

# Understanding why and how youth-friendly health services improve viral load suppression among adolescents and young people living with HIV in Nigeria: realist evaluation with qualitative comparative analysis

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**To cite:** Badejo O, Nöstlinger C, Wouters E, *et al.* Understanding why and how youth-friendly health services improve viral load suppression among adolescents and young people living with HIV in Nigeria: realist evaluation with qualitative comparative analysis. *BMJ Glob Health* 2023;**8**:e012600. doi:10.1136/bmjgh-2023-012600

**Handling editor** Seye Abimbola

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/bmjgh-2023-012600>).

Received 17 April 2023  
Accepted 4 September 2023



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## ABSTRACT

**Introduction** Youth-friendly health service (YFHS) approaches are essential to better outcomes for young people. We evaluated attainment of viral load suppression among young people living with HIV (YPLHIV) enrolled in an HIV treatment programme implementing YFHS models in Nigeria.

**Methods** A realist evaluation using qualitative and quantitative programme data from 10 implementing health facilities. We used qualitative information to explore how and why viral load suppression was attained across different settings and quantitative data to describe patterns and associations between youth-friendly structures and processes of care, care retention and viral load suppression. To consolidate the theories, we used qualitative comparative analysis to identify the necessary and sufficient conditions for attaining viral load suppression, using 30 YPLHIV as cases.

**Results** Between baseline (2018) and study-end (May 2022), viral load suppression coverage increased in 8 of the 10 study facilities. The number of facilities with viral load suppression coverage  $\geq 90\%$  rose from two to seven, while one facility remained unchanged, and another had a decline in coverage. Among the 30 selected YPLHIV cases, 18 had viral load suppression during the first test and 24 at the second test. However, viral load suppression attainment varied in different contexts. We identified the different YFHS interventions and key mechanisms that influenced viral load suppression in different contexts.

**Conclusion** YFHS interventions can improve young people's engagement with HIV services, but their effectiveness depends on specific mechanisms and contextual factors influencing their response to interventions. By exploring how and why viral load suppression was attained in different contexts, the findings will improve the design and implementation of strategies to improve outcomes in young people, which will be relevant for achievement of global goals to eliminate HIV by 2030.

## WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Youth-friendly health service (YFHS) approaches can support adolescents and young people to achieve better health outcomes.
- ⇒ The rapid explosion in YFHS implementation strategies has come with several challenges, including a lack of consensus in defining, operationalising and evaluating YFHS.
- ⇒ This has led to significant knowledge and practice gaps regarding YFHS' most effective strategies and how to scale them up.

## WHAT THIS STUDY ADDS

- ⇒ The findings contribute to a better understanding of YFHS by identifying fundamental mechanisms that explain the effectiveness of different YFHS strategies in different contexts, leading to a simpler and better-organised knowledge of YFHS.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ Study findings can lead to a greater consensus on how YFHS should be defined, implemented and assessed.
- ⇒ This can enable YFHS practitioners to identify better, different or additional YFHS strategies that can trigger key mechanisms to achieve better outcomes.
- ⇒ Findings can also enable YFHS practitioners and policy-makers to develop evidence-based and context-appropriate minimum service packages that could help address the needs of young people at scale.

## INTRODUCTION

Youth (adolescent) friendly health services (YFHSs) are a promising approach aimed at improving health outcomes in young people (adolescents aged 10–19 years and young

adults aged 15–24 years)<sup>12</sup> in line with the third Sustainable Development Goal of healthy lives and well-being for all.<sup>3</sup> Despite these efforts, significant gaps remain in meeting the YFHS' objectives to be accessible, acceptable, equitable, appropriate and effective.<sup>14</sup> Since being formalised by the WHO in 2012, YFHSs have been implemented through a multidisciplinary approach incorporating different care components, including clinical, behavioural, digital and others, into a comprehensive package of person-centred health services.<sup>5–8</sup> However, challenges remain regarding its definition, implementation and evaluation.<sup>4,9</sup>

YFHS is a complex intervention that involves multiple actors, including young people and providers, who interact within constantly changing social environments, which can lead to both intended and unintended outcomes.<sup>5 7 10 11</sup> However, this complexity has not been fully accounted for in much of the existing research on YFHS, which often relies on predictive designs or controlled experiments that assume linearity and predictability. Complementary approaches better suited to uncertainty and generative causality are needed to overcome this limitation. Theory-based approaches such as realist evaluation (RE) are valuable because they connect intervention components, contextual factors and mechanisms to the outcomes produced. They provide a framework to conceptualise and explain the relationships and pathways involved. In this study, we adopted a RE framework, incorporating quantitative and qualitative approaches, to understand how YFHS interventions influenced viral load (VL) outcomes among young people living with HIV (YPLHIV) in Nigeria.

Nigeria provides an appropriate setting because YFHS is being scaled up to improve outcomes among YPLHIV.<sup>12–17</sup> Although Nigeria's HIV prevalence of 1.4% is at its lowest since 1991,<sup>18</sup> challenges and unmet needs still hinder progress towards achieving the national HIV goals, disproportionately affecting young people. Only 31% of young people aged 15–24 are aware of their HIV status, compared with the national average of 46.9%. While over 90% of known YPLHIV are on antiretroviral therapy (ART), only 31.2% of known YPLHIV aged 20–24 years have VL suppression, lower than the national average of 43.1% in adults 15–64 years.<sup>18</sup>

The implementation of YFHS in Nigeria has been slow,<sup>16 19</sup> but recent progress has been made to integrate youth-friendly models into routine health services through the National Standards and Minimum Service Package for Adolescent and YFHS.<sup>15 17</sup> The guideline provides an up-to-date minimum package of services and quality standards to operationalise youth-friendly services in healthcare settings in Nigeria. The Government of Nigeria, with support from the US President's Emergency Plan for AIDS Relief (PEPFAR), has been scaling up the Operation Triple Zero (OTZ) model of YFHS to address unmet needs for HIV services for young people. OTZ involves young people as active partners by committing to three goals: zero missed appointments, zero missed

medication and zero VL. The scale up of OTZ and other YFHS models is strengthening the policy and practice of YFHS in the country.

## METHODS

### Intervention description

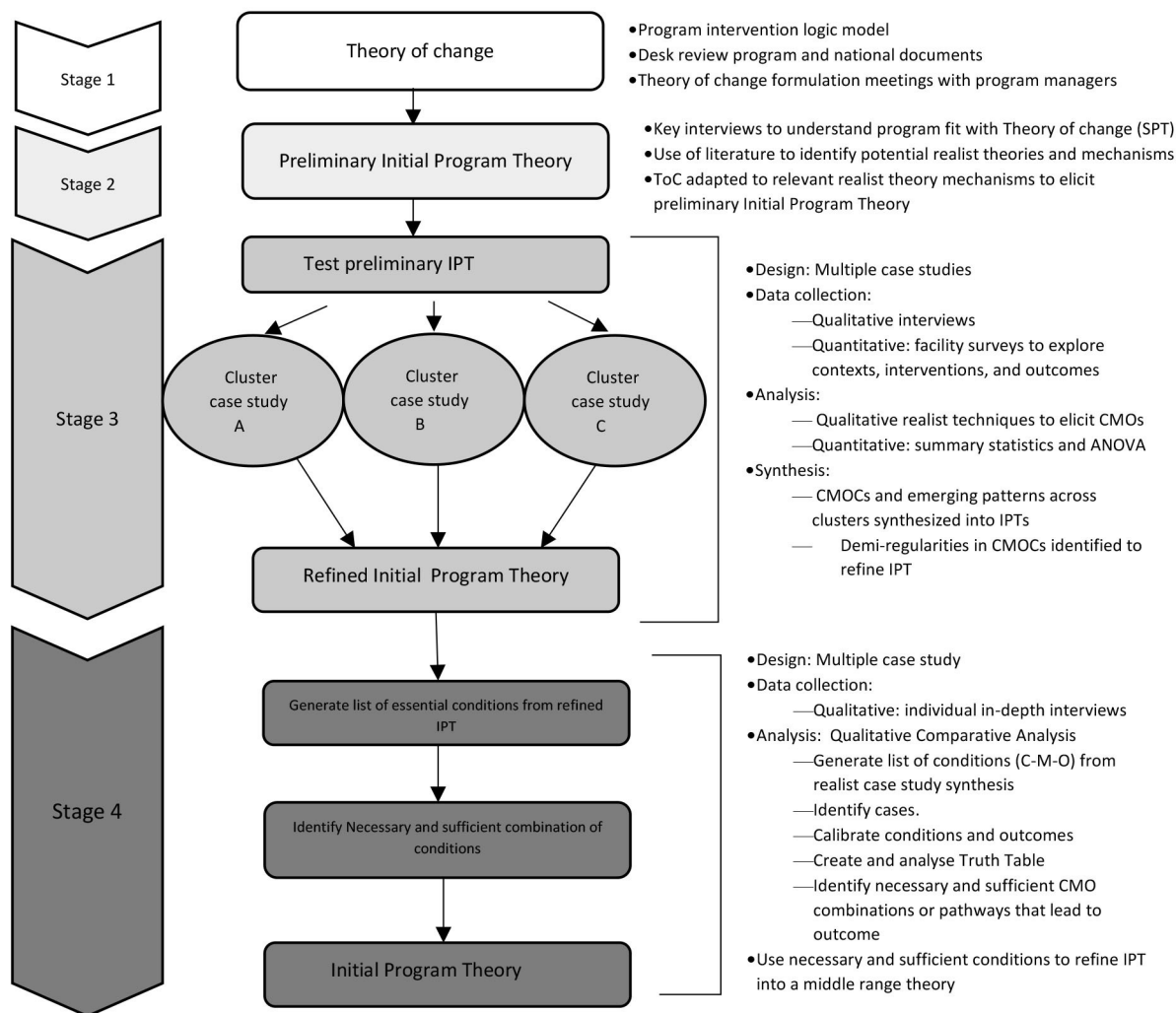
We conducted this study within a network of PEPFAR-funded healthcare facilities using youth-friendly models to deliver HIV services in a large HIV treatment programme managed by APIN Public Health Initiatives Ltd/Gte (APIN). APIN's YFHS models specifically included differentiated service delivery (DSD), which comprised in-facility models like fast-track and multi-month dispensing, as well as out-of-facility models such as adolescent refill clubs, community pharmacy ART refill programmes (CPARPs), community ART refill clubs and community ART refill groups.<sup>12–14</sup> Moreover, the programme adopted the OTZ peer-support model, which involved linking facilities to community support networks made up of peers, community-based organisations, civil society groups, economic support and legal resources to enhance the integration of YPLHIV into their communities. A detailed description of the programme intervention components is shown in online supplemental table 1, which maps the programme's interventions to the national standards and minimum package for YFHS.<sup>15</sup>

### Study design: RE with qualitative comparative analysis

This study employed a four-stage RE methodology.<sup>20 21</sup> RE is a theory-driven approach to understand how, why and under what circumstances outcomes happen. Using RE principles, we developed a programme theory by incorporating prior research, stakeholder insights and programme expertise to outline the intended change processes for the YFHS intervention. Based on context–mechanism–outcome (CMO) configurations, the programme theory outlines patterns and causal chains related to YFHS interventions. We developed this initial programme theory in the first two stages of our study.

In the third stage, we tested the programme theory using a multiple case study of 10 purposively selected health facilities implementing YFHS. We collected quantitative and qualitative data to comprehensively test or refine CMO configurations (CMOc), considering variations in facility profiles and YFHS implementation levels.

In the fourth stage, we used qualitative comparative analysis (QCA) to consolidate findings from the third stage.<sup>22–24</sup> QCA is an analytical technique within our RE framework that enabled a systematic cross-case analysis of realist context conditions, mechanisms and outcomes. This allowed us to identify the necessary and sufficient conditions while maintaining the generative perspective of CMOc from a realist sense.<sup>23 25</sup> The cases in the QCA included purposively selected YPLHIV who were enrolled in treatment at the 10 healthcare facilities mentioned earlier. **Figure 1** presents the overall study design, which involves a four-stage process described in detail below.



**Figure 1** Study design and stages. ANOVA, analysis of variance; CMO, context–mechanism–outcome; CMOc, CMO configurations; IPT, initial program theory. Adapted from Gilmore et al<sup>32</sup>

### Stage1: theory of change

Using the APIN programme’s intervention logic model, we developed a theory of change (ToC). We developed the ToC through meetings with relevant APIN programme coordinators at the national and state levels, during which relevant programme and national policy guidance documents were jointly reviewed. The process also drew on OB’s experience from programming and research coordination roles in PEPFAR HIV programmes in Nigeria. **Figure 2** summarises the ToC with the different programme elements and pathways to outcomes. However, although the ToC provided a framework to develop theory, it only focused on tangible interventions and could not explain the programme outcomes regarding latent, generative mechanisms of realist theories. To address this limitation, it was essential to refine the ToC.

### Stage 2: initial programme theory

In this stage, we expanded our ToC by adding specific mechanisms that could influence the outcomes, using the concept of ‘mechanism spaces’<sup>26</sup> which refer to areas within a ToC where various causal mechanisms are

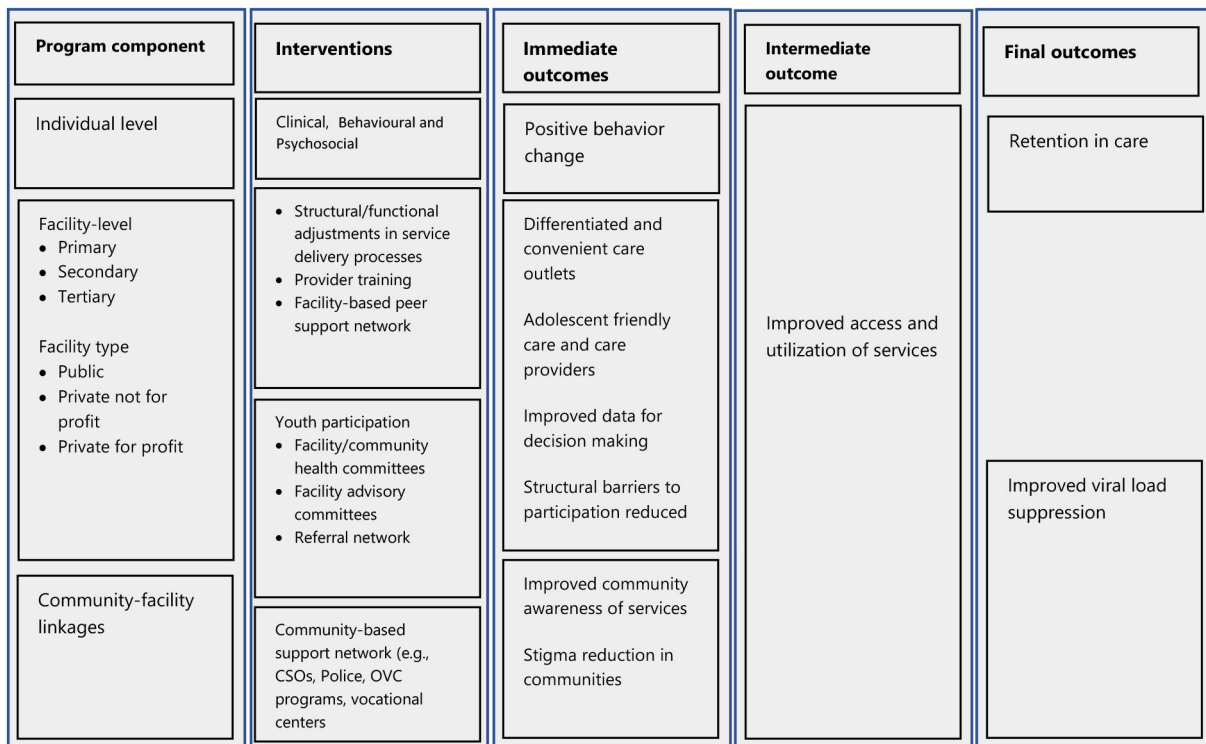
thought to function. This is a practical way to combine ToC with RE approaches.<sup>26 27</sup> We identified mechanisms by reviewing the literature on realist and systematic reviews of interventions to improve adherence and VL suppression in YPLHIV.<sup>5</sup> We then incorporated candidate mechanisms into the ToC to generate a preliminary initial programme theory which included all the essential elements of a realist theory, including the context, interventions, mechanisms and outcomes. We summarise this preliminary initial program theory (IPT) in **figure 3**.

### Stage 3: testing the preliminary IPT

In this stage, we employed a multiple case study<sup>28</sup> approach to test the preliminary IPT from the previous stage, using a mixed-methods approach that involved both qualitative and quantitative methods.<sup>20 21</sup> The steps we followed in this process are described below.

#### Case selection

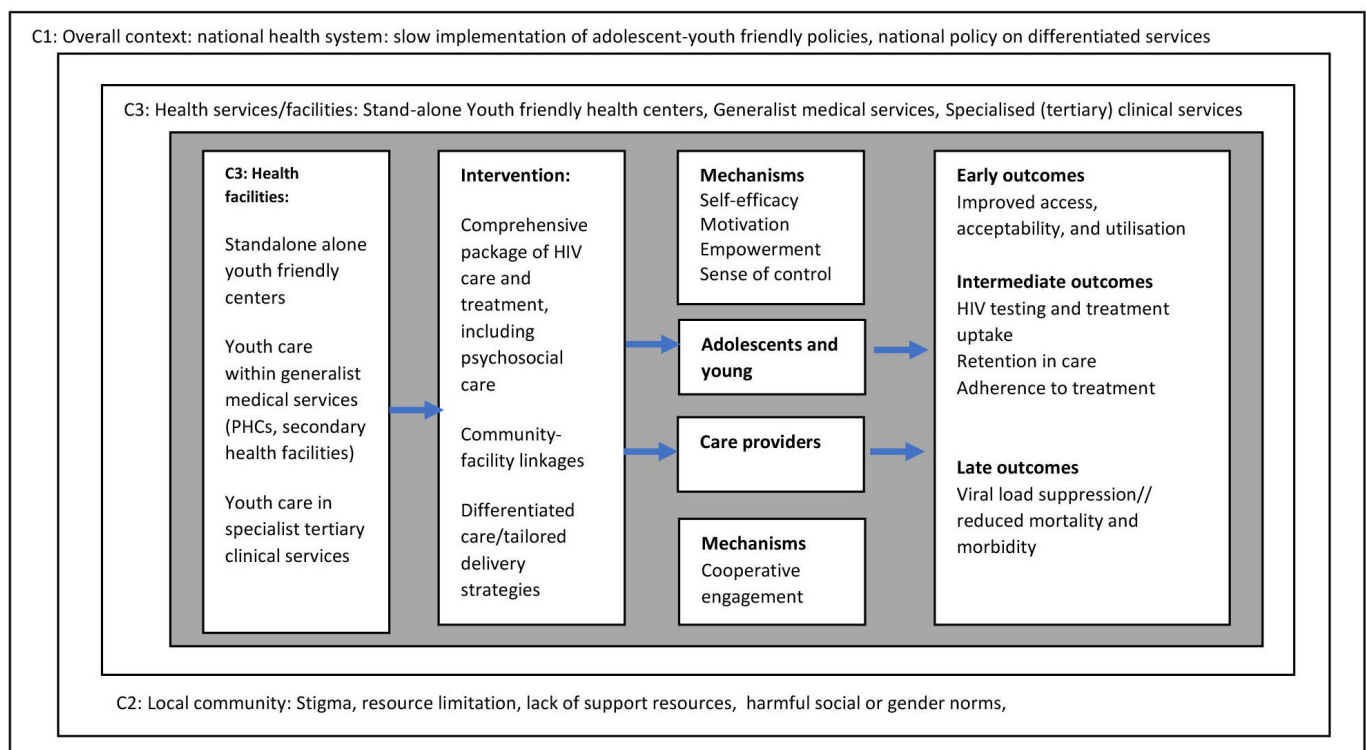
We purposively selected 10 health facilities in Benue State, Nigeria, from the APIN-supported secondary and tertiary facilities network. The selection was based on



**Figure 2** Summary ToC. ToC, theory of change; OVC, orphan and vulnerable children; CSO, civil society organisations.

our previous studies evaluating facility service conditions and YPLHIV treatment outcomes across the state.<sup>29 30</sup> To ensure diversity in outcomes, we grouped the facilities into three performance clusters: cluster A (low performing) with less than 75% coverage of HIV VL

suppression among enrolled YPLHIV, cluster B (medium performing) with 75%–89% coverage and cluster C (high performing) with 90% or more coverage. Additionally, we aimed for diversity in other facility characteristics, as shown in table 2.



**Figure 3** Preliminary initial programme theory. PHC, primary healthcare centre. Adapted from Ibiloye et al<sup>57</sup>



### Participant recruitment

YPLHIV were recruited through their care providers, who introduced the study to caregivers of YPLHIV under 18 years of age and directly to older YPLHIV during clinic days or facility-based OTZ peer-group meetings. Eligible participants needed to have received full HIV status disclosure, be on treatment for at least 12 months, and have had at least two VL test results at least 1 year apart. Healthcare providers were identified by contacting the hospital administrator or designated adolescent/youth focal person of each health facility and had to have at least 6 months of experience in HIV service delivery. Facility managers or HIV programme managers were approached for survey administration.

### Data collection

We conducted semistructured interviews with selected YPLHIV, their caregivers and service providers within each facility to gain insight into their perspectives and experiences related to various aspects of care. We interviewed one healthcare provider and two young person per facility (total of 30 interviews) using interview guides developed based on our emerging understanding of the CMOs from the previous stage. Interviews were conducted in private rooms within health facilities, ensuring confidentiality and high-quality audio recording. Participants provided written informed consent/assent, and parental consent was obtained for YPLHIV aged 10–17 years. Transcripts were pseudonymised to protect privacy.

Quantitative data collection focused on two main areas: (1) availability of youth-friendly structures and processes in each facility and (2) facility-level outcome data on retention in care and VL suppression. We developed a scored facility assessment tool based on the nine standards of the National Minimum Service Package for Adolescent and YFHS. The tool assessed various domains of facility-level youth-friendly structures and processes. We pilot tested it with programme managers and coordinators, incorporating their feedback and initial results to make modifications. Additionally, we abstracted VL and clinic appointment data, including records of peer-support group monthly attendance. Survey data were transferred from paper copies to electronic forms in a password-protected storage device.

### Analysis

In this stage, we followed an exploratory sequential approach to data analysis.<sup>31</sup> We used qualitative data to explore how and why YPLHIV achieved VL suppression under different circumstances. We used quantitative data to describe patterns and associations between care structures/processes, adherence and VL suppression, guided by the qualitative findings. Triangulating both data sources, we used Excel software for qualitative data coding and analysis, using inductive and deductive techniques to explore previously identified CMOs and emerging new themes. Two investigators (OB and CN) performed initial coding. CMOc were first explored

within each health facility (and cluster), then synthesised into a more generalisable programme theory. To do this, we created a table with headers for each CMO element, noting instances observed in transcripts with supporting evidence (quotes or data). Retroductive logic was used to identify causal relationships in each table through CMOc.<sup>32</sup> CMOc in each cluster were refined or combined based on similarities and differences. For example, if two within-cluster transcripts (YPLHIV1 and YPLHIV2) had the same CMOc 'A+B=C', we combined them into one CMOc with two data sources (YPLHIV1 and YPLHIV2). Emerging patterns across clusters were synthesised into the refined initial programme theory (IPT).

Quantitative facility assessment data were exported from Excel to Stata V.17 for data cleaning and analysis. Summary measures of interest were calculated based on emerging CMOs for retention in care and VL suppression, guided by qualitative themes. Pearson correlation was used to analyse associations between youth-friendly structures, processes and outcomes, exploring interfacility variations.

The authorship group reviewed, revised and agreed on the CMOc and initial programme theory (IPT) based on coded qualitative and quantitative data summaries.

### Stage 4: consolidating the IPT

Next, we used QCA to consolidate the IPT to identify the necessary and sufficient combinations of context conditions, mechanisms and outcomes that might explain attainment and variation in the attainment of outcomes.<sup>33</sup> We used the QCA technique to focus our theories on the key or most plausible causal conditions and explanations while maintaining RE's complex notions of causality and a holistic, generative perspective. Using QCA this way enabled us to extend the empirical support of realist theory in a controlled manner by transferring ideas from a few cases to several cases.<sup>22–24</sup>

We conducted another round of interviews with 30 newly and purposively recruited YPLHIV from the previous 10 health facilities, using the same recruitment strategy and study procedure from the previous stage. YPLHIV, who required their parents'/caregivers' consent to complete questionnaires, were excluded to ensure data accurately reflected the perspectives and experiences of young people themselves. The QCA procedures we followed are described below.

### Data collection

Interview guides were modified from the previous stage to reflect the evolving understanding of the theoretical proposition. We also administered standardised questionnaires, including the Situational Motivation Scale (SIMS),<sup>34</sup> to understand YPLHIVs' motivation for adherence behaviour<sup>35 36</sup> Berger's HIV stigma questionnaire,<sup>37</sup> HIV treatment self-efficacy assessment tool (HIV-ASES),<sup>38</sup> the Assessment of Capacity to Consent to Treatment (ACCT) questionnaire and WHO's guidance document

on assessing adolescents' autonomous decision-making in healthcare settings.<sup>39 40</sup> Participants' VL results were retrieved from medical records.

#### Operationalisation and calibration of conditions

We used the Generic Membership Evaluation Template to transform qualitative data into numerical values following an indirect calibration method.<sup>41</sup> Anchors were applied to each condition to determine a case's membership level in that condition, ranging from binary or crisp sets (eg, present/absent) to multilevel or fuzzy sets. For instance, a four-value fuzzy used the following anchors: 1 (fully present), 0.67 (more present than absent), 0.33 (more absent than present) and 0 (fully absent). Membership levels in conditions were determined by assessing the intensity and positive/negative valence of participant responses to predetermined dimensions of that condition. More details about the calibration strategy for qualitative data can be found in online supplemental material.

For data from standardised questionnaires, specific procedures were employed. For example, the ACCT questionnaire assessed decision-making capacity for HIV treatment, evaluating four abilities: understanding, appreciation, reasoning and expressing a choice. Adequate decision-making capacity was determined if a participant scored higher than 2 SD below the group mean in each ability, which we calibrated using crisp-set 0 (inadequate) and 1 (adequate). HIV-ASES questionnaire assessed self-efficacy, considering it adequate if the participant scored higher than the median group value, calibrated using crisp-set 0 (no self-efficacy) and 1 (self-efficacy).

The two conditions (decision-making capacity and HIV treatment self-efficacy) were combined into a super condition known as 'agency' during analysis, representing the 'personal ability to act and make free and informed choices to pursue a specific goal'.<sup>42</sup> The Berger HIV stigma scale assessed self-perceived HIV-related stigma and was calibrated using a three-value fuzzy set: 1 (severe stigma, score 81–120), 0.51 (mid-level stigma, score 81–120) and 0 (low/no stigma, score 40–80). Lastly, questions from the SIMS questionnaire were adapted to evaluate intrinsic and extrinsic motivation dimensions related to HIV adherence behaviour. Scores for each type of motivation were averaged and calibrated using a three-value fuzzy set: 0 (average score 1–3, no internal/external motivation), 0.51 (average score 4–5, moderate internal/external motivation) and 1 (average score 6–7, high internal/external motivation).

All facility-level data collection (including the third stage) occurred from October 2020 to May 2022.

#### Operationalisation and calibration of outcome

VL results were collected at two time points: one near the YFHS programme's start in 2018 and the other at the study's end in May 2022. We considered a YPLHIV to have the outcome if they achieved viral suppression (less than 1000 copies/mL, per national protocol)<sup>43</sup> at the second time point, regardless of their status at the

first time point. This was calibrated using crisp-set 1 (outcome) and 0 (no outcome).

We used established techniques<sup>42</sup> to simplify the analysis to reduce the list of potential causal conditions from earlier synthesised CMOcs. This involved removing conditions that lacked variation across cases and those correlating with other conditions, removing conditions with low necessity scores ( $\leq 0.40$ ), indicating less importance for the outcome, and combining related conditions into super conditions. This reduction minimised the challenge of limited diversity, where some combinations of conditions lacked empirical cases.<sup>44</sup>

#### Constructing and analysing the truth table

We created a Truth table in Excel with calibrated values for all conditions per case. The table was then imported into the fuzzy-set QCA software (fsQCA).<sup>45</sup> The output provided the necessity and sufficiency of each condition. A condition is considered necessary if it must be present for the outcome to occur. In our analysis, we set a necessity threshold of 0.9, meaning the condition must be present in at least 90% of instances when the outcome occurred. A condition is sufficient if it can produce the outcome on its own. We assessed sufficiency using consistency scores, indicating the frequency at which a condition or combination of conditions led to the outcome. A minimum consistency score of 0.8 is typically considered sufficient.<sup>45</sup>

#### Patient involvement statement

YPLHIV supported participant recruitment into the study through the OTZ peer-support group and their contacts. The OTZ peer-support group lead in one of the study facilities made valuable inputs and suggested modifications to the interview guides during the pilot of data collection instruments. He is listed in the acknowledgement.

#### Reporting

We followed the recommended reporting guidelines for realist evaluation (RAMESES II) and qualitative (Consolidated Criteria for Reporting Qualitative Research) studies.<sup>46 47</sup>

## RESULTS

Figures 2 and 3 show the summary of ToC (stage 1) and preliminary IPT (stage 2). Here, we present stages 3 and 4 results, where we refined and consolidated the preliminary IPT.

#### Participant characteristics

In the third stage, we recruited 34 participants across the 10 health facilities, comprising 7 adolescent programme coordinators, 6 care providers (doctors or nurses) and 20 YPLHIV or their caregivers. In the fourth stage, we recruited 30 YPLHIV, 18 had VL suppression at baseline and 24 at the second VL result. Participant characteristics are shown in table 1.

**Table 1** List of interviewees/respondents by study stages

| Stage 3 (n=34)  |  |   | Stage 4 (n=30)                                      |          |                             |             |
|---|--|---|---|----------|-----------------------------|-------------|
| Level of facility   | Type of facility (n=10)                          | Respondents   | Age   |          | Sex                         |             |
| Tertiary  | Public (1)                                       | Programme coordinator(1), doctor/nurse (1) YPLHIV (2) | 15–19 years   | 16 (53%) | Female                      | 16 (53%)    |
|   |  |   | 20–24 years   | 14 (47%) | Male                        | 14 (47%)    |
| Programme coordinator (5), care doctor, nurse, community health worker) (3) YPLHIV (14) | Public (7)                                       | Secondary   | Self-reported mode of HIV transmission by age group |          | 15–19 years                 | 20–24 years |
|   |  |   |   |          | Blood transfusion           | 2 (13%)     |
|   |  |   |   |          | Heterosexual transmission   | 0           |
|   |  |   |   |          | Intravenous injection       | 2 (13%)     |
|   |  |   |   |          | Perinatal transmission      | 9 (56%)     |
|   |  |   |   |          | Unknown                     | 3 (19%)     |
| Community health worker/adherence counsellors (2) YPLHIV(2)                             | Private for-profit (1)                           |   | No with viral load suppression                      |          | The first test (baseline)   | 18          |
| Private not-for-profit(1)   | Nurse (1), community health worker(1) YPLHIV (2) |   |   |          | The second test (follow-up) | 24          |

YPLHIV, young people living with HIV.

### Key outcome: VL suppression

For stage 3, whereas only two facilities were at performance cluster C (viral suppression coverage  $\geq 90\%$ ) at baseline, seven facilities were in this cluster after over 1 year, including the two that were at performance cluster A (viral suppression coverage  $< 75\%$ ) and five others that were at performance cluster B (viral suppression coverage 75%–89%). See [table 2](#) for more details on the profiles of the 10 facilities. Most facilities increased VL suppression coverage except two (F6 and F10), with F6 unchanged and F10 reduced. In stage four, whereas 18 of the 30 recruited YPLHIV had VL suppression at the first VL test, 24 YPLHIV had VL at the second. See [table 1](#) for other characteristics of YPLHIV recruited in stage 4.

### How and why did YPLHIV attain VL suppression within youth friendly services?

#### Cooperative engagement

This configuration posits that in the context of high stigma, low privacy and confidentiality(C), retention in care and viral suppression (O) improves with better implementation of tailored/differentiated services (I) through less stigmatising care channels that improve cooperative engagements (M) between young people and their providers to address adherence barriers.

Interview participants reported relatively high levels of community-level HIV stigma despite stigma reduction interventions, sometimes fuelled by breaches in privacy and confidentiality within health facilities. They described how introducing flexible/differentiated services provided YPLHIV with non-stigmatising channels

to access services, which has improved engagement and cooperation between YPLHIV and care providers.

Ok, I must confess that we have really softened care provision for them in this facility, we have really made it easy for quite a lot of them [...] now waiting time has been seriously reduced by the fact that you do not have to queue to see the doctors; [...] adolescents only come pick drugs twice a year because we have case managers or community-groups who can deliver their drugs at home, [...] unless you have been identified as non-adherent or your viral load has not been suppressed. Now confidentiality breaches and stigma are very very down the ladder in this facility; they (young people) now see us (care providers) as family, but we are still a work in progress... (HCP 1, F5)

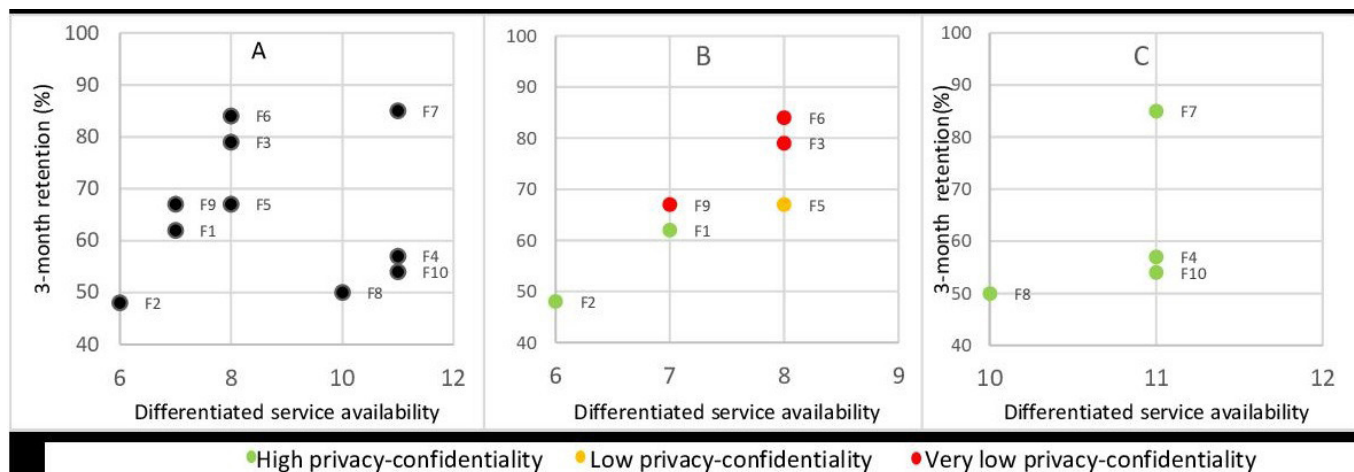
Quantitative analysis of facility assessment scores supported these qualitative observations. We analysed the relationship between retention rates, availability of flexible/differentiated care and levels of privacy-confidentiality in the 10 facilities. Overall, we found no correlation between retention rates and availability of differentiated services ( $r=0.03$ ;  $p=0.23$ ) across the 10 facilities regardless of privacy-confidentiality levels. However, a strong positive correlation was found between retention rates and availability of differentiated services ( $r=0.89$ ;  $p=0.04$ ) in the subgroup of six facilities where differentiated services were low or moderately available, largely mediated by privacy and confidentiality level. In contrast, the remaining four facilities, where differentiated services were fully implemented or available, with high privacy-confidentiality levels, showed a weak correlation between retention rates and differentiated services

**Table 2** Profiles of study healthcare facilities

| Code | Performance cluster (baseline) | Performance cluster (follow-up) | Rural/urban | Level of care | Type of outlet     | Ownership type         | YPLHIV enrolled (baseline) | YPLHIV enrolled (follow-up) | Viral load suppression coverage (baseline) | Viral load suppression coverage (follow-up) |
|------|--------------------------------|---------------------------------|-------------|---------------|--------------------|------------------------|----------------------------|-----------------------------|--|---|
| F5   | A                              | C                               | Urban       | Tertiary      | Specialist setting | Public                 | 624                        | 614                         | 73%  | 91%   |
| F2   | A                              | C                               | Rural       | Secondary     | Generalist setting | Private for-profit     | 85                         | 87                          | 65%  | 97%   |
| F4   | B                              | C                               | Urban       | Secondary     | Generalist setting | Public                 | 141                        | 143                         | 89%  | 92%   |
| F9   | B                              | B                               | Urban       | Secondary     | Generalist setting | Public                 | 298                        | 282                         | 86%  | 87%   |
| F7   | B                              | C                               | Urban       | Secondary     | Generalist setting | Private not for profit | 359                        | 345                         | 88%  | 90%   |
| F1   | B                              | C                               | Rural       | Secondary     | Generalist setting | Public                 | 223                        | 221                         | 84%  | 97%   |
| F8   | B                              | B                               | Rural       | Secondary     | Generalist setting | Private for-profit     | 50                         | 58                          | 86%  | 89%   |
| F3   | C                              | C                               | Urban       | Secondary     | Generalist setting | Public                 | 88                         | 67                          | 90%  | 95%   |
| F10  | B                              | B                               | Rural       | Secondary     | Generalist setting | Private not for profit | 118                        | 113                         | 87%  | 84%   |
| F6   | C                              | C                               | Rural       | Secondary     | Generalist setting | Public                 | 199                        | 201                         | 90%  | 90%   |

Performance cluster by viral load suppression coverage: cluster A=<75%, cluster B=75%–89%, cluster C=90%–100%.  
YPLHIV, young people living with HIV.





**Figure 4** Availability of differentiated services and retention rates in (A) all facilities (B) facility subset with low-medium availability of differentiated services (C) facility subset with high availability of differentiated services.

( $r=0.48$ ;  $p=0.10$ ). In alignment with the configuration, these quantitative findings indicate that even small improvements in differentiated service availability (I) can significantly enhance cooperative engagement (M) and improve retention (O) in facilities with privacy and confidentiality challenges (C). The finding is illustrated in figure 4.

#### Extrinsic motivation

This configuration posits that in areas with limited resources (C), financial and material support (I) linked to care is important to motivate (M) socioeconomically disadvantaged YPLHIV to remain in care (O) through positive reinforcement, which can lead to the attainment of VL suppression (O).

Participants reported that positive adherence behaviour change among YPLHIV required consistent external motivation (eg, financial, material support or linkage to vocational work) to overcome structural barriers to care. Some providers recalled specific examples where adherence behaviour and retention improved when the provision or continuation of tangible incentives became conditional on adherence milestones, such as completed quarterly clinic attendance, 6 or 12 monthly VL testing, and attending all treatment adherence sessions.

For adherence support? Like now this support group that they are doing for us is helping us, especially we girls [...] they help us with money [...] to take care of ourselves so that we will not go to boys to beg money or go around following boys. Since this support started, they used to encourage us to stay away from sex or be conscious about the type of people we stay with (have sex). This support group has helped my life; now I have stopped all those behaviours that I used to do to harm myself. (YPLHIV 3, F7)

Our facility assessment showed that all facilities provided incentives. However, there were reported shortages and inconsistencies in the availability of resources. Additionally, the extent to which available resources could fulfil the needs of enrolled YPLHIV varied across the different facilities.

We analysed how facility-level changes in VL suppression coverage were associated with the coverage of incentives for YPLHIV facing socioeconomic disadvantages, with lack of education used as a proxy indicator. The results showed a strong association between changes in VL suppression coverage and the proportion of enrolled YPLHIV with no education ( $r=-0.84$ ,  $p=0.03$ ). Facilities with a lower proportion of enrolled YPLHIV with no education, and therefore, more likely to have better incentive coverage, exhibited a significant increase in VL suppression coverage. On the other hand, facilities with higher proportions of YPLHIV without education, and thus less likely to achieve better incentive coverage, showed comparatively smaller improvements in VL suppression, as shown in table 3. This finding supports the theory that external motivation through incentives is important in overcoming adherence-related barriers to VL suppression.

#### Agency and enhanced self-efficacy

This configuration posits that when health workers support YPLHIV to provide treatment support to each other through problem-solving and role-modelling (I), more YPLHIV with multiple support needs (C) will enhance their treatment self-efficacy (M) and adopt positive adherence behaviour that leads to improved VL suppression (O).

Participants gave specific instances where role modelling by influential YPLHIV within peer networks has increased the adoption of positive adherence behaviour by other YPLHIV. The peer-support groups emphasise self-managed care, allowing young individuals to define treatment goals, develop strategies, and be accountable for their care. Examples were also provided where peer-support networks increased YPLHIV participation and advocacy.

... and also, in the OTZ group [...] though, I am not too good about Facebook and all these social media, but then, I do see all those things posted [...] sometimes they advise little adolescents on how to take their medication,

**Table 3** Facility-level changes in viral load suppression coverage by proportion of treatment enrolled YPLHIV with no education

| Facility code | Proportion of enrolled YPLHIV who have no education (%) | Viral load suppression coverage at baseline (%) | Viral load suppression coverage at follow-up (%) | Change in viral load suppression coverage |
|---------------|---|---|--|---|
| F2            | 8   | 65  | 97   | +32%                                      |
| F5            | 10  | 73  | 91   | +18%                                      |
| F1            | 21  | 85  | 97   | +12%                                      |
| F10           | 40  | 88  | 84   | - 4%                                      |
| F8            | 50  | 86  | 89   | +3%                                       |
| F4            | 60  | 90  | 92   | +2%                                       |
| F7            | N/A   | 88  | 90   | +2%                                       |
| F9            | N/A   | 86  | 87   | +1%                                       |
| F6            | N/A   | 90  | 90   | 0   |
| F3            | N/A   | 90  | 95   | +5%                                       |

N/A: education records not available.  
YPLHIV, young people living with HIV.

concerning sex education, or maybe HIV information, so like that I got educated. And now I know how I can manage myself, to deal with stigma and HIV disclosure... (YPLHIV 2, F3)

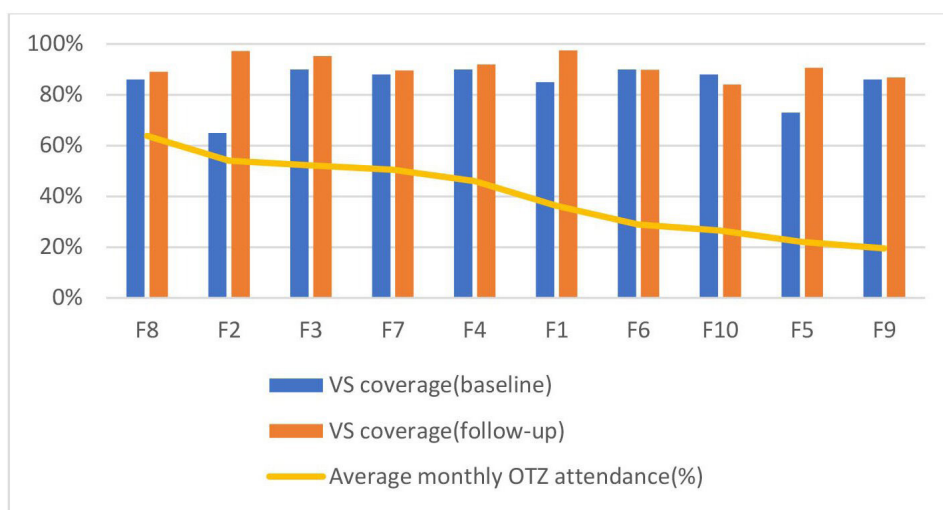
However, our quantitative facility assessment showed a weak association between facility-level participation in peer network (OTZ) and changes in VL suppression coverage ( $r=0.18$ ;  $p=0.61$ ). While most facilities reported increased VL suppression coverage, there was no significant increase in OTZ participation month-on-month. Moreover, the VL suppression coverage increase was not associated with the average monthly attendance proportion among enrolled YPLHIV in OTZ, as shown in figure 5. This suggests that while OTZ might play a role in achieving VL suppression, it may not be essential, as other factors likely contributed significantly to the observed improvements in VL suppression rates.

### Empowerment

YPLHIV who have specific individual needs can be encouraged to seek and continue medical treatment if healthcare services help them to take control of their health and improve their self-management skills. Though this empowerment, YPLHIV will feel more confident in managing their health, leading to better adherence to treatment and suppression of the VL.

We do contact tracing, like, for example, this boy in school whom I talk to on the phone, I told him to get a diary and “tick everything as you take your drugs and send the diary to me on the phone” [...] After a while, he was able to monitor himself without even my supervision. IDI healthcare provider (HCP005)

Participants highlighted the effectiveness of supporting YPLHIV in developing personalised adherence strategies



**Figure 5** Facility-level changes in viral load suppression and proportional attendance at peer-network meetings. OTZ, Operation Triple Zero; VS, viral suppression.

tailored to their specific barriers, encouraging YPLHIV to work proactively towards improved adherence behaviour. Putting YPLHIV in control of their care proved to be a more effective approach to promoting behaviour change. Initially, health workers provided the necessary knowledge and skills for self-monitoring and reinforced the skills through supportive supervision.

### Refined programme theory

After combining the four CMOs, we formulated the refined initial programme theory: ‘YPLHIV are more likely to adhere to treatment and achieve VL suppression if they are motivated by intrinsic or extrinsic factors. Extrinsic motivation can be provided by linking financial and material support to clinical care for socioeconomically disadvantaged YPLHIV, reinforcing positive treatment behaviours. Intrinsic motivation can be achieved by offering care services that address individual needs, are tailored to YPLHIV preferences or are driven by peers. This will lead to increased self-efficacy, sense of control, agency and trust, which can help YPLHIV overcome barriers to adherence and VL suppression’.

### What are the necessary and sufficient conditions for attaining VL suppression?

We synthesised the following final list of eight conditions from our refined IPT: (1) stigma, (2) respectful care, (3) privacy-confidentiality, (4) peer support, (5) material support, (6) differentiated services, (7) agency and (8) extrinsic motivation. We categorised stigma, respectful care and privacy-confidentiality as context conditions; peer support, material support and differentiated services as interventions; and agency and extrinsic motivation as mechanisms.

### Pathways to viral suppression

Using fsQCA, we identified privacy and confidentiality as necessary conditions and four distinct sufficient combinations of conditions or pathways to VL suppression. We obtained a solution consistency of 0.81 and coverage of 0.36, indicating that these pathways consistently lead to VL suppression in cases where they occur and jointly explain 36% of all observed cases of VL suppression. These pathways are shown in table 4 and described below.

Pathway 1 showed attainment of VL suppression in the absence of respectful care and the presence of stigma, financial/material support, participation in a peer network and utilisation of differentiated services with privacy-confidentiality and a high level of Agency. Pathway 2 showed VL suppression in the presence of respectful care, privacy-confidentiality, financial/material support, participation in a peer network, high extrinsic motivation and absence of agency. Pathway 3 showed attainment of VL suppression in the presence of respectful care, privacy-confidentiality, financial/material support, utilisation of differentiated services with high extrinsic motivation and agency. Pathway 4 showed attainment of VL suppression in the presence of respectful care, financial/material support, participation in peer networks, utilisation of differentiated services with high extrinsic motivation and agency.

### Pathways to viral non-suppression

We also identified three pathways that led to viral non-suppression among YPLHIV: Pathway 1 shows VL non-suppression without differentiated service utilisation and peer networks participation. Pathway 2 shows VL non-suppression in the absence of stigma and utilisation of differentiated care services. Pathway 3 shows VL

**Table 4** fsQCA analysis showing pathways to viral suppression and viral non-suppression

| Conditions                   | Necessity score                       | Viral suppression |      |      |      | Viral non-suppression |      |      |      |
|------------------------------|---------------------------------------|-------------------|------|------|------|-----------------------|------|------|------|
|                              |                                       | 1                 | 2    | 3    | 4    | 1                     | 2    | 3    |      |
| Context condition            | Stigma                                | 0.78              | ●    |      |      |                       | ⊕    | ●    |      |
|                              | Confidentiality and privacy           | 0.90              | ●    | ●    | ●    |                       |      |      |      |
|                              | Respectful care                       | 0.67              | ⊕    | ●    | ●    | ●                     |      | ●    |      |
| Intervention                 | Material support integrated into care | 0.69              | ●    | ●    | ●    | ●                     |      |      |      |
|                              | Differentiated care                   | 0.46              | ●    |      | ●    | ●                     | ⊕    | ⊕    |      |
|                              | Peer-support network                  | 0.55              | ●    | ●    |      | ●                     | ⊕    |      |      |
| Mechanism                    | Extrinsic motivation                  | 0.82              |      | ●    | ●    | ●                     |      | ⊕    |      |
|                              | Agency                                | 0.86              | ●    | ⊕    | ●    | ●                     |      |      |      |
| Unique coverage              |                                       |                   | 0.03 | 0.06 | 0.04 | 0                     | 0.17 | 0.02 | 0.15 |
| Raw coverage                 |                                       |                   | 0.13 | 0.10 | 0.28 | 0.23                  | 0.45 | 0.22 | 0.33 |
| Overall solution consistency |                                       |                   | 0.81 |      |      |                       | 0.46 |      |      |
| Overall solution coverage    |                                       |                   | 0.36 |      |      |                       | 0.62 |      |      |

●, Condition is present; ⊕, Condition is absent; empty cells=condition is not relevant to pathway.

**Table 5** Analytical process of IPT consolidation using QCA

| Theory consolidation using QCA   |  |   |  |
|--|--|---|--|
| Programme theory   |  |   |  |
| YPLHIV are more likely to adhere to treatment and achieve viral load suppression if they are motivated by intrinsic or extrinsic factors. Extrinsic motivation can be provided by linking financial and material support to clinical care for socioeconomically disadvantaged YPLHIV, reinforcing positive treatment behaviour. Intrinsic motivation can be achieved by offering care services that address individual needs, are tailored to YPLHIV preferences or are provided by peers. This will lead to increased self-efficacy, sense of control, agency and trust, which can help YPLHIV overcome barriers to adherence and viral load suppression. |  |   |  |
| Pathways (CMOs) generated after QCA analysis   |  |   |  |
| Pathway 1  | Pathway 2  | Pathway 3   | Pathway 4  |
| YPLHIV achieved viral suppression in the context of high stigma and disrespectful care, were also materially supported, belonged to a peer network, and used differentiated services. They were satisfied with care privacy-confidentiality and had high levels of agency  | YPLHIV achieved viral suppression in the context of respectful care, confidentiality and privacy, were also materially supported and part of a peer network. Extrinsically motivated with low levels of agency.  | YPLHIV achieved viral suppression in the context of respectful care, confidentiality and privacy, materially supported and used differentiated services. Extrinsically motivated and had high levels of agency. | YPLHIV achieved viral suppression in the context of respectful care, were materially supported, belonged to peer networks, and used differentiated services. Extrinsically motivated and had high levels of agency.  |
| ↓  | ↘  | ↙   | ↓  |
| Refined programme theories   |  |   |  |
| YPLHIV face challenges staying in care due to stigma in their community and poor treatment at healthcare facilities. But, being part of peer networks and having access to confidential and differentiated services empowers YPLHIV and helps them overcome obstacles to treatment adherence, leading to successful viral suppression  | When YPLHIV receive respectful treatment and have privacy confidentiality at healthcare facilities, they are more likely to stick to their treatment plan and achieve viral suppression. This can be achieved through both extrinsic motivators, such as material support and intrinsic motivators, such as being part of a peer network or having access to confidential healthcare services. |   | When YPLHIV receive respectful care and material support at healthcare facilities, their chances of achieving viral suppression are increased by both intrinsic and extrinsic motivation. This can be achieved by using confidential healthcare services and being part of a peer network. |
| Programme theory   |  |   |  |
| Health services/facilities that provide respectful care are more likely to improve viral suppression in YPLHIV; because when YPLHIV feel respected, they may be (more) motivated intrinsically (through agency-enhancing interventions) or extrinsically (through material incentives) to address and overcome adherence barriers to achieve viral suppression. Health facilities that provide agency-enhancing interventions can intrinsically motivate YPLHIVs in high-stigma and disrespectful care settings to address adherence barriers and achieve viral load suppression.  |  |   |  |
| CMO, context–mechanism–outcome; IPT, initial programme theory; QCA, qualitative comparative analysis; YPLHIV, young people living with HIV.  |  |   |  |

non-suppression in the presence of stigma, and respectful care, with the absence of extrinsic motivation. This is illustrated in [table 4](#).

[Table 5](#) illustrates the analytical process used to consolidate the initial programme theory (IPT) based on the four pathways to viral suppression. The refined IPT states that:

Health services/facilities that provide respectful care are more likely to improve viral suppression in YPLHIV; when YPLHIV feel respected, they may be (more) motivated intrinsically (through agency-enhancing interventions) or extrinsically (through material incentives) to

address and overcome adherence barriers to achieve viral suppression. Health facilities providing agency-enhancing interventions can intrinsically motivate YPLHIVs in high-stigma and disrespectful care settings to address adherence barriers and suppress VL.

**DISCUSSION**

Our study combined RE and QCA to identify and test conditions configurations that explain how and why YPLHIV achieve viral suppression within a youth-friendly programme delivering HIV services. We found that



services granting the condition of privacy-confidentiality, while necessary, are not sufficient to achieve viral suppression in YPLHIV. To achieve viral suppression, privacy-confidentiality must be present with seven other conditions: differentiated care services, material support, peer network support, respectful care, agency and extrinsic motivation. These conditions, when combined, can lead to viral suppression through four different pathways, which reflect variations in context conditions, utilisation patterns and motivation processes in YPLHIV.

The first pathway (pathway 1) found that YPLHIV in non-conducive settings (high stigma and disrespectful care) who achieved VL suppression used all available intrinsic and extrinsic motivation-based interventions. However, only interventions based on intrinsic motivation (peer support and differentiated services) could trigger the corresponding mechanism (agency), which led to viral suppression. This implies that while YPLHIV in non-supportive settings might still use interventions based on extrinsic motivation, these interventions are not likely to be adequate to achieve viral suppression. On the other hand, intrinsic motivation-based interventions were effective on their own in achieving viral suppression. This finding supports previous research that shows improved viral suppression in YPLHIV through peer-support and DSD.<sup>48 49</sup> By allowing YPLHIV to set their own treatment goals and make their plans, the programme's peer-support network empowers YPLHIV by building a sense of agency to motivate them towards better adherence behaviour. By offering flexible care and drug delivery options, differentiated HIV services build agency by putting YPLHIV in charge of their care. The combination of peer support and differentiated services means that intrinsic motivation can diffuse within YPLHIV groups from mentor YPLHIV to others. This may explain why peer-supported DSD models in low-income and middle-income settings have produced superior<sup>48</sup> HIV viral suppression outcomes compared with standard clinic care.

Pathways 2 and 3 also demonstrate that YPLHIV in conducive environments who achieved VL suppression used intrinsic and some extrinsic motivation-based interventions. In pathway 2, both intervention types activated their corresponding mechanisms (agency and external motivation) when the intrinsic motivation-based intervention was differentiated care. However, in pathway 3, only extrinsic motivation-based intervention (material support) activated the corresponding mechanism (extrinsic motivation) when the used intrinsic motivation-based intervention was a peer-support network. Both pathways suggest that YPLHIV in conducive settings use a combination of extrinsic and intrinsic motivation-based interventions. While not all intrinsic motivation-based interventions are effective, the effective ones (such as differentiated services) must be complemented with extrinsic motivation-based interventions to achieve VL suppression, whereas extrinsic motivation-based interventions can be effective independently.

Pathway 4 shows that YPLHIV achieved viral suppression in a setting of respectful care, were materially supported, belonged to peer networks and used differentiated services. They were also extrinsically motivated and had high levels of agency. This suggests that in conducive environments, some YPLHIV will use intrinsic and extrinsic motivation-based interventions, and both types can be jointly effective in achieving VL suppression.

Taken together, our findings suggest that while YPLHIV who achieved VL suppression, used both intrinsic and extrinsic motivation-based interventions, the effectiveness of interventions varied with context conditions. The more non-conducive the environment, the more important individual agency becomes in achieving VL suppression, suggesting that agency is a key factor determining the health outcomes of young people in unconducive environments. Importantly, it suggests that while unfavourable settings can present challenges, HIV services that build agency can support young people to develop an adequate level of agency to withstand an unsupportive environment to achieve better outcomes. Similar results have been found in many other studies from 60 countries that focus on sexual and reproductive health and HIV/AIDS programmes.<sup>50–53</sup> These studies emphasise the importance of incorporating agency building into health programmes to enhance health outcomes, especially in environments where harmful norms and gender restrictions limit agency, particularly among women and young people.<sup>54</sup>

However, while promoting agency in health services is important, it should not be a substitute for broader efforts to improve the overall environment for young people, such as stigma reduction and improving privacy and confidentiality. Our findings prove that viral suppression can occur even when agency is not important (pathway 2) or less essential (pathways 3 and 4). Thus, providing support in a conducive environment can still lead to good health outcomes for young people lacking agency. Another implication of our findings is that, despite their high likelihood of being used, extrinsic motivation factors such as material support may not be effective in non-conducive settings with entrenched structural barriers, like stigma, discrimination or non-respectful care. This unsustainable approach can create perverse incentives or undermine intrinsic motivation.<sup>34 55</sup> Extrinsic incentives can be a helpful component of a comprehensive programme that considers the various individual, social and structural factors that influence behaviour.<sup>55</sup>

### Implications and reflections for youth-friendly service practice and research

Our findings on the necessary and sufficient conditions can form the basis for developing or revising minimum care packages for better reach and effectiveness. However, we have shown that these conditions may differ based on the context conditions. YFHS researchers and practitioners should use available guidance<sup>56</sup> to assess their intervention contexts to determine the appropriate

minimum conditions for a high-impact, sustainable minimum care package. Such context-specific packages can appeal to policymakers, making them easier to adopt, as in Zimbabwe and other African countries.<sup>48</sup> Additionally, context-specific packages will help build a more context-appropriate evidence base for YFHS, making it more relevant and valuable.<sup>56</sup>

Our study makes a methodological contribution as an example of how QCA can be used within a RE as a theory-based method to gain a deeper understanding of how YFHS programmes work, which differs from the more common evaluation approaches that rely on positivist or probabilistic methods. When dealing with large-N studies like ours, analysing and synthesising numerous CMOs in developing or refining a programme theory can become unwieldy. QCA provides additional value by allowing RE to focus on the key or most plausible causal conditions and explanations while maintaining RE's complex notions of causality and a holistic, generative perspective. Using QCA this way enabled us to extend the empirical support of realist theory in a controlled manner by transfer of ideas from a few cases to several cases.<sup>23</sup> In addition, our approach allowed the triangulation of quantitative and qualitative findings to strengthen the robustness of our evaluation further.<sup>20 21</sup>

Our study has limitations. One challenge was determining whether documented missed clinic appointments were due to patient behaviour or service delivery issues, particularly during the peak period of the COVID-19 epidemic included in our analysis. Although we triangulated multiple data sources to address this, we cannot completely rule out errors in our estimates and interpretations. Second, it was not possible to assess adherence directly. We used viral outcomes as a proxy for adherence, but this may not accurately reflect adherence and may overlook resistance mutations among otherwise adherent YPLHIV. This may have introduced measurement error and case misclassification. Third, while we tried to confirm the theoretical assumptions about our objectives, some conceptual or methodological issues may have been missed. We may have overlooked significant data or information that could have influenced our analysis and interpretations differently because we had to reduce our list of conditions to the optimal number recommended for QCA analysis.<sup>23</sup> This could also explain the low coverage of 0.36 we obtained, which may limit the generalisability and make it difficult to draw broader conclusions about the relationship between the causal factors and viral suppression. Although listing and calibrating characteristics in QCA do not constitute realist causal analysis, it is crucial to recognise that realist theories and empirical insights guided our condition selection for QCA. This approach enables a systematic analysis that maintains the generative/relational perspective of context from a realist standpoint. It also highlights the compatibility between RE and QCA approaches.<sup>23</sup>

## CONCLUSIONS

Our findings demonstrate that the attainment of VL suppression among YPLHIV depends on their capacity to adjust to various context conditions, which can influence their patterns of HIV service utilisation and trigger various motivation processes. Therefore, to improve the effectiveness of YFHS at scale, health services must consider how the existing context conditions in which they deliver interventions shape YPLHIV motivation processes and the service utilisation patterns that unfold from such preferences.

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**Acknowledgements** The authors are grateful for the support they received from APIN management during their study. They also thank the patients (adolescents and young people living with HIV), their caregivers and healthcare providers who consented to their information being used for research purposes. Mr Jacob Inalegwu, the peer-support group lead in one of the study facilities, made valuable input during the pilot of data collection instruments, for which the authors are grateful. Finally, the authors thank Dr Honey Okpe and Dr Kelechi Ngwoke for coordinating the youth-friendly initiative within the APIN Program.

**Contributors** OB conceived the study, conducted the analysis and wrote all manuscript drafts. All authors provided critical reviews of the draft. All authors read and approved the final draft. OB is responsible for the overall content as guarantor and accepts full responsibility for the finished work and the conduct of the study, had access to the data, and controlled the decision to publish

**Funding** Some of the program data used is based on a project funded by the US Presidents Emergency Plan for AIDS (PEPFAR), awarded through the Centers for Disease Control and Prevention, and managed by APIN Public Health Initiatives Ltd/Gte. OB received doctoral research funding from the Belgium Directorate-General for Development Cooperation (DGD) awarded through the Institute of Tropical Medicine Antwerp, Belgium. SVB received funding from the Flanders Research Foundation (FWO) grant number 1221821N.

**Disclaimer** The funder had no role in the conduct and writing of this study.

**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

**Patient consent for publication** Not applicable.

**Ethics approval** This study involves human participants and this study was approved by the Health Research Ethics Committee of the Benue State Ministry of Health, and the Institutional Review Boards of APIN, the Federal Medical Center, Makurdi, and the Institute of Tropical Medicine, Antwerp, Belgium. The management of the 10 study health facilities also approved the study. Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data may be obtained from a third party and are not publicly available.

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