Adolescent retention in HIV care within differentiated service-delivery models in sub-Saharan Africa

Mhairi Maskew, Karl Technau, Mary-Ann Davies, Rachel Vreeman, Matthew P Fox

Adolescents and young people living with HIV are at risk of disengaging from HIV care at all stages of the care cascade. Differentiated models of care offer simplified HIV-service delivery options in the hope of improving treatment outcomes, including retention on antiretroviral therapy. However, it remains unclear how successful and widespread these models are for adolescents in sub-Saharan Africa, where the burden of HIV is the greatest. Very few differentiated models of care specifically targeted to adolescents can be found and this priority group are currently ineligible from several models that exist. Where differentiated care has been made available to adolescents, data on the implementation and effectiveness of these interventions remain scarce. Despite this scarcity of evidence on the effectiveness of differentiated care among adolescent populations, several interventions, particularly community-based groups with peer navigators or supporters, might have potential to increase the reach, effectiveness, and adoption of differentiated care in adolescent HIV-care programmes.

Introduction
In sub-Saharan Africa, despite being the region with the largest global HIV epidemic and numbers of people living with HIV, many countries have successfully implemented and scaled up antiretroviral therapy (ART) treatment programmes.1,2 Furthermore, HIV programmes in the region have grown and adapted over time, expanding access to ART with progressively increasing CD4-count eligibility thresholds and subsequent sustained successes in terms of decreases in HIV-related mortality,1 reductions in mother-to-child transmission of HIV,4 and more recently, progress towards universal access to ART through test-and-treat policies.5

However, not all populations groups have realised these gains and successes equally. In 2020, UNICEF estimated that 2·5 million children and adolescents were living with HIV in sub-Saharan Africa alone.6 Adolescents and young people (aged 10–24 years) living with HIV (referred to hereafter as adolescents) continue to be the age group with the highest infection rates and the only group with increases in HIV-related mortality.1 Increases in numbers of adolescents appear to be driven by both continued increases in HIV incidence through horizontal transmission, particularly among adolescent girls, and successes in paediatric ART programmes increasing survival of children with perinatally acquired HIV.7-9 Although retaining patients in long-term HIV care remains one of the most crucial challenges facing all age groups, recent reviews confirm adolescents are more likely than any other age group to disengage from HIV care at all stages of the care cascade,10-11 with the bulk of attrition occurring before ART initiation and within the first 6 months on treatment.12-15 Several economic and social concerns including stigma and violence victimisation, such as bullying,16 transport costs, missed school visits, missed wages among older youth (18–24 years), and long waiting times for clinic visits and ART refills are well described barriers to accessing care and drivers of poor retention to care and adherence to ART in this age group.12,16 Further, both paediatric and adult treatment programmes might not effectively meet the needs of this population. There is a recognised need for focused attention on health-care approaches to adolescent HIV service delivery19 and the extent to which the needs of adolescent populations are being met.

Since the adoption of universal access to antiretroviral therapy, treatment programmes throughout sub-Saharan Africa have begun to face the fact that traditional approaches to continuity of HIV care have not achieved global targets; particularly among adolescents. One approach that has been proposed and tested to address poor retention in adults is the implementation of differentiated models of service delivery (DSD models). Recognising that the one-size-fits-all approach to HIV service delivery is unlikely to result in sustainable improvements in HIV treatment outcomes, differentiated models of care offer simplified and patient-centred care options tailored to each stage of the patient care journey.20,21 These models adapt traditional HIV-care programme design to specific patient population groups and service-delivery contexts, including options such as task shifting, decentralised access to treatment, facility or peer-supported clubs, and multimonth dispensing options for patients considered stable on treatment. Such approaches also offer the promise of decongesting clinics (through reduced visits for those who are adherent) and reducing travel requirements for patients (both of particular advantage during the current pandemic climate) while allowing for focused attention on patients who struggle to maintain a suppressed viral load. Studies of differentiated care suggest equivalent or improved retention comparing DSD for stable patients with conventional models of care,22-25 with evidence that community-based support models could also improve rates of viral suppression in children and adolescents.26,27

However, despite several years of experience with differentiated care and urgent need for effective interventions addressing adolescent retention, several questions to delineate best practices for implementing...
DSD models in adolescent HIV programme design remain. First, there remains limited high-quality evidence describing the extent to which DSD models for HIV treatment have been adapted to and implemented among adolescents. Second, it remains unclear how effective differentiated care interventions within adolescent HIV service delivery might be for supporting retention on ART. Lastly, identifying opportunities for improving adolescent programme design and alignment with implementation science frameworks are needed.

Characterisation of DSD models within an adolescent context

Previous definitions of differentiated care consider an intervention to be part of a DSD model if they either singly, or in combination with other interventions, formed part of a treatment-delivery model not recognised as standard of care for ART delivery in terms of at least one of population (for example, youth-only services offered), location (non-facility-based delivery site), frequency (multiple month dispensing or reduced visit requirement), or provider cadre (ART delivery or care visit managed by community or family member). We used the classification proposed by Grimsrud and colleagues to group the DSD model interventions we identified into four approaches: client-managed groups; health-care worker-managed groups; facility-based individual models; and out-of-facility individual models. The characterisation of DSD models according to these four approaches has been described by Huber and colleagues (table 1) and here we expand on this description as follows: a description of the model and intervention; criteria for entry into that DSD model; countries in sub-Saharan Africa where the model approach has been implemented or evaluated; evidence of adolescent (aged 10–24 years) eligibility for inclusion into the model; and whether the design of the model was specifically designed for or tailored to adolescent needs and context.

Overall, we identified 22 models or interventions that met the definition of a differentiated-care approach (table 1). Most were health-care-worker led groups or facility-based individual models. We reviewed six out-of-facility models and only found two client-managed approaches. As noted previously, not all models operate exclusively from each other; for example, adolescents eligible for the scholar model access multimonth dispensing (3–6 months ART refills depending on the model) also had the option of meeting outside of usual clinic operating hours. Although age restrictions for eligibility varied across different settings in which the same conceptual model was implemented, many differentiated approaches currently in place were available only to people older than 18 years of age with a

<table>
<thead>
<tr>
<th>Model or intervention description</th>
<th>Eligibility criteria</th>
<th>Available to adolescents?</th>
<th>Specific to adolescents?</th>
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</thead>
<tbody>
<tr>
<td><strong>Client-managed groups: Kenya, Lesotho, Malawi, Mozambique South Africa, Swaziland, Uganda, Zambia, and Zimbabwe</strong></td>
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<tr>
<td>Community adherence groups</td>
<td>Groups of patients from a close geographical area meet once per month for support and ART refill. One member of the group able to collect medications from a community point and distribute them to other group members. Supported by community-adherence workers</td>
<td>Stable on ART for &gt;12 months</td>
<td>Yes, &gt;15 years of age in some groups; other groups are adults only (aged &gt;18 years)</td>
</tr>
<tr>
<td>Community ART access points</td>
<td>Similar approach to community-adherence groups, but the group is led and facilitated by one of the patients who has received training to lead the group</td>
<td>Stable patient on ART for 6 months (12 months in some models)</td>
<td>Yes, &gt;15 years of age in some access points; others are for adults only (aged &gt;18 years)</td>
</tr>
<tr>
<td><strong>Group managed by health-care workers: Democratic Republic of the Congo, Kenya, South Africa, Swaziland, Zambia, and Zimbabwe</strong></td>
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<tr>
<td>Adherence clubs</td>
<td>Small patient groups that meet at a health facility or at community points. Nurses or community-health workers provide clinical care, support, and medication refills and clinical visits at the facility twice per year</td>
<td>Stable patient on ART for 6 months (12 months in some models)</td>
<td>Mostly adults &gt;18 years of age; some cater for adolescents &gt;15 years of age</td>
</tr>
<tr>
<td>Family-led adherence clubs</td>
<td>Adherence club targeted at children on ART and their caregivers. As the children reach age milestones, they graduate as a group to youth or teenage clubs</td>
<td>Stable children on ART</td>
<td>Children mostly &lt;12 years of age</td>
</tr>
<tr>
<td>Postnatal club</td>
<td>Groups of mothers who are HIV positive and exposed babies meet at agreed locations on the basis of the vaccination schedule of the babies of the group. Nurses provide care and medication for both mothers and babies</td>
<td>Women who are pregnant and postpartum</td>
<td>No</td>
</tr>
<tr>
<td>Scholar model</td>
<td>Monthly support groups for school-going children and adolescents for education and psychosocial support. 3–6 months prepacked ART collection outside of school times</td>
<td>Stable school-going child or adolescents on ART</td>
<td>Yes</td>
</tr>
<tr>
<td>Teenage clubs</td>
<td>Groups of adolescents aged 10–19 years meet once per month at the health facility, often on weekends. Nurses or medical officers provide clinical care and medication refills. Counselling support offered and group social activities.</td>
<td>Teenagers on ART</td>
<td>Yes, aged 10–19 years</td>
</tr>
<tr>
<td>Youth clubs</td>
<td>Similar model to teenage clubs, but might involve access to internet hubs and library facilities. Model also provides transition support to adult programmes</td>
<td>Youth on ART</td>
<td>Yes, aged 10–24 years</td>
</tr>
<tr>
<td>Viraemia adherence club</td>
<td>Support groups for patients on ART who are unstable with elevated viral loads who meet once per month. Nurses provide clinical care and adherence support until the patient has a suppressed viral load</td>
<td>Unstable patients with detectable viral load</td>
<td>Some are adults only; others are available to all age groups</td>
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</tbody>
</table>

(Table 1 continues on next page)
few potentially available to younger adolescents aged 10–14 years, and only four of these were groups managed by health-care workers that exclusively targeted children, families, adolescents, or children of school-going age. Other than viramidine adherence clubs and clinic services targeted at patients with high viral loads, all differentiated models required participants to be stable on ART for a minimum of 6 months in some programmes and up to 12 months in other programmes. We found no client-managed groups targeted to adolescents, but several teenager-focused or adolescent-focused health worker-managed groups offering social and counselling support alongside nurse-provided clinical care and ART refills. We also identified facility-based models designed specifically for adolescents aged 10–19 years—the family model, paediatric ART clinics and teenager, youth, and scholar clinics providing dedicated adolescent or youth services within health facilities. Other than youth-specific outreach programmes providing community-based care and ART refill, no other out-of-facility individual models were specific to adolescents.

**Table 1:** Characterisation of differentiated service delivery models and interventions

<table>
<thead>
<tr>
<th>Model or intervention description</th>
<th>Eligibility criteria</th>
<th>Available to adolescents?</th>
<th>Specific to adolescents?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Facility-based individual models: Ethiopia, Malawi, Rwanda, South Africa, Swaziland, Uganda, Zambia, and Zimbabwe</strong></td>
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<tr>
<td>Fast-track ART refill</td>
<td>Accelerated pharmacy pickup available at the facility by separating the clinic visit from the ART-refill schedule or creation of a dedicated fast-track dispensing point or queue within the facility.</td>
<td>Stable patient on ART for 6–12 months with or without suppressed viral load</td>
<td>Some programmes, others are adults only</td>
</tr>
<tr>
<td>Multimonth dispensing for 3-6 months</td>
<td></td>
<td>Stable patient on ART for 6–12 months with or without suppressed viral load</td>
<td>Mostly adults &gt;18 years of age</td>
</tr>
<tr>
<td>After-hours clinic</td>
<td>ART service delivery is offered at facilities outside of normal clinic operating hours.</td>
<td>Stable patient on ART for 6 months (12 months in some models)</td>
<td>Some programmes, others are adults only</td>
</tr>
<tr>
<td>Family model</td>
<td>Programme for unstable children younger than 14 years. Involves the family of the child and the child themselves attending once per month a clinical visit together for clinical care, and emotional and psychosocial support</td>
<td>Child &lt;14 years of age with unsuppressed viral load</td>
<td>Yes &lt;14 years of age</td>
</tr>
<tr>
<td>High viral-load clinic</td>
<td>A patient with detectable viral loads or who switched from standard first-line ART regimens is seen by a dedicated team of clinical and psychological support staff. Medication refills once per month. Some facilities operate after hours</td>
<td>Detectable viral load or switched from first-line ART</td>
<td>In some programmes, others are adults only</td>
</tr>
<tr>
<td>Paediatric ART clinic</td>
<td>Standalone clinic offering ART services to children younger than 16 years. Stable children in older age categories are eligible for multimonth dispensing</td>
<td>Child or adolescent &lt;15 years of age</td>
<td>Yes &lt;15 years of age</td>
</tr>
<tr>
<td>Teenage, youth, or scholar-focused clinic</td>
<td>Dedicated services for adolescents or youth of school-going age. Clinic appointments scheduled for weekends and older teenagers are eligible for multimonth dispensing</td>
<td>Some target people aged 16–19 years, others those aged 15–24 years</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Out-of-facility individual models: Democratic Republic of the Congo, Malawi, Namibia, South Africa, Swaziland, and Zambia</strong></td>
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<tr>
<td>Mobile clinic or outreach programme</td>
<td>Community delivery of 2-month or 3-month ART dispensed by a nurse using a mobile van or at a community venue that can be identified as a hotspot for specific groups (men or youth). Also used in rural settings and in farm workers</td>
<td>Stable on ART &gt;12 months; some also do ART initiation</td>
<td>Yes, in most cases. Some run youth-specific outreaches</td>
</tr>
<tr>
<td>Community pharmacy</td>
<td>Clinical services provided at the originating facility while medication is delivered through private pharmacies near the originating facility</td>
<td>Stable patient on ART for 6 months (12 months in some models)</td>
<td>Yes, in some programmes, others are adults only</td>
</tr>
<tr>
<td>Key populations meeting in locations other than health facilities</td>
<td>Key populations (men who have sex with men and female sex workers primarily) receive care from service providers dedicated to key population care at home or community health posts</td>
<td>Member of key population group</td>
<td>Some programmes cater to those &gt;15 years of age, others only to those aged &gt;18 years</td>
</tr>
<tr>
<td>CCMDQ external medication pickup points</td>
<td>Patient follows 6-month visit schedule at facility and 2-month prepackaged ART dispensed at external locations (eg, private clinics, health shops or pharmacies, churches, community centres, and sites run by non-government organisations)</td>
<td>Stable patient on chronic medication for either 6 months or 12 months</td>
<td>Some programmes are for adults (&gt;18 years) only, or other programmes that cater to adults and adolescents</td>
</tr>
<tr>
<td>Home-based ART delivery</td>
<td>Similar approach to external medication pickup points, but ART is delivered to the home of the patient by contracted couriers or treatment supporters</td>
<td>Stable patient on ART for 6 months (12 months in some models)</td>
<td>No</td>
</tr>
<tr>
<td>Medication lockers and pharmacy dispensing units</td>
<td>Prepacked medication is dispensed through electronic medication lockers (similar to an ATM) supported with telepharmacy consultation. The lockers need to be in places where they can be accessed during out-of-office hours</td>
<td>Stable on ART; identity or passport number; and owns a mobile phone</td>
<td>&gt;18 years of age only</td>
</tr>
</tbody>
</table>

Framework provided by Grimoud and colleagues and Huber and colleagues. ART=antiretroviral therapy. CCMDQ=central chronic medicine dispensing and distribution.
We sought to describe the effect of differentiated HIV service delivery in improving retention in care among adolescents. We found the effect of adherence clubs on retention varied across studies. We note that, for programmes targeted at stable patients who already are highly adherent, equivalent outcomes can be seen as successful if the burden on the patient or the facility is reduced. Fox and colleagues reported generally high rates of retention among the adult population studied in South Africa (85% overall retention across the group receiving the intervention (those that attended an adherence club) and the control group (those that did not attend an adherence club), but similar retention in adherence clubs when comparing those aged 18–29 years not enrolled in adherence clubs (–1.2%, 95% CI –13.2% to 10.8%). Similarly, a Namibian cohort of adolescents aged 10–19 years found high rates of retention, but no increase in retention associated with facility-based teenager clubs compared to standard care among those aged 10–19 years (percentage alive and in care at study closure 91% vs 90%). In another South African study, only six (40%) of 15 young people aged 18–24 years were retained in community-adherence clubs; the remainder were referred back to clinic-based care because they did not pick up ART refills at the club. District-level estimates of facility-based retention at 12 months after ART initiation were higher in districts in Lesotho that had implemented several progressive and combined differentiated-care interventions including teenage clubs, peer-support groups and community-adherence groups. Comparing implementing with non-implementing districts, all adolescent and youth age categories reported higher proportions of 12-month retention: 10–14 years with 89% versus 50%; 15–19 years with 74% versus 55%; and 20–24 years with 70% versus 65%.

An intervention that involved ART refill fast tracking and appointment spacing implemented in Tanzania among children and adolescents reported that more than 98% of participants were alive and in care at study closure; however, eligibility criteria for the programme were quite stringent and the population studied probably represented patients who were already stable and highly adherent. Lastly, a study that evaluated community adolescent treatment supporters programme in Zimbabwe also found high retention rates both 6 months (99.8%) and 12 months (99.5%) after starting ART among children and adolescents up to 24 years involved in the community adolescent treatment supporters programme, although no comparison group was evaluated.

**Application of the RE-AIM framework to DSD models: implications for adolescent programme design**

Reviews have repeatedly highlighted the need for more adolescent and youth-focused studies, yet several gaps and challenges for adolescent and youth HIV-service delivery remain, and published data on the evaluation of service-delivery approaches such as differentiated care are scarce. We considered the application of the interventions and approaches of current DSD models for adolescent HIV-service delivery against RE-AIM, an implementation science framework that has been applied across several health settings and contexts for more than two decades. The framework attempts to address the failure of much public health research to successfully translate seemingly effective interventions into sustained improvement in clinical outcomes at scale; frequently through the absence of widespread implementation. The RE-AIM framework has been developed to facilitate translation of research findings through five dimensions, comprising reach, effectiveness, adoption, implementation, and maintenance (table 2). Here, we apply the five principles as a structured framework to consider the evidence for how DSD models can inform best practice in adolescent programme design and its potential effects on retention on ART; one of the key challenges facing adolescent HIV-service delivery.

**An adolescent-focused programme should focus on the adolescent**

The widespread implementation of differentiated models of care is occurring in an era of increasing awareness of specific challenges of the adolescent’s unique stage of development. A successful transition from childhood to adolescence will benefit not only the adolescent living with HIV, but also the adult HIV services who subsequently manage individuals who may have had extensive ART experience as children. Despite this, few DSD models of care are specifically targeted to adolescent needs and several of these models are not available for this priority age group. Most models are aligned with guidelines and practices for adult care programmes. In terms of assessing the reach of DSD models, most studies reviewed report absolute numbers of adolescents and young people participating in the study, but the absence of denominators indicating the total number of adolescents from which the sample was drawn makes drawing conclusions on the representativeness of the adolescents difficult.

Although some aspects of adult-based differentiated care could meet specific adolescent needs (remote or after-hours medication dispensing, for example), input from adolescents informing the design process could improve not only reach, but also adoption of differentiated care. PEPFAR’s Dreams, Resilience, Empowered, AIDS-Free, Mentored, and Safe (DREAMS) programme implementers noted that although the targeted approach of the program to multisectoral HIV prevention-service delivery increased the reach of the programme for adolescents living with HIV, the absence of meaningful engagement with these adolescents hampered the implementation and maintenance of the intervention efforts of the programme. Mixed-methods and codesign
approaches advocated by the RE-AIM framework could assist in understanding structural and contextual barriers to retention that differentiated care could address.

**Few DSD models or interventions are adolescent led**

Although some adult DSD interventions assume a level of independence not appropriate for adolescents, implementation of programmes that rely excessively on health worker, parental, or caretaker supervision might be equally counterproductive in terms of adoption. The group of adolescents living with HIV is diverse, with vastly different personal journeys, which in some cases involve severe loss, past illness experience, and trauma. Carefully tailored psychosocial support is needed to equip young adolescents to have an active role in their care. Developing autonomy is a crucial developmental task for all adolescents, and an ideal health-programme design should empower the individual (and adolescent specifically in this case) to take ownership of their health-care journey. Given the lifelong course of the HIV-care journey, the earlier a person feels empowered and supported in the transition to treatment self-management, the more likely they are to stay engaged and adherent for the duration. HIV self-testing models have shown high adoption among adolescents and also led to peer distribution of further testing kits. Despite mixed results in terms of efficacy, previous studies have shown high acceptability and feasibility of these models. Lesotho implemented a transitional approach started in community intervention clubs for children aged 5–9 years on ART that address psychosocial, physical, and spiritual needs of enrolled children on ART refill days, and then transitioned at age 10 years to teenager or peer-support groups and again at 18 years to youth-community adherence groups in preparation for transition to adult-based groups by 25 years of age. This study found improved 12-month retention on ART among adolescents in districts where teenage clubs and peer-support groups were implemented compared to non-implementing districts (73% vs 63%). Of note was the combination of differentiated interventions these models included—all were led by youth ambassadors or club champions offering psychosocial support and included home-based visits and support structures. Resources to adequately train and support adolescent peers remain a crucial gap in implementation capacity that requires addressing. Peer-led community approaches with positive role models could represent an important building block toward individual autonomy and independence, which in turn might increase the likelihood of programme maintenance.

**The greatest gaps in retention are not addressed by differentiated-care models**

Despite the promise DSD models hold in terms of reach and adoption, the majority of DSD models are not available to patients during the period of highest risk for disengagement, which is the first six months on ART. This factor is a major obstacle to increasing the effectiveness of a differentiated care model’s potential to improve retention on ART. The focus of the DSD model on stable patients should in theory reallocate resources and clinic-visit time to people most at need, but additional

### Table 2: RE-AIM framework assessment: evaluating DSD models within an adolescent context

<table>
<thead>
<tr>
<th>Definition</th>
<th>Critical focus areas for adolescent programme design and evaluation</th>
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<tbody>
<tr>
<td>Reach</td>
<td>Absolute number, proportion, and representativeness of individuals who are willing to participate in a given initiative</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>Effect of an intervention on outcomes, including potential negative effects, quality of life, and economic outcomes</td>
</tr>
<tr>
<td>Adoption</td>
<td>Absolute number, proportion, and representativeness of settings and intervention providers who are willing to initiate a programme</td>
</tr>
<tr>
<td>Implementation</td>
<td>The fidelity of an intervention provider to the various elements of an intervention’s protocol</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Extent to which a programme or policy becomes an institutionalised part of routine organisational practices and policies</td>
</tr>
</tbody>
</table>

DSD=differentiated service delivery.
Clinic-based resources will not help those struggling with the high visit burden of the early months on ART or other challenges related to clinic attendance. For example, school-age children or students with full-day schedules who have the frequency of visits in the early months on treatment as obstacles to remaining in care might benefit from multimeal dispensing with after-hours access for ART refill. Under the current implementation, most DSD interventions are restricted to patients who are stable on ART whereas the largest effect of a DSD approach might only be realised among those needing adherence support. There is, for example, evidence that differentiated models are feasible in the first 6 months of care. Data from the DO ART trial among adults in South Africa and Uganda evaluated the provision of the full cascade of community-based HIV-service delivery from HIV testing, ART initiation, and follow-up, and found that adult participants accessing HIV care through an exclusively community-based service model demonstrated improved rates of viral suppression 12 months after ART initiation compared with standard clinic-based service delivery (74% vs 63%). Adolescents at the highest risk for disengagement might indeed be the ones who would benefit most from DSD models.

Adolescent programme design should be informed by robust implementation research

Where differentiated care has been made available to adolescents, data on the implementation and effectiveness of these interventions remain scarce. We found only six published studies describing the effect of differentiated HIV-service delivery on adolescent retention, two of which were restricted to youth aged 18–24 years. To date, insufficient age-disaggregated data reporting on outcomes in relevant age bands (children, adolescents, and youth) are available to robustly quantify the effectiveness of DSD models on improving retention in care and furthermore to evaluate potential effect-measure modification by age group. Both the clinical trials and one cohort study reviewed reported individual-level outcomes for comparison groups accessing standard-of-care HIV service delivery to establish the effectiveness of the differentiated-care intervention. One study compared outcomes at the district level whereas the remaining two studies reported no comparison-group data. Three studies reported outcomes by age-disaggregated groups, and one was restricted to those aged 10–19 years. Quality of life and economic outcomes were not presented in any of the studies reviewed. Interventions should be offered to representative adolescent populations with valid comparison groups so that these can be evaluated in complex real-world settings rather than under optimal conditions with highly selected individuals where efficacy might be overestimated. Eligibility criteria for inclusion into differentiated-care models were frequently very stringent in the studies reviewed (and also in DSD-care models more generally) and so, by design, result in very stable and highly-adherent groups being selected into DSD models; adolescents least likely to require or benefit from interventions to improve retention.

In addition, the perspective of the health worker or agent delivering the intervention could offer insight into adoption and implementation challenges. While uptake of differentiated care at the level of the setting (facility or policy) appears to be expanding, this does not necessarily translate into consistent adoption among providers and there is a paucity of evidence on involvement and perceptions of staff implementing programmes. Although differentiated-care interventions have been implemented across a diverse range of settings in the studies reviewed, proportions of sites or health workers approached who are unwilling to participate or implement the interventions is largely undocumented. Low adoption at the provider level could hamper success of health-worker or facility-based programmes.

Differentiated care for adolescents will also need to be integrated and equitable care

The complex landscape of adolescent health means that HIV-service delivery cannot be divorced from other key health needs, regardless of the setting and provider offering it. In particular, mental health services paired with social and emotional support to address key issues such as substance abuse, depression and anxiety, with a focus on building resilience, could bolster service delivery and enhance outcomes in this group. The current COVID-19 pandemic brought this acutely into focus, exacerbating not only difficulty in accessing health services, but also creating new challenges. Reported rates of anxiety and depression among adolescents has nearly doubled during the first year of the pandemic compared to prepandemic times.

In addition, integration of sexual and reproductive health into youth-friendly services should be prioritised. In sub-Saharan Africa, six in seven new HIV infections among those aged 15–19 years are in girls, and in South Africa, more than a third (34%) of births registered during 2020 were to young mothers aged 24 years or younger. Social inequalities have been identified as key factors in driving onwards transmission among vulnerable groups and effects on goals of ending the epidemic. Young mothers living with HIV, while also facing the needs of caring for a young infant with limited childcare knowledge and support, could benefit from interventions targeting specific barriers to accessing health services. Keeping girls in secondary school, for example, was found to be protective against HIV acquisition in Botswana, whereas social protection provisions such as cash incentives appear to reduce adolescent engagement in transactional sex and improved adherence to ART. Integration of several
Adolescent programmes will need to adapt over time

There is evidence that differentiated-care interventions are becoming more widely implemented and have the potential to become relatively stable, enduring components of HIV service. For example, one of the randomised trials was unable to randomly assign sites to decentralised medication delivery, because several sites were mandated to begin this programme during the study period. Another analysed retention at the district level because of the progressive and staged rollout of various differentiated-care approaches over several years before the study. However, although all studies reviewed reported patient outcomes over 12 months or 24 months, longer-term outcomes among adolescents accessing HIV care through DSD models remain unclear. Care must also be taken to accommodate elements of treatment and pall fatigue in adolescents with many years of treatment experience.

For sustained maintenance of differentiated care among adolescents, programmes will need to make provisions for flexibility in approach and adaptation over time as unanswered questions come to the fore—a central tenet of implementation research. For example, what is the role of mHealth and other technology solutions in providing health care to an age group that are both highly mobile themselves, and also access mobile technology, digital applications, and social media platforms in previously unheard-of ways and duration? Evidence exists suggesting that information sharing, mental health resources, and peer-support can be accessed in this way to increase reach, adoption, and effectiveness. Previous mHealth interventions show high acceptability and increased linkage to care among those aged 18-30 years, but little effect on retention. These findings are somewhat limited in that most studies provided smart phones, and it is unclear how uptake would be affected by the absence of an incentive like this.

In addition, the role of newer antiretroviral agents among adolescent populations is unclear. Several long-acting drugs now allow for weekly, monthly, or two-monthly dosing (tablets or injectable); some can be delivered subcutaneously, which would mean ART dosing simplified down to self-administered injections twice per year. The double-edged sword of the newer drugs is their so-called long tail, meaning persistence of low drug concentrations in the body, opening up the possibility of resistance arising during drug concentration decay if the next scheduled dose is not delivered on time.

High amounts of non-adherence among adolescents makes them both a group that would benefit from long-acting agents, but also the least likely to get them. Although it is not yet clear how acceptable this ART modality might be among adolescents and how best to deliver these types of services to young people, adapting programmes to pair this type of regimen with a behavioural component or home-based care intervention might warrant investigation.

Also, heterogeneity within groups of adolescents and young people living with HIV needs to be acknowledged and prepared for, because service-delivery plans are designed and implemented. Approaches that allow for variations in care models and approaches to be offered to differing subpopulations (for instance, awareness of duration and previous treatment experience of young people with perinatally acquired HIV compared with those with horizontally acquired HIV who are ART naive at initiation) could strengthen programme effectiveness.

Conclusions

The challenges facing adolescent HIV-care programmes are not yet addressed and retention throughout the HIV-care journey should remain a priority programme goal. Despite a persistent paucity of data evaluating adolescent HIV-service delivery, several interventions, particularly community-based groups with peer navigators or supporters, have potential to increase the reach, effectiveness, and adoption of differentiated care in adolescent HIV-care programmes. Programme design should be guided by well supported adolescents to address the unique complexities that characterise this unique period and implementation of differentiated-care interventions needs to be supported by robust research. Opportunities for integrated care and promotion of independence and treatment self-management should be sought if adolescent HIV-service delivery is to be optimised and maintained.

Search strategy and selection criteria

For this Review, we searched peer-reviewed publications and conference abstracts that reported on HIV-infected populations receiving antiretroviral therapy through a differentiated model of care. We searched PubMed, Cochrane Library, the Cumulative Index of Nursing and Allied Health Literature, EMBASE, Web of Science, and WHO Global Index Medicus on Nov 2, 2021, with no language restrictions. We limited the review to studies reporting outcomes among participants aged 10–24 years (inclusive) from sub-Saharan Africa as the geographical region of interest. To avoid overlap with a recent summary review of youth-friendly services and adolescent-specific differentiated care models, we excluded studies published before 2018. A full description of the search strategy and article inclusion criteria is provided in the appendix pp 1–9.
Contributors
All authors conceptualised the study, the search strategy, and methodology. MM did the literature search and wrote the original draft manuscript. All authors contributed towards editing and final review of the manuscript.

Declaration of interests
We declare no competing interests. Prof Davies declares grants paid to her institution from the Wellcome Trust, Bill & Melinda Gates Foundation, Viiv Healthcare, and the South African Medical Research Council during the 36 months before initial planning of this work. All other authors declare no competing interests.

Acknowledgments
This study was funded by the US National Institutes of Health Eunice Kennedy Shriver National Institute of Child Health & Human Development and the National Institute for Allergy and Infectious Diseases under grant R01 HD103466 and also by the National Institute Of Mental Health of the National Institutes of Health under Award Number R01MH122998. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The funding source had no role in the design of this study and will not have any role during its execution, analyses, interpretation of the data, or decision to submit results.

We wish to acknowledge and thank Dr Amy Huber and the AMBIT Biomedical Library, Vanderbilt University) and Dr Kate Clouse (Vanderbilt University School of Nursing) for their advice and assistance in developing and implementing the study search terms.


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