCC and prevention of mother to child transmission clinics. CQI meetings took a median of 21 minutes (range 13 – 75).

Table 3.1. Summary of CQI meetings and adoption of the phone call strategy

CQI Summary	
Post-COVID CQI meetings	59
HCW per CQI (median)	5 [4-10]
Duration (median, minutes)	21 [13 – 75]
Phone Call Adoption Success	
Calls attempts	N= 1444
Calls reaching AYA	82% (1180)
Calls successful	96% (1137)
Phone charged	99% (1175)
Call received in a conducive environment	96% (1148)
Day call was made	N=566
Weekday	88% (498)
Weekend/public holiday	12% (68)
Time call was made	N=566
Morning	28% (158)
Afternoon	57% (323)
Evening	15% (85)
At least one chapter discussed	N = 1180
	93% (1096)

3.4.1 *Adaptation Characteristics*

We identified 72 adaptations, 32 of which were unique and mainly targeting the actor or implementer of the phone strategy to improve on HCW organization, workflow, and patient-HCW engagement. Table 2 and 3 summarize unique adaptations and their characteristics. Most of the adaptations were simple and grounded in one main idea, however, there were a number that comprised multiple ideas but communicated as one adaptation.

Table 3.2. Summary of adaptations identified across sites

	Adaptations	Frequency
Action	Wait for next scheduled clinic visit/Default to in-person	5
	Provide shortened time to next in-person clinic visit	1
	Schedule calls in advance, increase airtime and shuffle HCWs	2
	Simplify language	1
	Add interactive elements	1
	Obtain/use alternate contact information	7
	Define notation for documenting client progress	1
	Total	16
Actor	Divide adolescents among HCWs	10
	Designate specific cadre responsible for follow-up calls	1
	Reduce staff making calls and create targets	1
	Match provider to client based on client language needs and assess understanding	4
	Use CHV/link person/community drug distribution to locate adolescent	7
	Create priority list to organize provider access to phone	1
	Prioritizing HCWs going on leave and handing over pending clients	1
	Shuffling HCWs who are making calls	2
	Assign specific cadre to oversee proper documentation	1
	Total	28
Setting	Calling after hours	3
	Carry phone home for afterhours calls	1
	Total	4
Target	Ask clients to document important details	1
	Target calls to caregivers	3
	Assign clients memorization activities and check recall	2
	Create priority list based on adolescents with fewest call attempts and schedule	1
	Implementing pre-calls to schedule and prepare adolescents	8
	Total	15
Timing	Call at different times of day	2
	Postponing calls during heavy workload seasons	1
	Designating call days	1
	Total	4
Frequency	Repetition of ATP chapters	2
	Repeating call attempts	4
	Increase volume of calls attempts made per day	1
	Total	7
Dose	Spreading material over several calls	1
	Reduce material covered during call and match clients' language needs	1
	Total	2

Frequencies represent unique or first-time appearances of an adaptation at each site. If a facility sustains a unique adaptation, it is not counted repeatedly. Some adaptations are a combination of >1 change and may targeting different components of the phone strategy.

Table 3.3. Summary of the application of FRAME-IS AND FRAME to the phone strategy

The EBP being implemented is: The Adolescent Transition Package The Implementation Strategy being modified is: The phone delivery strategy Specification of the Implementation Strategy Action: Making a phone call Actor: Frontline HCW at CCC clinics Context/Setting: CCC clinics Target: YLH Timing: During working hours (8am – 5pm) Frequency: Once a month Dose: One chapter per call for up to 45 minutes	
The modifications being made are:	See table 1 and Appendix 1
The reasons for modification are:	Low phone ownership Incorrect phone numbers Challenges incorporating calls to workflow Low quality call experience Fear of unintended disclosure Scheduling conflict (See Appendix 1 for extensive list)
What is modified:	Context (format, personnel, and setting) Content Evaluation procedures
What is the nature of the content, evaluation, or training modification?	Adding, Tailoring, Spreading
Relationship to core elements:	NA
What is the goal:	Increase adoption Increase reach Increase fit Increase feasibility Increase fidelity and effectiveness
What is the level of the adaptation rationale?	Implementer and patient level
When is the modification initiated?	Mid-implementation phase
Is the modification planned?	Planned/proactive
Who participants in the adaptation decision?	Entire team of implementers/care team
How widespread is the modification?	All implementers and patients. Sub-sets of implementers and patients who share similar characteristics

The reasons for adaptations were varied and constituted challenges implementing the phone strategy or reaching YLH. HCWs most frequently adapted how they were implementing

phone delivery to address barriers such as difficulties reaching YLH because of missing or incorrect contact information, scheduling challenges, low phone ownership in this group, limited availability of youth and fear of unintended disclosure which manifested in YLH refusing or ending calls without warning (Figure 1, Appendix 1). The phone strategy had limited success where YLH were sharing phones with unsupportive caregivers, siblings, or partners. HCW-level barriers that drove the decision to adapt were also identified. For example, initially, some HCWs did not consider making phone calls part of their job. Only one phone was available to HCWs at each site, forcing HCWs to share access. HCWs also experienced burdensome workloads especially during reporting periods when majority of their time was spent collating files, documenting, and enumerating outcomes. Decline in staffing numbers due to COVID-19 infection was also common.

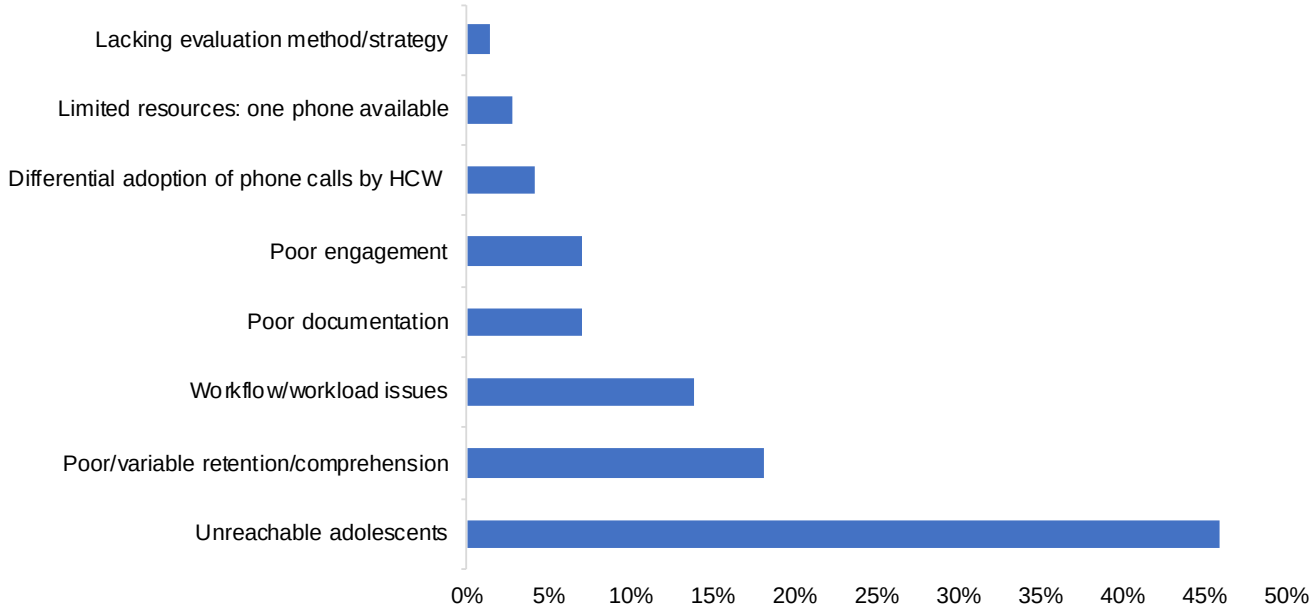

Figure 3.1. Reasons for adaptations across all intervention sites

Adaptations were primarily context adaptions (53%, n=38); 28 adaptations involved only context changes. (Figure 2, Appendix 1) These featured personnel (74%, n=26) and setting (40%, n=14) changes affecting the overall way the phone strategy was delivered. Personnel-related context adaptations included sharing of tasks among available staff, prioritizing phone use for HCWs based on an agreed-upon schedule, or redistribution of tasks to HCWs with more availability, or with better rapport or language skills compatible with specific YLH.

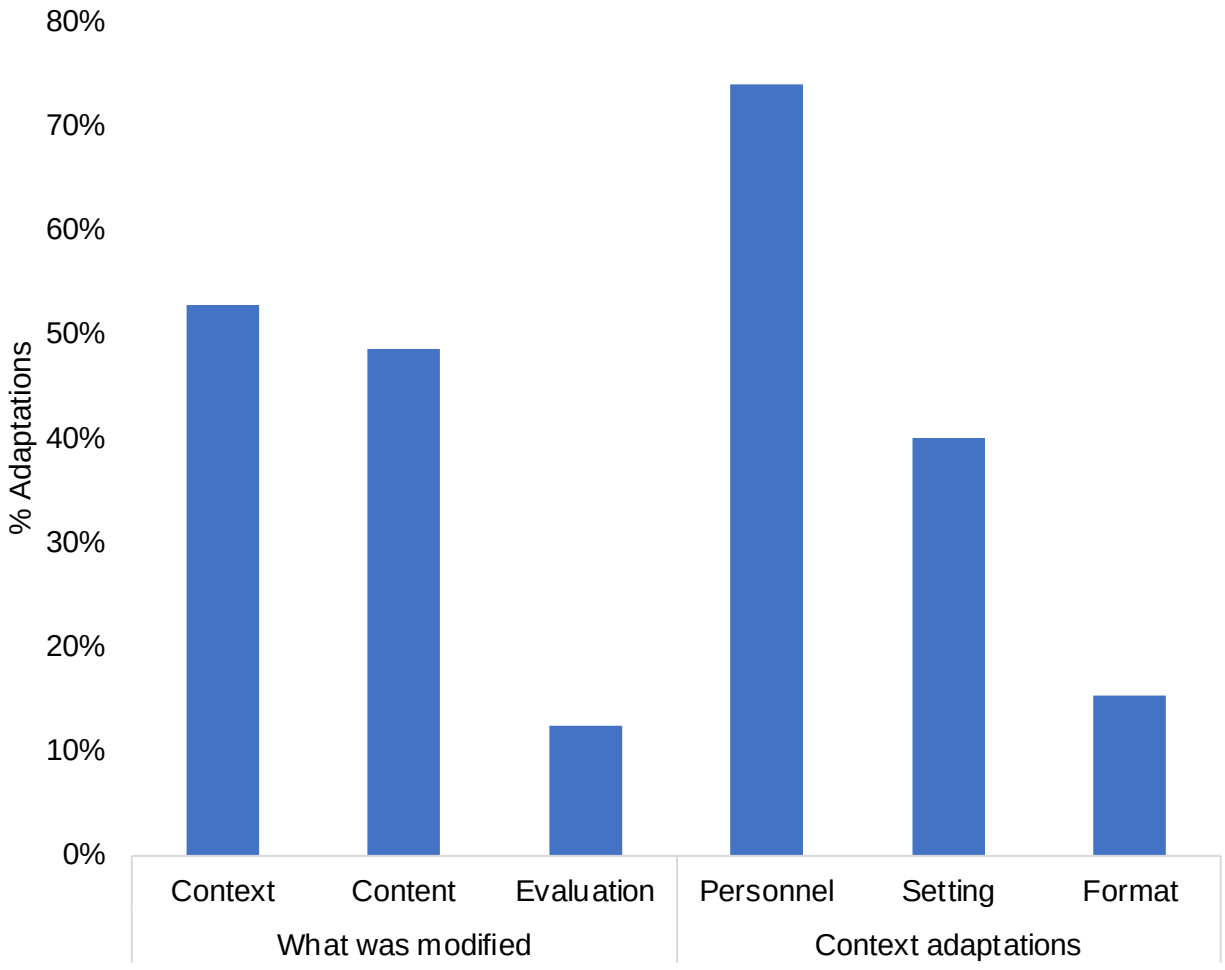

Figure 3.2. Targets of adaptations across all intervention sites

The frequency of content adaptations was like context adaptations (49%, n=35, with 28 exclusively classified as such). Lastly, we noted 13% (n=9) evaluation adaptations to respond to the need to document and evaluate the progress YLH made during calls. The nature of content and evaluation adaptations ranged from addition of discrete elements like questions or the use of scripts (32%, n=20), focused refinements or tailoring (8%, n=5), repetition for example repeating calls or repeating call content (15%, n=9), shortening (2%, n=1), spreading material over several calls (5%, n=3) and integration of home tracing using community health volunteers as another strategy alongside the phone strategy (8%, n=5; Figure 3). There were several instances of drift with retum (8%, n=5) to the original strategy. For example, when YLH could not be reached at all HCWs resorted to inviting them to attend clinic visits to discuss the ATP.

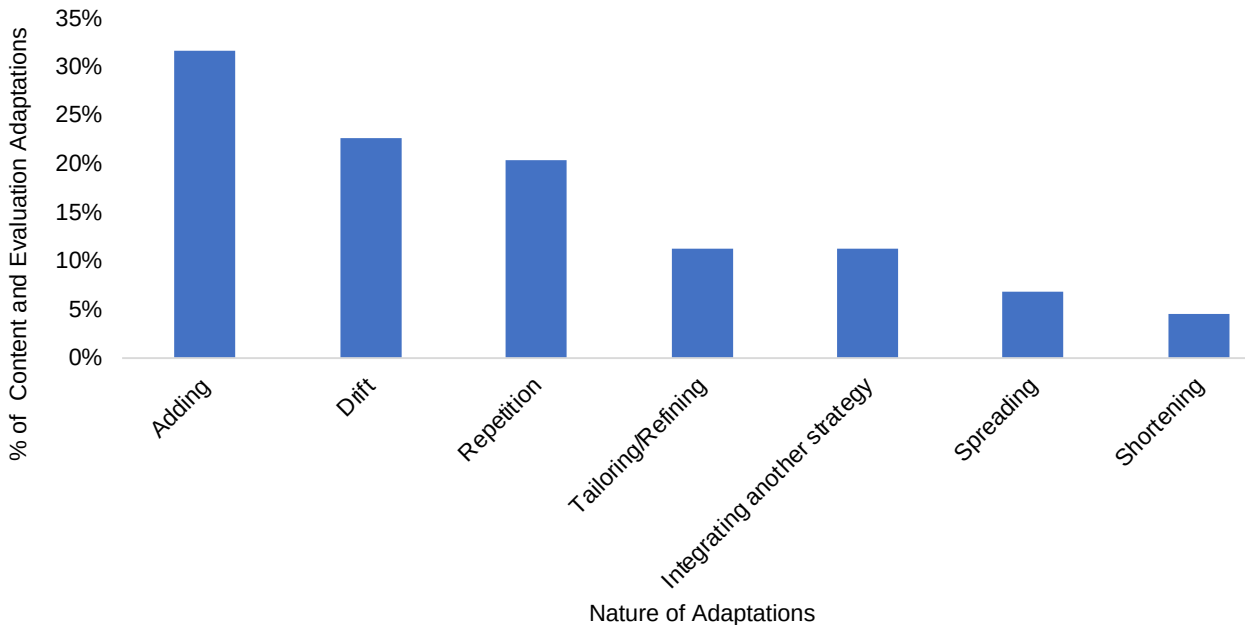

Figure 3.3.. Nature of content and evaluation adaptations across all intervention sites

The goals of the adaptations were most frequently to increase reach (49%, n=35), fidelity of implementation (33%, n=24) and fit of the strategy to the HCWs' schedules, preferences,

environment, and workload (24%, n=17; Figure 4) Improving effectiveness of the intervention was less frequently discussed and, in some instances, co-occurred with the fidelity goal. The same was noted with adoption, which co-occurred with a few discussions about improving the reach and fit of the strategy.

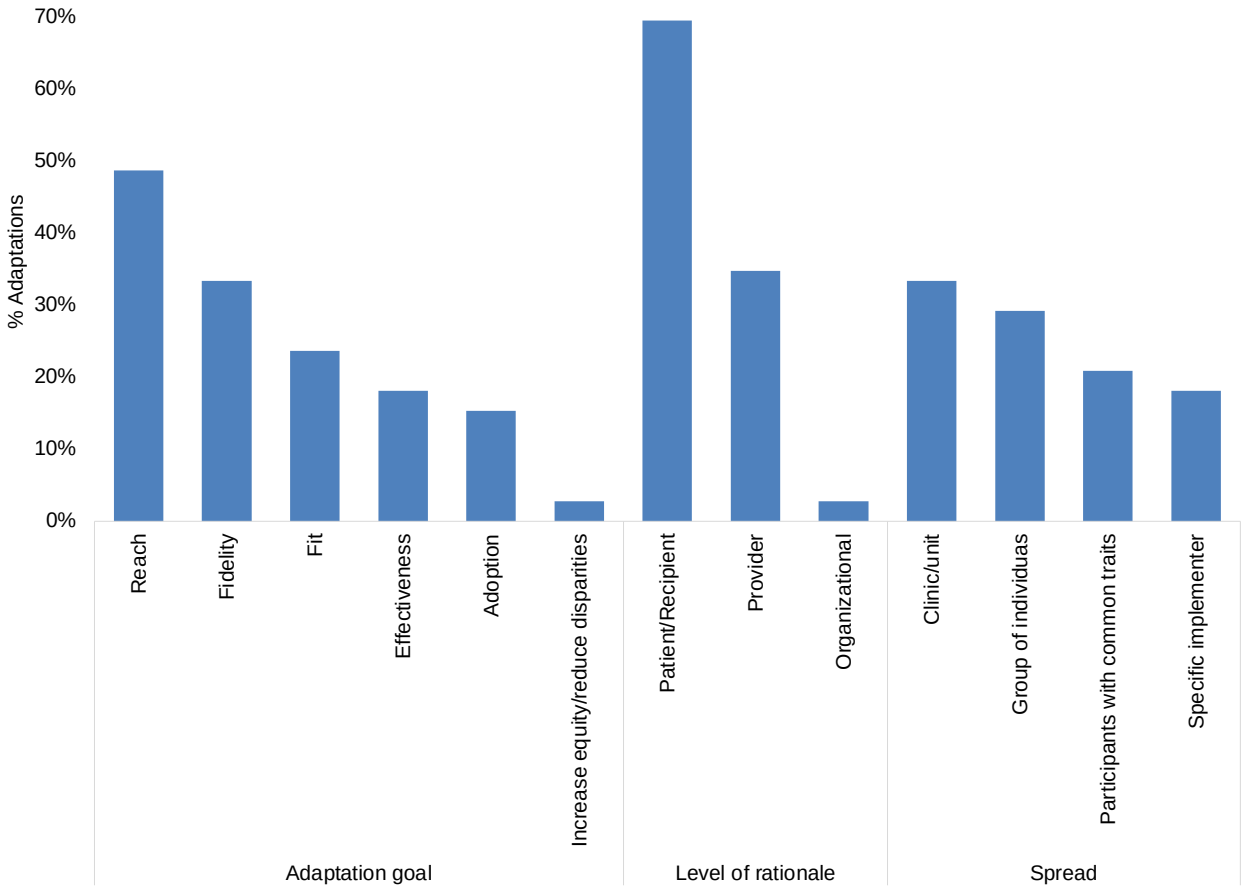

Figure 3.4. Goals, rationale and spread of adaptations across intervention sites

The level of the organization that most directly informed the adaptations was the patient or recipient level (69%, n=50), aligning with the goal of increasing the number of calls reaching YLH (Figure 4). There was also much focus on adaptation rationale from the HCW level (35%, n=25) which influenced the selection of modifications that aimed at improving adoption by removing or

reducing workflow-related barriers. We noted that majority of adaptations were intended to reach all HCWs in the implementing unit (33%, n=24) and all YLH clients receiving the ATP intervention (29%, n=21; Figure 4). Targeted adaptations were present but less frequent: 21% (n=15) for youth with specific characteristics or issues and 18% (n=13) for individual implementers whose specific role, skills or experience were leveraged to address client- or HCW-level barriers.

3.4.2 *Site-level differences*

Comparison of adaptations across sites demonstrated that sites were tackling similar challenges to phone-based ATP delivery and conceived of similar adaptations. A few differences were in the number of adaptations per site: the median number of adaptations per site was 7 (range: 4-11) and some variation across sites in what was modified. For example, one facility implemented context adaptations exclusively while another had 25% context modifications and 75% content modifications. For all facilities, most context modifications involved format changes except for one facility that primarily implemented personnel-related adaptations. Only six facilities enacted evaluation adaptations. Figure 5 summarizes the variation in adaptation characteristics across sites.

Figure 3.5. Heatmap summarizing characteristics of adaptations, overall and by site

3.4.3 *Outcomes of adaptation implementation*

HCWs perceived that 96% (n=69) of adaptations made implementation of the phone strategy more feasible than before the change was introduced. Overall, 83% (n= 60) of the adaptations were perceived to make delivery of the phone strategy easier than when there was no adaptation. (Table 4) Temporary or permanent migration of adolescents, phones that were turned off, wrong numbers and a reduction in number of staff available to make calls due to COVID-19 infection are examples of factors that made phone delivery of the ATP less successful. After testing, most adaptations were either incorporated immediately into routine workflows (47%) or selected for further testing and then adopted after secondary review (47%). (Table 4) Very few adaptations were abandoned after testing (6%): for example, home visits that leveraged community health volunteers (CHVs) were abandoned at one site because of lack of funds to support that cadre's activities.

Table 3.4. Outcomes of implementing adaptations to the phone strategy, overall and by site

N= number of adaptations	All (N=7)	Site 1 (N=7)	Site 2 (N=6)	Site 3 (N=7)	Site 4 (N=10)	Site 5 (N=6)	Site 6 (N=8)	Site 7 (N=6)	Site 8 (N=7)	Site 9 (N=4)	Site 10 (N=11)
Implementation of adaption went as planned:											
	96% (69)	86% (6)	100% (6)	100% (7)	100% (10)	100% (6)	100% (8)	100% (6)	100% (7)	75% (3)	91% (10)
Phone delivery after adaptation easier than in-person:											
	83% (60)	86% (6)	100% (6)	71% (5)	100% (10)	100% (6)	63% (5)	83% (5)	71% (5)	75% (3)	91% (10)
Decisions made after adaptation testing:											
Adapt	47% (34)	14% (1)	67% (4)	86% (6)	40% (4)	50% (3)	25% (2)	50% (3)	71% (5)	25% (1)	27% (3)
Adopt	47% (34)	86% (6)	33% (2)	14% (1)	60% (6)	50% (3)	38% (3)	50% (3)	14% (1)	75% (3)	73% (8)
Abandon	6% (4)	-	-	-	-	-	38% (3)	-	14% (1)	-	-

HCWs recommended the use of the WhatsApp platform to augment the phone strategy by facilitating individual or group communication, sharing of ATP text and pictures and allowing storage of information in text form so that adolescents can refer to it when needed. Other recommendations from HCWs included providing shorter times to clinic appointments, providing phones to clients, increasing airtime allocation, and increasing the number phones available to HCWs. The use of video calls was suggested to improve the remote visit experience. HCWs also felt increasing call frequency may help adolescents retain what they have learned.

3.5 DISCUSSION

The objective of our study was to characterize dynamic, provider-led adaptations to phone delivery of the ATP using FRAME-IS. We found that adaptation was a feasible way of addressing barriers to continuity of transition support care for YLH during the early stages of the COVID-19 pandemic. FRAME -IS was a useful tool for characterizing and understanding adaptations (summarized in Table 3). Adaptations were similar across all sites and originated from 32 unique ideas. The inability to reach clients was a recurrent reason for adaptations. The need for adaptations emerged from challenges integrating the phone delivery strategy into their workload and workflow. We identified primarily context adaptations which were frequently intended for the whole care team or all YLH receiving the intervention. To our knowledge, this is the first study in our setting to characterize adaptations using FRAME-IS.

In our study, the main motivation for proposing adaptations was to improve the reach of the phone strategy. HCWs were unable to reach adolescents for a variety of reasons. For example,

when called, YLH were busy, with many competing interests which resulted in scheduling conflicts. There were also frequent refusals to answer calls or abrupt ending of calls because of fear of unintended disclosure. Limited phone ownership was also a common challenge in this population and many YLH were reliant on phones owned by a caregiver, sibling, or partner. Uptake of the phone strategy was impacted by scheduling conflicts with caregivers or unwillingness of caregivers, sibling, or partner to support the client by availing the phone at necessary times, for a sufficient duration or fostering privacy and confidentiality needed by the adolescents. These and other barriers appear elsewhere in literature examining the implementation of digital technologies for health.[13,99] Additionally, the role of stigma on youth engagement with health services is not new and has impact on adoption and uptake of health services in the clinic setting as well as virtually.[16,100] Our study demonstrates how using CQIs facilitated identification of challenges and selection of adaptations to address them successfully.

Addressing barriers in the HCW workflow was another important motivation for adaptations to phone delivery. At each facility HCW were sharing one phone to implement the strategy and were not always able to complete their call loads when scheduled at the same time as other colleagues. The addition of new activities to their workflow at times conflicted with pre-existing responsibilities. For instance, HCWs found it hard to adopt the phone strategy during monthly reporting periods when majority of their time was required to collate reports. Key adaptations that could be used to improve reach beyond the trial were scheduling calls ahead of time and incorporating separate preparatory calls targeted to caregivers. HCW identified these changes as priorities for long term integration into their routine activities. This trial exemplified how frontline HCWs in our context can be engaged in adaptation selection and testing to mitigate

challenges in accessing health services. This was especially important during the pandemic when health systems were facing staffing shortages due to illness or redistribution of HCWs to areas of highest need, interruptions in the supply chain and reallocation of financial resources.

Most adaptations involved context changes, that is tweaking the way the phone strategy was delivered. In implementation science, context refers to the constellation of cultural, organizational, social, financial and leadership aspects that influence how an innovation or strategy is provided or received. Given that all these spheres were affected by the pandemic in one way or another, the frequency of context adaptations is not unexpected.[87,101,102] For example, task shifting aspects of phone delivery to community health workers was a context adaptation to address gaps in reaching adolescents when they failed to answer calls or lacked contact information in their patient files.

The rest of the adaptations we identified were primarily content changes achieved by making simple additions or refinements to the intervention. In our scenario, these kinds of simple adaptations may represent opportunities for optimization that are low-lying-fruit as they neither required extensive time nor resources and would introduce minimal disruption to the overall functioning of the health system. Simple adaptations make sense where HCWs are not trained in the language and concepts of adaptations or improvement science. Nonetheless, it was highly advantageous to involve frontline HCWs, including members of informal cadres like mentor mothers or fathers, in the adaptation process. Their proximity to clients, opportunity for rapport-building and familiarity with clients provided access to information necessary to customize and optimize phone delivery of the ATP to their needs and contexts. Engaging community perspectives

is important for leveraging local knowledge and expertise to create programs that are relevant and customized to the target population, to encourage trust-building and to promote positive and sustainable involvement in facility-based care.[81,103,104]

Post-CQI evaluations underscore the acceptability, feasibility, and appropriateness of the adaptations as most of them were either adopted immediately after testing or adapted and then adopted after a second round of testing. However, the occurrence of drifts from the strategy cannot be ignored: we identified nine instances where the adaptation involved abandoning the phone strategy because previous adaptations were infeasible or unsuccessful. For example, the use of CHVs was limited by lack of funds to support their commute. The phone strategy was also abandoned when HCW identified certain individuals' inability to retain information, or who were virally unsuppressed and required further clinical examination. The limited capacity of telemedicine for physical examination, HCW-patient relationship-building and as a medium for patient education has been noted as a persistent barrier and fuel for HCWs' resistance to the use of this and other digital health strategies.[13,101,105]

Of note, the use of WhatsApp to deliver the ATP intervention was proposed up to three times across all CQI meetings but not selected for testing in the PDSA cycle. HCWs in non-clinical cadres who are primarily tasked with retaining clients in care noted that communication via WhatsApp had been effective for maintaining contact, information sharing including appointment reminders and engaging youth in support groups. The feasibility and success of using WhatsApp for reaching adolescents has been identified in several studies.[100,102,106] The novelty of the application, affordability of data required to operate it, capacity for text and voice messages, video

calls, and sharing of documents, exemplify the youth-friendliness of the platform, making it a promising avenue for improving the ATTACH phone strategy and other mHealth interventions. More work is needed to explore the best ways of utilizing this technology to support YLH transitioning out of pediatric care.

FRAME-IS is the first tool developed specifically to address modifications and adaptations to implementation strategies. It's modular structure and flexibility makes it an apt and systematic tool for classifying the adaptations. Few studies have applied FRAME-IS to track and/or characterize adaptations[107–112], but more examples are needed to explore the range of its utility for Implementation Science and to identify areas of improvement. Currently, FRAME-IS is not designed to capture or describe adaptation outcomes and may benefit from incorporating a module that does this. An outcomes module may inspire more careful selection of adaptations. Within LMICs, tracking outcomes may provide the information needed by frontline HCWs in LMICs to focus adaptations. One study merged FRAME-IS and RE-AIM frameworks so that HCWs could leverage reach and adoption outcomes to track progress following a given adaptation.[108] This allowed the teams to compare between adaptations and select for the high-yield ones. Future work may focus on cataloguing adaptations that support the best yield in clinics, including their FRAME-IS-defined characteristics. This resource would introduce efficiencies to adaptation development by allowing HCWs to focus on identifying solutions that fit their context or reconfiguring adaptation characteristics of select ideas to improve fit and feasibility in their clinics. Incorporating more instructions and a user-friendly design to guide the process of adaptation selection and specification may increase use of FRAME-IS among adaptation teams. This could support real-time documentation and characterization of adaptations and may offer more benefits

to implementers than the retrospective application of the framework. Furthermore, there is room to strengthen our understanding of adaptations and their downstream influence on outcomes by adding another module that documents micro-contextual changes coinciding with the introduction of adaptations, for example when trained HCWs transfer out or a champion for the strategy emerges within the care team.

This study used PDSA protocols to structure the adaptation process, thereby introducing a degree of methodological rigor. Guided by research staff who introduced in simple terms the process and importance of this approach, HCWs engaged in consensus discussions to identify context-specific adaptations. However, we observed that leading and coaching teams to identify specific change concepts or ideas was challenging. The implementation team may have benefited from broad knowledge about the range of changes possible and linkages between barriers and adaptations that are most suited to address them.

Although we were able to characterize the adaptations, we noted that the coding process was challenging. Coding directly from audio-recordings to structured forms defining FRAME-IS modules was not a 1:1 process; it involved condensing a lot of information to fit the discrete modules. In some cases, overlap in categorization of adaptations was unavoidable. The groups within the modules did not always allow for parsimonious characterization such that some adaptations fell into several categories at the same time. Additionally, it was challenging to apply it to adaptations that were an amalgamation of several change ideas e.g., an adaptation that consists of an additional element delivered at a different frequency by a different cadre of HCW. This may impact our ability to recognize patterns or associations in adaptation data when examining and

comparing across similar studies. Lastly, categorization of adaptations was retrospective, and coding was done by researchers. Real-time, prospective characterization of the adaptations using forms or checklists modelled after FRAME-IS may be an advantageous approach especially in the context of a pandemic or other emergencies. We note that rapid qualitative analysis using FRAME-IS as a coding guide may be a game-changer in ensuring that adaptation data can be fed back to facilities and policy makers within a shorter timeline.[40,113]

The extraction and characterization of adaptation data happened retrospectively and relied primarily on audio recordings that were of variable quality. However, we overcame this issue by looking to data in PDSA forms for clarification. CQI process differed from site to site. There was a degree of subjectivity in the way the meetings were structured and run, which depended on the ATTACH staff. For example, not all teams discussed what to do with the adaptation after two weeks of testing during the meeting. In some cases, the decision was made and captured two or three CQI meetings later. It is possible that the experiences and variation of adaptations presented in this study may not mirror what is possible in other contexts. In this study we attempted to track implementation outcomes linked to each adaptation using a survey, however, due to pandemic-related protocol changes these data were incomplete and insufficient for inclusion. We also did not specify core versus peripheral elements of the phone strategy to HCWs nor assess their fidelity to the implementation strategy. Therefore, we were unable to ascribe changes in study outcomes to specific adaptations.

3.6 CONCLUSION

Knowledge that interventions are not always effective when transferred to new contexts provides impetus for further study of the role of adaptations. The need for rapid adaptation is also underscored in significant emergencies like the COVID-19 pandemic which introduce sudden changes in the immediate context. To study adaptations, it is important to identify, document and evaluate them, while considering the dynamism of implementation contexts. In this study we saw how introduction of adaptations allowed frontline HCWs to introduce and implement solutions that impacted their ability to adopt the phone delivery strategy. We identified and characterized a range of challenges associated with phone delivery of the ATP, which may occur at other facilities if we were to scale out to new clinics. Using FRAME-IS we classified what were a majority context adaptations to address these gaps. This study adds to the literature describing a range of possible adaptations which allowed HCWs to maintain engagement with clients during the COVID-19 pandemic when many health systems experienced prolonged service interruptions. Additionally, it demonstrates the utility of FRAME-IS and adds to existing examples of its application in research.

Chapter 4. COMPARING PATIENT SATISFACTION WITH IN-PERSON AND PHONE DELIVERY OF THE ADOLESCENT TRANSITION PACKAGE IN KENYA DURING THE COVID-19 PANDEMIC

4.1 ABSTRACT

Background: The COVID-19 pandemic disrupted adolescent and young adult clinic visits and prompted a switch from in-person to phone delivery of HIV services for youth living with HIV (YLH). There is limited data from YLH's perspective on service delivery options for HIV care beyond the pandemic. The objective of this study was to examine and compare youth satisfaction with phone versus in-person delivery of an Adolescent Transition Package designed to support transition to independent HV care, in Kenya during in the COVID-19 pandemic.

Methods: We nested this analysis within 10 intervention sites in Kenya participating in a hybrid 1 cluster randomized controlled trial to evaluate effectiveness of an adolescent transition package (ATP). During the COVID-19 pandemic, health care workers (HCW) utilized phone calls to deliver intervention material. We applied a parallel convergent mixed methods approach using satisfaction surveys with YLH and in-depth interviews (IDI). We analyzed the survey data using descriptive summaries to evaluate satisfaction with phone or in-person delivery of intervention material. We conducted a content analysis on qualitative data to identify patterns in YLH experiences, describing satisfaction with phone and in-person delivery and their preferences.

Results: Overall, 375 YLH were surveyed. A majority were 18 years and older (55%, n=205) and female (62%, n=232). Interview participants were 18 years and older (65%, n=45) and female (56%, n=37). Surveys showed higher satisfaction for in-person delivery of the ATP than phone delivery. For phone delivery, YLH experienced highest satisfaction with language used and sense of being valued during phone calls (both 89%) while for in-person, YLH reported highest satisfaction with duration, timing (all 97%). For both strategies, items depicting suitability for self-expression and appropriateness for communicating sensitive issues had the lowest performance (phone: 58% and 34%; in-person: 67% and 36%, respectively). A head-to-head comparison of both strategies showed that majority youth perceived the phone strategy to be superior than in-person visits. IDIs showed youth had good experiences with both strategies. Their experience with phone delivery was easier, more convenient, and cost-efficient, and maintained provider-patient relationship, but was marked by privacy concerns, call quality issues and overall lower comprehension. In-person visits were easy, perceived as safe and private, while facilitating direct relationship connection and clear communication. Overall, the majority preferred in-person visits for long-term use, although some individuals stated a preference for phones owing to advantages over in-person visits related to its convenience, cost- and time-saving attributes.

Conclusion: Overall, we identified higher satisfaction with, and preference for receiving the ATP sessions in-person compared to via phone call, among YLH. Privacy and confidentiality, patient-provider relationship and connection, convenience, and averted time and financial costs were notable drivers of YLH's perspectives that may be important to consider when designing HIV care delivery strategies for YLH.

4.2 INTRODUCTION

The COVID-19 pandemic prompted a switch from in-person delivery to phone delivery of HIV services for youth living with HIV (YLH).[101,105,114,115] Phone delivery could potentially address several long-standing barriers that YLH face in accessing HIV services, including transport costs, lack of knowledge needed to navigate health systems, long clinic wait times, anticipated and experienced stigma and privacy concerns. [116–118] At the same time, phone delivery may introduce new challenges such as privacy concerns, added stress due to increased workload, and increased health inequity due to disparities in technological literacy and phone ownership.[20,29,30] Beyond the pandemic, it will be critical to understand the use of phones for health services and identify which groups would benefit the most from it. To guide decision-making, we need comparative assessments of the appropriateness, acceptability, and feasibility of these two delivery options from the perspective of YLH.[8,9]

Understanding youth preferences could inform the prioritization of acceptable and feasible strategies for reaching youth outside of the clinic. Measuring patient satisfaction, which refers to "a healthcare recipient's reaction to salient aspects of the context, process and results of their experience" is one way to evaluate youths' preferences.[119,120] High levels of satisfaction are central to maintaining engagement in care and persistently low satisfaction may indicate a mismatch between services delivered and client needs.[121,122] Among YLH, high satisfaction with HIV services has been associated with improved adherence to medication and retention in care.[123,124] The comparative experience of YLH with phone and in-person delivery of health services has not been well studied and whether satisfaction differs with service delivery mode is unknown. A meta-

analysis comparing mHealth delivery of a smoking cessation intervention targeting people living with HIV (PLHIV) identified short-term benefits of technology use in increasing smoking cessation. However, this study did not explore patient satisfaction or preferences.[14] Another study exploring the use of two-way test messaging for improving clinic attendance and viral load suppression among YLH reported improvements in these outcomes and high levels of patient satisfaction with the mHealth intervention, but no comparisons of satisfaction with the standard of care were evaluated.[125]

In this study, we examined youth satisfaction with phone versus in-person delivery of an Adolescent Transition Package (ATP) in Kenya during the COVID-10 pandemic. We leveraged quantitative and qualitative data from the ATTACH trial (NCT03574129) in Kenya to describe and compare youth experiences and preferences with phone or in-person delivery of ATP material.

4.3 METHODS

4.3.1 *Study design and setting*

We used a convergent mixed methods design (including qualitative and quantitative methods) to assess satisfaction with phone and in-person delivery of the ATP in Kenya.[126,127] Both qualitative and quantitative approaches were weighed equally (QUANT + QUAL). Quantitative data from surveys and qualitative data from in-depth interviews were collected concurrently from YLH in the intervention arm of the ATTACH trial. We analyzed the data separately and merged the findings at the end to synthesize and interpret the combined results. A joint display is used to present integrated qualitative and quantitative findings, highlighting notable convergence and

divergence in findings across data streams. The procedures used in this study are summarized in Figure 1.

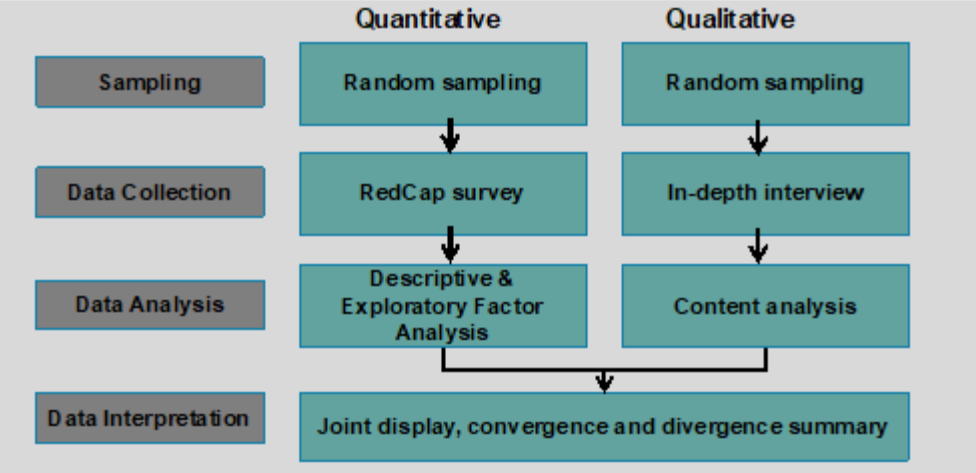

Figure 4.1. Schematic of convergent mixed methods approach applied in this study

We utilized cross-sectional data collected post-trial from the ATTACH study. The parent trial tested the effectiveness of the ATP in 4 counties in Kenya (Nairobi, Homa Bay, Kajiado and Nakuru).[24] Participants were recruited at 20 HIV comprehensive care clinics (CCCs), the main venue for coordinated HIV care for adult, adolescent, and pediatric populations in Kenya. Ten clinics were randomized to receive the intervention, the ATP, while ten maintained the standard of care. Details of facility characteristics are published elsewhere.[97] The trial found that those receiving the intervention had significantly higher transition readiness scores overall, and higher scores for HIV literacy domain among those who received the intervention compared to those in the control arm.[23]

4.3.2 *The Intervention and Implementation strategies*

The ATP combines tools to support the YLH transition process, including a booklet (Taking Charge) designed to guide patient education and empowerment sessions during YLH clinic visits and a tracking tool to document YLH progress through the booklet. The ATP was delivered by public sector health care providers providing HIV care services to YLH trained on the study protocol. The intervention was originally designed to for in-person delivery, however, during the COVID-19 pandemic when social distancing and movement restrictions were put in place, the study pivoted from in-person to phone delivery of the ATP. HCWs made phone calls to YLH once a month for up to one hour to deliver ATP material. Calls were to be made at a time determined by each individual HCW. During calls, HCWs used a script which guided them to introduce themselves and prepare the YLH for the discussion by building rapport, and querying if their phone was charged and whether they were in a conducive environment. HCWs then read through and discussed relevant sections of the ATP.

4.3.3 *Study population*

The study population included YLH, aged 15 - 24 years, receiving HIV care in 10 participating ATTACH intervention sites, who were enrolled in the ATTACH RCT. Eligibility included willingness to complete an anonymous survey and knowledge of HIV status. Recruitment was done by a member of the study team. IDI participants were a nested sample selected from YLH who had completed the survey.

4.3.4 *Study sample*

We conducted 375 post-trial surveys and 66 in-depth interviews with YLH. ATTACH study staff conveniently sample enrolled YLH from intervention sites who had been exposed to the ATP tool to complete the post-trial satisfaction survey. All enrolled YLH had experienced at least one session of in-person delivery of the ATP. Participants for the in-depth interviews were also conveniently sampled by clinic staff from those who had been exposed to the ATP, who then referred those selected to the study team. At least six YLH were selected at each site. Contact information was obtained from adolescent champions or peer educators working at each clinic and selected YLH were reached by phone and invited to return to the clinic for post-trial evaluation. Selection of IDI and survey participants occurred at the same time.

4.3.5 *Data Collection*

From March - May 2021, YLH participants completed a survey which included 24 questions to assess their satisfaction with both phone and in-person strategies employed in this study, and 7 questions to comparing the two strategies. First, we gathered data on baseline characteristics of respondents including age, gender, education, duration of known HIV status and duration on antiretroviral treatment. Second, we measured satisfaction with clinic-based and phone delivery of ATP using survey items adapted from the validated, youth-centered, Client Satisfaction Questionnaire (CSQ-8),[128,129] with additions from the Multi-dimensional Adolescent Satisfaction Scale (MASS).[130] Questions included satisfaction with the experience overall, accessibility and suitability of the strategies, effectiveness, participation, and quality of interpersonal relationship during interactions with HCWs. Responses were based on a four-point scale (1= a lot and 4= not at all). The comparison questions evaluated participants perception of ease, convenience,

affordability, and effectiveness of phone delivery versus in-person delivery. The comparative measures were developed iteratively in a previous study, with input from the study team.[131] Surveys were administered by HCW using RedCap electronic data capture tools on tablets provided by the study. Surveys took 30 – 45 minutes to complete and were conducted in English, Swahili or Dholuo. Appendix 1 summarizes survey items.

We conducted in-depth interviews (IDIs) with YLH between April and May 2021 with a nested sample of YLH who had completed the satisfaction survey. IDIs were conducted in private rooms at the clinic. Prior to IDIs, participants completed a short demographic survey. IDIs were conducted by one of four trained female Kenyan interviewers with previous experience conducting IDIs with YLH. Interviewers used a semi-structured guide developed to capture YLH perceptions and recommendations about the ATP in general, as well as specific perceptions about phone and in-person delivery. IDIs took a median of 40 minutes to complete. IDIs were conducted in Kiswahili, Luo, English. All IDIs were audio-recorded, and later transcribed and translated into English. Interviewers wrote detailed notes, in the form of targeted debrief reports, following each IDI.

4.3.6 *Quantitative Analysis*

We analyzed survey data using descriptive statistics, computing medians, and interquartile ranges (IQR) for continuous variables and frequencies and proportions for categorical variables. Negatively phrased items were reverse coded prior to analysis. Analyses were conducted in R, using statistical software packages ggplot2 and Likert statistical packages to construct graphical summaries of responses to each question, excluding missing responses.[132,133]

4.3.7 *Qualitative analysis*

For analysis of IDI data, we used Atlas.ti software (version 9).[46] Transcripts were analyzed using conventional content analysis.[134] Two coders (MM, KBS) initially developed codes deductively to align with IDI guide prompts and used open coding of a subset of transcripts to expand the code list and code definitions. Using a final version of the codebook, KBS and MM conducted consensus coding on a subset of five transcripts until agreement in code application and text segmentation was reached. After reaching agreement, transcripts were independently coded by one coder, and code application reviewed by the other coder for all transcripts. Any disagreements in coding were resolved through group discussion. Using select code groupings defining benefits and challenges of phone and in-person delivery, preferences, and recommendations we pooled data from the coded transcripts. We read through the individual documents holding pooled data, and evaluated them for patterns in delivery experiences, delivery recommendations, and satisfaction with phone verses in-person delivery. We looked at transcripts repeatedly for positive, negative, or mixed opinions about phone delivery, highlighting frequently discussed ideas, while also noting uncommon experiences and opinions.

4.3.8 *Ethics and permissions*

The ATTACH study was reviewed and approved by the University of Washington Institutional Review Board and the Kenyatta National Hospital/University of Nairobi Ethical Review Committee. All participants ≥ 18 years provided written informed consent while minors provided written assent and parental consent waivers. Findings in this paper were reported in accordance with guidelines/checklist.

4.4 RESULTS

A total of 375 surveys were completed by YLH (65% of the 578 YLH enrolled in intervention sites). The majority of YLH were 18 years or less (55%, n=205), female (62%, n=232), enrolled in secondary school (41%, n=155), had known about their HIV status for >5 years (65%, n=242), and had been taking antiretroviral therapy (ART) for >5 years. Approximately two thirds of respondents lived with their parents or grandparents in households with a median size of 4 people (Table 1).

Table 4.1. Characteristics of survey respondents

Characteristics (N=375)	**N, %** **Median, IQR**	
Sex		
Female	232	62%
Age (median, IQR)	19	5
≤18	205	55%
Current grade level		
Primary	110	29%
Secondary/High school	155	41%
Polytechnic/University/College	35	9%
Other/ Not currently enrolled[1]	75	20%
Duration of known HIV status (missing =1)		
≤ 2 years	46	12%
2-4 years	86	23%
More than 4 years	242	65%
Duration on ART (missing =1)		
<1 year	32	9%
1-2 years	59	16%
2-4 years	127	34%
5-10 years	156	42%
Primary caretaker(s) in household		
Parents/grandparents	218	58%
Spouse/partner	68	18%
Other	89	24%
Household size (median, IQR) (missing = 6)	4	2
0 - 3	130	35%
>3 - 5	149	40%
>5	90	24%

[1]Among not currently enrolled (n=75), 28% had attained primary school education, 54% had reached secondary or high school level, 18% had attained polytechnic, university, or college.

4.4.1 *Survey results*

Figure 1 panel A highlights satisfaction with in-person visits. Satisfaction was generally high for in-person and phone strategies, but higher for in-person visits. Compared to in-person, a higher proportion of responses indicating low to no satisfaction was noted across all phone items assessed. Most respondents were either very satisfied or somewhat satisfied with the duration, timing, speed, and language used, during in-person visits (panel A). Most clients were satisfied

with their ability to speak without fear or hesitation during in-person visits (81%) and a small proportion reported low satisfaction with the confidentiality afforded by in-person visits (8%). There was greater variability in satisfaction with phone compared to in-person delivery of the ATP (see Figure 1 panel B). For phone delivery, YLH were most satisfied with language used and perceived value of YLH contributions during phone calls (both 89%). Twenty-five percent of respondents reported low or no satisfaction with the confidentiality of phone visits and 28% felt delivery by phone did not allow them to speak freely without fear or hesitation. For both strategies, self-expression, and appropriateness for communicating sensitive issues had the largest proportions reporting little to no satisfaction (phone: 58% and 34%; in-person: 67% and 36%, respectively).

Despite separate assessments showing better responses for some categories for in-person versus phone, when YLH were asked to compare the two strategies, respondents indicated that the phone strategy was superior to in-person visits in all domains (Figure 2). YLH reported that phone calls were easier (71%), more convenient (75%), less burdensome (64%), more user-friendly (67%), more confidential (68%), more cost effective (78%) and overall, more effective (65%) than in-person visits.

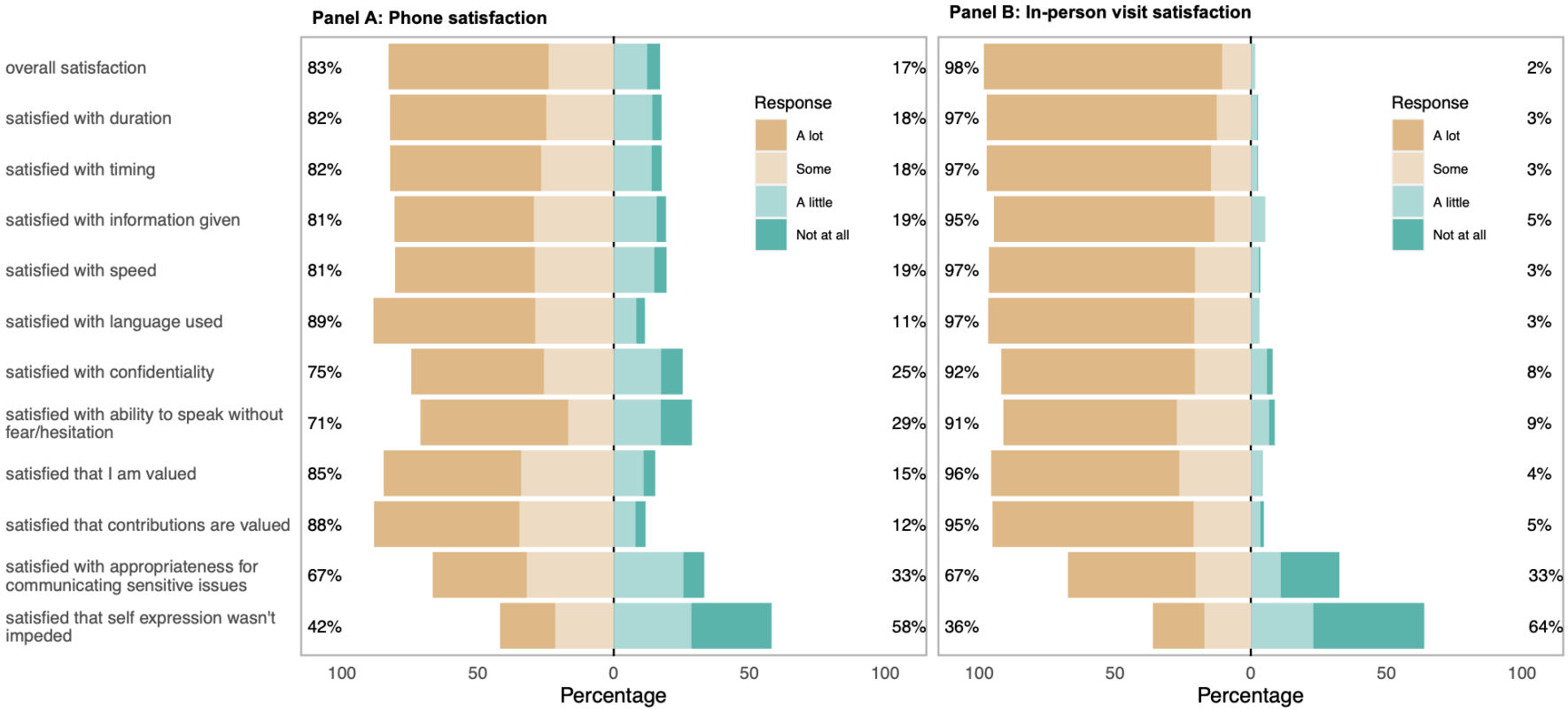

Figure 4.2. Youth satisfaction with phone and in-person delivery of the ATP

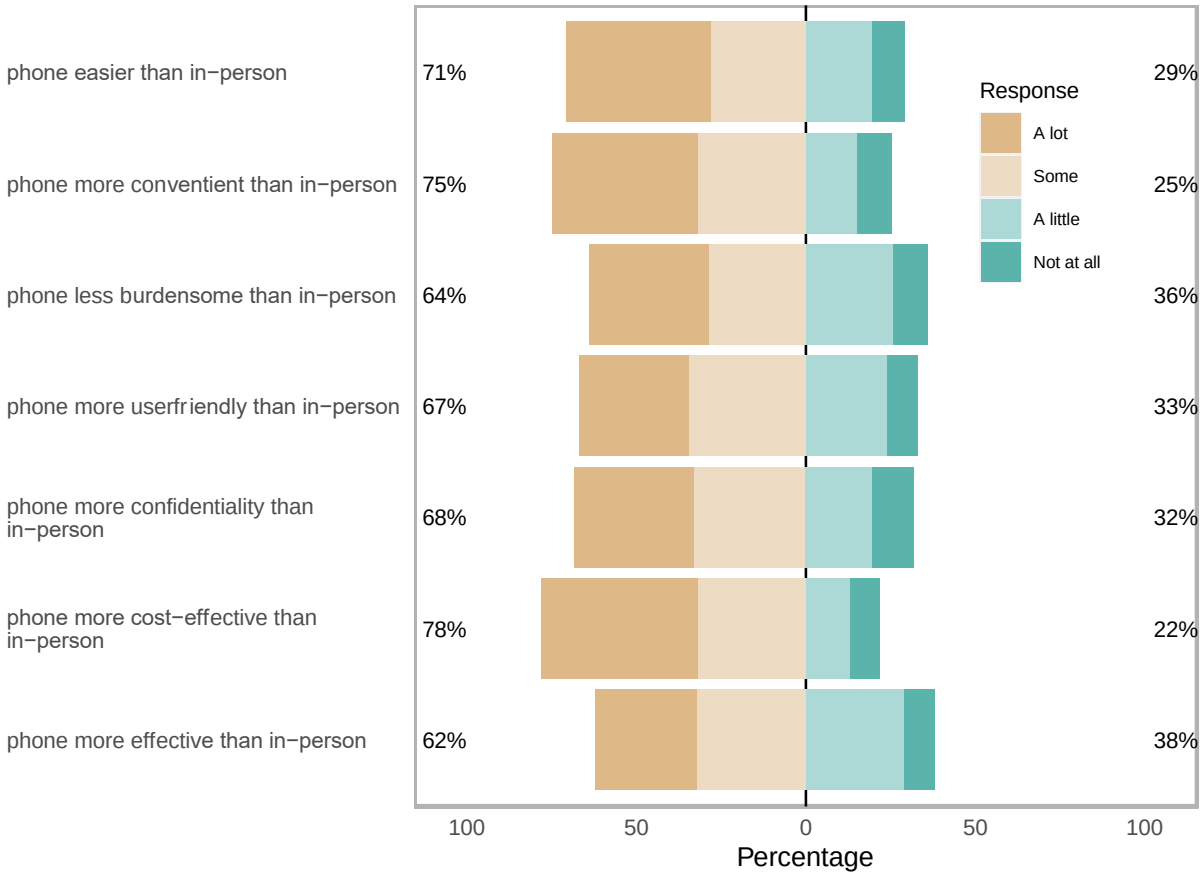

Figure 4.3. Comparison of perceived benefits of phone delivery compared to in-person delivery.

4.4.2 *Qualitative results*

IDI participants were mainly below 18 years of age (65%), female (56%) and in secondary school (48%) at the time of the IDI. Most received HIV services in adolescent clinics (86%) compared to adult clinics and had been on ARTs for at least 4 years (81%). (Table 3)

Table 4.2. Characteristics of in-depth interview participants

Characteristics (N = 66)	**N, % or median, IQR**	
Sex		
Female	37	56%
Age (median, IQR)	20	4
<18	45	65%
Current grade level		
Primary	7	11%
Secondary/High school	32	48%
Polytechnic/University/College	10	15%
Other/ Not currently enrolled[1]	17	26%
Receives adolescent services (versus adult)	57	86%
Duration on ARTs		
<=2 years	4	6%
2-4 years	8	12%
More than 4 years	54	81%
Employment status		
Full time, salaried role	2	3%
Part time, hourly role	13	20%
Unemployed	43	65%
Other	8	12%
Household size (median, IQR) (missing = 3)	4	2
0 - 3	27	35%
>3 - 5	24	40%
>5	12	24%

[1]Among those not currently enrolled, 7 had gone up to primary school, 7 to secondary, 2 to university/college/polytechnic and 1 was missing information.

The qualitative data supported the general patterns identified by the quantitative data. Overall, youth described positive experiences with both strategies, and appreciated receiving the ATP content regardless of delivery format (phone vs. in-person). Despite appreciable satisfaction with phone delivery of the ATP, majority preferred receiving the intervention at the clinic. The youth described several key concepts influencing delivery experiences and preferences, including: 1) convenience, 2) relationships and connection, 3) privacy and confidentiality, 4) resource availability, and 5) comprehension of ATP material (Table 4).

Convenience

Many youth reflected that attending clinic visits in-person, although easy and familiar, was time intensive and less convenient, requiring them to take time off from other activities and to "keep coming every time". In contrast, the youth found the remote access offered by phone delivery to be more convenient, since discussions over the phone were shorter, and saved costs by reducing the need to travel. Additionally, youth felt that phone calls facilitated expedient problem-solving because providers were able to address urgent issues immediately.

> "The moment you receive a phone call, if you had a burning question you will ask it in that call instead of waiting until the day you will come to the clinic by when you will have already forgotten about the question you wanted to ask, so, you will not have been helped." Male, 24 years.

Among the few that preferred phone delivery of ATP, the convenience of remote access, cost and time savings were the main reasons.

> "Okay I prefer over phone calls yeah because I work as a hairdresser, so sometimes I might be having a client and I am also needed immediately at the hospital you see. But if it is a phone call you can tell your client to give you like 30 minutes then you go talk on the phone and come back." Female, 21 years.

Relationship and connection

Clinic visits supported direct interaction and relationship-building and maintaining close connections between youth and providers. For in-person visits, most of the youth valued and preferred being able to observe body language as visual cues to enhance their clinical care experience.

> "Yeah, I liked it because at least the healthcare worker can show me some signs and now at least they are visible and I can see him." Male, 21 years.

Related to connection, youth felt that the phone strategy encouraged and supported client-provider relationship-building when clinic visits were limited or unavailable due to COVID-19 restrictions. Youth described feeling valued, like "someone cares for them" and were motivated by the encouragement they received to continue taking their medicines. However, youth felt these interactions differed from connections built in-person, sometimes describing them as "dry".

While youth preferred the in-person experience, some noted that the visibility afforded by direct interactions was a barrier to discussing sensitive issues or "topics that may cause embarrassment". This was not the case with phone delivery, which offered youth a degree of anonymity when interacting with providers. Some youth described experiencing freedom to "ask questions without feeling any shame", thereby supporting the growth of more trusting relationships between clients and providers.

> "On phone I can say it is not bad, you know you are not seeing face to face, so even…you can ask any question without feeling ashamed, you can just ask unlike when you are talking live like this, you might feel a little embarrassed to ask and will end up not asking" Male, 23 years.

Privacy and confidentiality

In person visits were felt to provide better privacy and confidentiality when compared to phone delivery. YLH perceived the clinic as a secure, designated space and time where YLH could interact with providers "live", in a "comfortable" environment, without distraction or disruption. This environment allowed YLH to feel confident discussing issues and topics that might reveal their HIV status.

> "It is better to come [to the clinic]..I just feel it is okay because you just talk and talk freely and you can even tell him there and then if you have any problem" Female, 20 years.

However, not all youth agreed that clinics were private, confidential spaces. Some youth were afraid of unintended disclosure on their HIV status during clinic visits because "being inside the facility, everyone can see you."

Similar issues with privacy and confidentiality were noted with phone delivery. Although most YLH felt that phone calls were "good", some YLH were afraid of unintentional disclosure when phone calls came during work hours or in the presence of peers. YLH worried that their phone conversations, which included HIV-specific content, could be overheard and lead to stigma and discrimination.

> "I won't prefer a phone call, maybe a face-to-face talk…Yes, because walls have ears. You get that let's say when you are talking over the phone, maybe there might be a person hearing you and later on they come and say that, 'so this is the state of so and so and I have never known.' So that is when mockery and hate start, they may say, '' I hate this person because he is HIV positive,'' he can tell my friends, 'don't get closer to this person, you will die just like him.' Such things." Male, 19 years.

To address this concern, some YLH highlighted instances when providers checked that youth were in suitable environments, including directly requesting caregivers to ensure the youth had privacy, before proceeding with calls.

> "In the calls I would be asked questions when I am alone and no one knew whatever we were discussing because they would call when I am alone, and once I knew, like when I am told, 'I am so and so from XYZ' if I was where there are so many people I would excuse myself and go talk away from people. It is better than being inside the facility here where everyone can see you what, what." Female, 21 years.

Resource availability

YLH identified few examples of resource constraints associated with in-person visits. YLH described having extended time to address their needs during in-person visits, and this contributed to improved satisfaction with intervention delivery. Although it was their norm to attend clinic

visits, YLH noted that transportation costs were a financial barrier and something that needed to be planned for.

> "I prefer phone calls because sometimes you might be asked to go to the hospital immediately and you don't have transport money." Male, 19 years.

In contrast, variable phone ownership among youth limited access to phone delivery, affecting when and how providers could reach patients. Youth who shared phones with parents or a spouse felt restricted on when they might receive calls.

> "No, I have not received any phone calls because sometimes I could give them a number to use to call me but when they called maybe I was not available. This is because this is my partner's number and he kept on switching from Safaricom to Airtel networks so therefore they could not find me." Female, 21 years.

Limited time, including airtime for phone calls, was one facility-level resource constraint affecting satisfaction with the phone delivery strategy and driving some of the preference for in-person delivery. Youth perceived providers had limited time and a finite amount of phone credit, which they believed led to short call durations, providers who spoke too fast, and calls that ended abruptly.

> "Yes,...I didn't like phone calls because unlike physical contact, it would require credit and this limited the conversation since one couldn't be able to engage in a lengthy discussion with his or her [healthcare worker]." Male, 17 years.

> "The one that you do face to face is easy, understandable and maybe the person who is taking you through the book has more time, but you know through the phone calls, maybe the person is doing something else and then they would insist that I want it to be done now or maybe the person might tell you call later or I will call you, yes." Female, 21 years.

Comprehension

Youth perceived in-person visits to be conducive for YLH to seek clarification or address other challenges. Individualized care was available during in-person clinic visits, as youth indicated that providers often accommodated requests for extended consultation time as needed.

Additionally, youth could access pictures associated with ATP chapters, which when compared to phone delivery, better supported their learning.

> "Okay, I would prefer face to face because with the phone you will not see what you are being taught but face to face you will see and even see the pictures." Female, 21 years.

Issues related to call quality described previously compromised the youths' ability to comprehend the ATP material. Youth highlighted dropped calls, poor network connectivity and providers speaking too fast as barriers to understanding the content in ATP chapters.

> "Actually, I wasn't impressed because of network problems. At times, we could not understand one another and sometimes words would break hindering our communication..." Female, 24 years.

Nonetheless, youth appreciated the ability of the ATP to be individually tailored to meet their needs. They reported that during calls, providers accommodated individual requests by customizing their approach, including repeating content or requesting extended review of the ATP chapters.

> "It was good because the day that I was called they were teaching…they were summarizing about the book because I had texted them telling them that I needed that, and that at least they should summarize it for me, the whole of the book." Female, 19 years.

Although there were some elements with higher satisfaction and preference was for the in-person strategy, there was notable support for sustainment of the phone strategy while addressing client recommendations for improvement. These included incorporating preparatory steps such as providers sending advance notice, introducing themselves and the goal of the call clearly at the beginning and using a consistent phone number for easy recognition. Youth suggested that the purpose of the phone strategy be restricted to information sharing including viral load results, education, reminders, and medication adherence support. YLH proposed integrating peer groups

into calls to support the learning process. Lastly, a few YLH expressed ambivalence about integrating counselling into the phone strategy, saying "whichever is the better way" worked for them.

Figure 5 integrates findings from the QUANT and QUAL databases. There was overall convergence in the main messages of this study: YLH were generally satisfied with phone and in-person visits but satisfaction with face-to-face interactions was higher and preferred over calls. Areas of divergence were primarily related to satisfaction with phone. Survey results depicted higher satisfaction with items assessing timing, content comprehension, ability to speak without fear, confidentiality, appropriateness of the medium for self-expression and for discussing sensitive issues, than was described in the qualitative IDIs.

Table 4.3. Summary of concepts and representative quotes

Concepts	In-person delivery	Phone delivery
Convenience	"Face to face takes longer but over the phone is it just a few minutes you are asked questions and the story ends. I prefer over the phone because you don't take long." Female, 18 years.	"Okay I prefer over phone calls yeah because I work as a hairdresser, so sometimes I might be having a client and I am also needed immediately at the hospital you see. But if it is a phone call you can tell your client to give you like 30 minutes then you go talk on the phone and come back." Female, 21 years.
Relationship/ Connection	"I prefer going through it face to face with the provider. Okay, face to face is good because there is interaction as compared to phone calls which there could be a hard time reading it." Female, 22 years.	"Okay, I liked just being checked on and I just wonder, they just call you and ask, "Hi (name of participant) are you? Are you faring well? Okay, stay safe" I just loved it, being checked on and someone just feels good." Female, 21 years.
Privacy & confidentiality	"It is better if you just come and be told here [in the clinic], in case of anything. Over the phone-no…You can be called, and it finds you in a public place, you can't receive a call while in a public place. Or maybe you are somewhere with someone, you can't receive the call, you ignore." Male, 21 years.	"You get that let's say when you are talking over the phone, maybe there might be a person hearing you and later on they come and say that, '' so this is the state of so and so and I have never known.'' So that is when mockery and hate start, they may say, '' I hate this person because he is HIV positive,'' he can tell my friends, '' don't get closer to this person, you will die just like him.'' Male, 21 years
Resource availability	You know face to face you can explain to someone the challenges you're facing and there would be no word breakdown. But on phone there will be the issue of network, credit and even phone charge..." Male, 20 years.	"No, because sometimes I could give them a number to use to call me but when they called maybe I was not available. This is because this is my partner's number and he kept on switching from Safaricom to Airtel [networks] so therefore they could not find me." Female, 21 years.
Comprehension	"I prefer face to face because it makes me to understand more better than through phone. You know while using phone, you tend to talk faster and one may not understand easily. But I would understand it better if I get to read it myself." Male, 17 years.	"Actually, I wasn't impressed because of network problems. At times, we could not understand one another and sometimes words would break hindering our communication…. That conversation would end there." Female, 24 years.
Recommendations		"They should prepare or inform one prior before the call so that one may find a private place convenient for the conversation should the call find one in some public places." Female, 20 years

Summary of quantitative survey results	Summary of qualitative findings with representative quotes	Convergence Insights
Concept: Convenience ● Proportion ≥ some satisfaction (phone versus in-person): 1) Overall experience: 83% vs. 99% 2) Duration/ length: 83% vs. 98% 3) Timing/scheduling: 83% vs. 98% ● Items related to the theme i.e. duration and timing, showed high satisfaction for both strategies, but more so for in-person visits ● Survey responses indicate phone was more convenient, easier, and more user friendly than clinic visits	● Phones offered convenience, time, and cost savings in addition to ease of access to information. In-person visits were easy but less convenient ●"The one that you do face to face is easy, understandable and maybe the person who is taking you through the book has more time." Female, 21 years. ●"You know the one over the phone is fast but visit the clinic you have to sit and wait." Female, 21 years.	● Convergence in messages about satisfaction with duration, cost, and relative ease of phone calls ● Divergence in messages about satisfaction with length of in-person visits
Concept: Relationship/connection ● Proportion ≥ some satisfaction (phone versus in-person): 1) Supports speaking without hesitation/fear: 81% vs. 91% 2) Client felt valued: 85% vs. 95% 3) Contribution was valued: 89% vs. 97% ● Items related to the theme i.e. client felt valued, client felt their contribution was valued, showed high satisfaction for both strategies, but more so for in-person visits ● Survey responses suggest in-person visits were slightly more suitable for interaction and relationship building	● Youth felt valued and enjoyed relationship and connection with providers. Both strategies supported interactions with providers but face-to-face meetings were preferred ●"When you talk with a person one on one there is that extra conversation you will have but when you talk over the phone it will be like dry text what the person has said is what you will answer directly." Male, 19 years. ● "I would prefer now whatever we lacked. We lacked the grouping, face to face, as much as I would want the call, I would still want that because we missed that." Female, 20 years.	● Convergence in messages about importance of relationships and connection for YLH ● Convergence in message about clinic visits being better suited for connection

Figure 4.4. Joint display integrating qualitative and quantitative findings[1]

[1] Green shading highlights area of divergence

Summary of quantitative survey results	Summary of qualitative findings with representative quotes	Convergence Insights
Concept: Privacy and confidentiality ● Proportion ≥ some satisfaction (phone versus in-person): 1) Confidentiality: 75% vs. 92% 2) Appropriateness for communicating sensitive issues: 67% vs. 67% 3) Format supports self-expression: 44% vs. 36% ● Items measuring satisfaction with confidentiality and ability to speak without fear/hesitation, showed high satisfaction for both strategies. Satisfaction with appropriateness for communicating sensitive issues and capacity for self-expression was notably lower across both. Survey responses suggest in-person visits offered more privacy and confidentiality.	● In-person visits were perceived as safe environments whereas phone calls were perceived to be less private and confidential ● "Over the phone, you may not be in a safe environment, where you can talk on the phone. So, it is better if you just come and be told here, in case of anything. Over the phone-no…You can be called, and it finds you in a public place, you can't receive a call while in a public place. Or maybe you are somewhere with someone, you can't receive the call, you ignore." Male, 21 years. ●"Phone is better than being inside the facility here where everyone can see you what, what…." Female, 21 years.	● Convergence in theme highlighting importance of privacy for YLH ● Convergence in message about clinic visits offering better conditions to support privacy and confidentiality
Concept: Resource availability ● No survey item evaluating satisfaction with cost ● One item compared cost-effectiveness of phones and clinic visits and suggests YLH felt phones were more cost effective. ● No item assessed phone access or availability of other resources like airtime	● No major resource challenges were linked to in-person visits. However, satisfaction with phone calls was limited lack of phones among youth, limited airtime for calls and time for discussion ● Sometimes they would get me on phone, and sometimes they would not. Because I don't have a phone. It is my mother's." Female ,18 years. ● "The one on one was better than phone calls, on the phone she went through the chapter in a hurry even before they explain in details. You cannot ask questions because of airtime." Female, 19 years.	● Divergence in the main message in the qualitative work highlighting resource availability as an important factor with the survey response showing perceived cost-effectiveness of the phone strategy
Concept: Comprehension ● Proportion ≥ some satisfaction (phone versus in-person): 1) Content comprehension: 80% vs. 94% 2) Speed: 80% vs. 98% 3) Language: 89% vs. 97% ● Items showed high satisfaction for both strategies, but more so for in-person visits	● YLH were more satisfied with their ability to comprehend discussion material during in-person visits, highlighting that poor call quality as a key barrier. ● "You know while using phone, you tend to talk faster and one may not understand easily. But I would understand it better if I get to read it myself." Male, 24 years. ● "I prefer face to face…He [the provider] can explain to you more through face to face than phone calls. You can also ask him a lot of questions when you are with him face to face than when he is calling you" Female, 18 years.	● Expansion in understanding comprehension during phone calls and pointing out underlying areas for quality improvement ● Convergence of findings about comprehension during in-person visits ● Divergence of findings about high satisfaction with comprehension during phone calls

4.5 DISCUSSION

Youth around the world face significant barriers accessing sexual and reproductive health services.[135,136] mHealth and other digital health technologies have emerged as acceptable and beneficial approach to addressing these gaps to support continuity of care.[8,12,13,137] Our study investigated YLH's satisfaction with phone versus in-person delivery of the ATP, a HIV care transition intervention implemented in the context of the COVID-19 pandemic. Overall, YLH found different benefits and drawbacks for in-person delivery and phone delivery of the ATP. Across both strategies items evaluating suitability for self-expression and communicating sensitive issues had the lowest performance and aligned with qualitative evidence describing discomfort due to perceived lack of privacy, limited time available on phones and inability to connect in-person and leverage the intimacy of one-on-one communication between YLH and providers. Youth experience with phone delivery was good but marked by concerns about privacy, call quality and overall comprehension of the ATP material.

YLH found that there were certain aspects for which phone delivery was superior and others where in-person was preferred. YLH placed high value on the patient-provider relationship and seemed to rely on healthcare workers for a considerable amount of information and encouragement. The influence of patient-provider relationship on HIV outcomes among YLH has been documented.[138–140] Studies have shown that people living with HIV who perceive that their providers care about them and understand them have demonstrated higher rates of adherence to treatment and suppressed viral loads.[138,139,141,142] The preference for in-person visits also signals YLH need for interaction with their peers. Peer support groups in HIV clinics are a common feature in SSA.[143] Among youth, peer support offers a source of emotional support, indicate social

acceptance and confer a degree of protection from anticipated and experienced stigma.[143–145] During the COVID-19 pandemic, social distancing policies and limited access to facilities created a barrier for youth to engage in support groups, creating a gap in YLH support system. Preference for in-person visits with the anticipation of connecting with peers once again is as expected.

mHealth strategies possess advantages like user-friendliness, efficiency, convenience, timely communication, anonymity, and cost savings, which contributed to appreciable satisfaction with phone delivery in our study.[18,145–147] However, drawbacks of the phone strategy include a perceived lack of privacy and confidentiality which likely underlies YLH's anticipated fear of unintended disclosure of HIV status and subsequent stigmatization.[142,148] This contrasts with other studies that link mHealth strategies in general with better trust, privacy, confidentiality than face-to-face interactions.[18,146,149] The lack of advance preparation by providers as evidenced by complaints about receiving calls at inconvenient times in environments where privacy could be compromised may also explain YLH's fear. These experiences point at the need for further training of providers on appropriate delivery of phone calls and other mHealth strategies. However, it is noteworthy that in this context, majority of providers were new to mHealth and had abruptly pivoted to remote delivery of health services, while maintaining existing responsibilities and managing COVID-19 related-changes to their workflows. In ideal circumstances, providers would have been provided ample training and lead time before initiating phone calls.

Although mobile phone penetration in SSA is growing exponentially, among youth there is considerable variability in ownership, with many young people lacking or sharing phones with others.[13,35,149,150] This inhibits timely delivery of health services via digital technology. Sharing of

phones increases the risk of information breaches and may compromise youths' trust in providers.[13,151,152] In our study, limited access to phones negatively impacted the quality of provider engagement, and YLH ability to be open. Limited phone airtime and fluctuating cellular network service, which are common in LMICs, were highlighted as other sources of low to no satisfaction with phone calls.[10,18,19]

This analysis highlights the need to evaluate patient satisfaction with mHealth strategies such as the use of phone calls to transmit information to YLH. In addition, our findings also underscore the need to carefully consider and integrate youth feedback into implementation of health services for the purposes of improvement, and to make progress towards the global goal of providing youth-friendly health services. Lastly, mHealth has yet to be fully maximized to support HIV care transition. To date only two other studies document the use of various forms of mHealth for YLH transition.[13,100,153] Future research may explore the utility of different mHealth functionalities to prepare or support YLH before, during and after transition to enhance retention in care. Incorporating continuous measurement of patient satisfaction will provide insight into how YLH are experiencing HIV services and highlight service characteristics that can be improved on to improve service quality.

To our knowledge this is the first mixed methods study to evaluate satisfaction with two modalities of delivering a transition intervention. The application of mixed methods is a strength of this analysis. Combining qualitative and qualitative data added to our understanding of youth's experience during the ATTACH study; we were able to integrate our results in a joint display to identify and illustrate areas of convergence or divergence. This triangulation of information may

be useful for targeting quality improvement efforts in future implementation of youth interventions. These findings may be generalized to similar geographies with comparable HIV prevalence and organization of HIV services because we randomly sampled from YLH who attend publicly funded health facilities in western Kenya therefore our results can be generalized to that region.

Satisfaction is a complex and multi-dimensional measure reflecting individual-level values placed on their expectations and experiences with health services, which are subject to influences at the community, provider, or clinic level.[154,155] In this analysis, we did not explore the influence of these variables. However, studies show that young age, technology literacy, disclosure status and low socio-economic status have a strong association with satisfaction with mHealth-supported HIV services.[10] We also did not assess phone ownership, satisfaction with technical quality or technical skills of the staff or physical environment of the participant during intervention delivery. Like similar studies surveying youth, there was a risk of social desirability bias stemming from YLH anticipating receipt of incentives related to their participation or the fear of upsetting or disappointing adults who are seen as authority figures. This may explain the positive skew or ceiling effect detected in the quantitative responses. Furthermore, the survey included positively stated statements requiring respondents to agree or disagree. Studies have shown that positive framing could induce bias and add to the ceiling effect.[156,157] We also note that some youth may have been uncomfortable opening up, therefore they may have hidden or abbreviated their responses. To mitigate this, the study staff made sure that participants felt comfortable and assured of confidentiality, and repeatedly reminded youth of the safeguards that had been put in place. Items assessing satisfaction used a 4-point scale, which eliminates a midpoint response

representing neutrality. While this may be seen as a disadvantage, other work has shown 4-point scales have the potential to minimize social desirability bias, when compared to scales with a midpoint.[158] Youth are also associated with the tendency to agree with statements of opinion regardless of content (acquiescent response).[159] This may explain the high positive responses in the survey. The inclusion of qualitative data helped corroborate survey findings. Lastly, we assessed satisfaction cross-sectionally therefore we are unable to comment on whether service quality had changed over time or remained the same.

4.6 CONCLUSION

Our study findings indicate that there was higher satisfaction with both in-person and phone delivery of the ATP as they transitioned from pediatric to adult HIV care. Convenience, time spent and averted costs were strong drivers of satisfaction for phone calls. However, YLH need for ample time, dedicated spaces guaranteeing privacy and confidentiality and interest in maintaining close relationships with providers seemed to drive the satisfaction and preference of the majority towards in-person visits. Using phone calls to deliver health services during times of society-wide upheaval YLH was useful and necessary, but to sustain such a strategy, improvements are needed that better match the phone use and other mHealth strategies to youth preferences. Further studies assessing the role of provider and patient characteristics on satisfaction with in-person and phone-based services may elucidate criteria for better targeting of either strategy. Given the inevitable expansion of mHealth, persistent gaps in access to HIV care beyond the pandemic, and repeated calls to buttress the youth-friendliness of HIV services, it is critical to focus attention on improving strategies that promise to improve HIV outcomes among the youth.

Chapter 5. CONCLUSION

This dissertation assessed the implementation of mobile phone delivery of the ATP in Kenya using Implementation Science frameworks, qualitative and mixed methods to identify determinants of implementation success, the characteristics of provider-led adaptations and the perceived quality of service from the client perspective, comparing between experiences with mobile phone delivery and in-person delivery. This work also showed the feasibility and acceptability of using phone calls to support YLH preparation for transition to independent care in adult HIV clinics.

In the qualitative analysis of determinants of phone delivery of the ATP intervention, we found that salient factors influencing acceptability, feasibility and reach were related to the technical simplicity of phone calls, relative convenience, and efficiency of using phones, and to inner setting characteristics such as the presence of collaborative teams, availability of information and resources, and compatibility. Determinants related to patient needs and resources and community, specifically low phone ownership among youth, and the youths' relationships with caregivers and spouses, were significant, underscoring the need for future mHealth initiatives to address the inequities in health access created when services are delivered by phone. The effect of relationships with caregivers and spouses on YLH behavior needs closer examination, and potentially new behavioral interventions to increase knowledge, reduce stigma and enhance families' ability to support YLH may be gamechangers in the efforts to improve HIV outcomes among youth.

Through the comparison of patient satisfaction, we further highlighted the importance of considering patient-level factors before and during implementation of mHealth interventions. The comparison of satisfaction showed that though YLH were able to appreciate the advantages of both strategies, their preferences were mixed. The need for convenience and ease, privacy and confidentiality, and patient-provider connection guided YLH preferences. While most youth perceived that the phone could not guarantee their privacy, others were less concerned about the risk of privacy breaches and instead were excited by the convenience and cost efficiency of the strategy. We conclude that mHealth may be beneficial for some but not all youth, therefore implementers need to assess patient characteristics and preferences to inform them on which groups to target.

In our application of FRAME-IS to characterize provider-led adaptations to mobile phone delivery, using CQI data, we demonstrated the feasibility of the process for introducing adaptations within HIV clinic settings. We also showed that FRAME-IS was apt for describing the modifications, majority of which were context adaptations introduced to increase the feasibility of phone delivery. We identified avenues for improvement of the FRAME-IS, including adding a module for specifying and enumerating outcomes and propose other uses like applying the modules to guide the adaptation process. An outcomes module would be a transformative change for Implementation Science, offering new avenues for studying how adaptions influence implementation and effectiveness outcomes.

We provide evidence for consideration in the implementation of mHealth interventions for YLH in resource-limited settings during global epidemics and opportunities for future research.

We also add to the research on mHealth implementation in sub-Saharan Africa, demonstrating how Implementation Science might inform optimization of digital health strategies and considerations for new applications of mHealth.

To follow up on the lessons learned from this dissertation, I am interested in identifying ways to strengthen the measurement of satisfaction using psychometric scales and cognitive interviews with YLH to evaluate how well they understand satisfaction survey items. I would also like to explore readiness for implementation of mHealth and other digital health technologies in Kenya using a longitudinal study design to identify at baseline what a typical health facility might be ready for and how those changes over time. Given the absence of a policy angle in my dissertation work, I am also interested in disseminating the results of this dissertation to various stakeholders in Kenya and through that identify suitable participants for researching the role of policy in the integration of mHealth into the broader health system. Lastly, there is a big gap in the availability of costing data to support mHealth interventions. To that end, I am interested in developing a grant to apply micro-costing methods for estimating the resource requirements associated with designing and implementing a new mHealth application for YLH that leverages voice, text, and video functions of mobile phones.

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