Exploring sustainability in the era of differentiated HIV service delivery in Sub-Saharan Africa: A systematic review

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Funding: This work was supported by Erasmus Mundus Joint Doctorate Fellowship, Framework Partnership Agreement 2013-0039, Specific Grant Agreement 2014-0681.

The authors report no conflicts of interest related to this work.

Competing interests: The authors declare that they have no competing interests.

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Authors’ contributions
NEO, SH, and GBG conceptualized and designed the study. NF contributed to the design of the study. NEO and UL screened and selected all articles included in the review. NEO and UL conducted data extraction from articles selected in the initial search. NEO extracted data from articles included after the final search, while GBG validated extraction from one-third of articles. NEO conducted the data analysis and produced the tables and graphs. SH, LL, and GBG provided input into the analysis and interpretation of data. NEO prepared the initial draft of the
manuscript and circulated it among all authors who provided important intellectual feedback and comments used to prepare subsequent revisions. All authors read and approved the final draft of the manuscript.

Abstract

Introduction: The World Health Organization recommends differentiated service delivery (DSD) to support resource-limited health systems in providing patient-centered HIV care. DSD offers alternative care models to clinic-based care for people living with HIV (PLHIV) who are stable on antiretroviral therapy (ART). Despite good patient-related outcomes, there is limited evidence of their sustainability. Our review evaluated the reporting of sustainability indicators of DSD interventions conducted in sub-Saharan Africa (SSA).

Methods: We searched PubMed and EMBASE for studies conducted between 2000-2019 assessing DSD interventions targeting HIV-positive individuals who are established in ART in SSA. We evaluated them through a comprehensive sustainability framework of constructs categorized into six domains (intervention design, process, external environment, resources, organizational setting, and people involvement). We scored each construct 1, 2, or 3 for no, partial, or sufficient level of evidence, respectively. Interventions with a calculated sustainability score (overall and domain-specific) of >90% or domain-specific median score >2.7 were considered likely to be sustainable.

Results: Overall scores ranged from 69% to 98%. Top scoring intervention types included adherence clubs (98%) and community ART groups (95%) which comprised more than half of interventions. The highest scoring domains were design (2.9) and organizational setting (2.8).
The domains of *resources* (2.4) and *people involvement* (2.3) scored lowest revealing potential areas for improvement to support DSD sustainability.

**Conclusions:** With the right investment in stakeholder involvement and domestic funding, DSD models generally show potential for sustainability. Our results could guide informed decisions on which DSD intervention is likely to be sustainable per setting and highlight areas that could motivate further research.

PROSPERO Number: CRD42019120891

**Keywords:** Sustainability, Differentiated service delivery, HIV/AIDS, Sub-Saharan Africa, Patient-centered care

**Introduction**

Traditional clinic-based care to test, treat, and retain all people living with HIV (PLHIV) poses a challenge to constrained health systems, especially in sub-Saharan Africa (SSA)\(^1\). Innovative service delivery options are necessary to scale up and support favorable long-term outcomes of antiretroviral treatment (ART). By tailoring services according to client clinical profile, differentiated service delivery (DSD) offers a practical alternative\(^2\). Overall, the goal of DSD is to decrease barriers in access to care and to guarantee the quality of services at reasonable costs to the healthcare system. Several DSD interventions have been implemented since the 2000s and show encouraging programmatic and clinical outcomes\(^3\)\(^-\)\(^5\). DSD anchors on four pillars: the person who provides care (‘who’; healthcare workers [HCW], doctors, nurses, community health workers [CHW], peers, etc.), the location of care (‘where’; clinic or community), the frequency of care (‘when’; monthly or multi-monthly) and which HIV services are provided (‘what’; ART
refill, counseling, health screenings, etc.), respectively. DSD models are defined by a combination of one or more of these pillars which are adapted to the local context. The simplest DSD model is one that includes multiple (3-6) months prescriptions and task-shifting of ART dispensing tasks from doctors to other HCW. Currently, four main DSD intervention types exist including 6.

(a) HCW managed groups e.g. adherence clubs in clinics or communities.

(b) facility-based individual models delivered by HCWs e.g. fast track refills, six-month appointments, multi-month scripting.

(c) client-managed groups in communities e.g. community ART groups.

(d) community-based individual models e.g. community drug distribution points, mobile outreaches, and home delivery.

These DSD interventions focus on individuals who are established (stable) on ART, as complicated cases require facility-based individualized care. This group became the priority for service delivery innovations such as adherence clubs and down-referrals from hospitals to clinics in South Africa, to community ART groups in Mozambique 3,7–10. The defining criteria for being established on ART are in constant evolution and vary by setting, adapted by national HIV programs. WHO currently defines being established on ART as receiving ART for at least six months; no current illness (which does not include well-controlled chronic health conditions); good understanding of lifelong adherence; adequate adherence counseling provided; and evidence of treatment success (preferably at least one suppressed viral load result within the past six months).
As countries increasingly adopt DSD models that show encouraging results, it is necessary to assess where to focus efforts to enhance the sustainability of these models. In this review, we aimed to evaluate the sustainability of DSD interventions using a comprehensive framework and to assess whether variations in the definition of individuals who are established on ART influence outcomes and sustainability of DSD interventions.

Methods

The methods for this review have been published elsewhere. Briefly, we systematically searched and identified studies in the English language about ART delivery interventions to individuals established on ART in SSA conducted between January 2000 and November 2019. The search was conducted in PubMed and EMBASE using terms including differentiated care, decentralized care, community ART, task shifting, SSA, and HIV program descriptors. Reference lists of included articles were also searched. Inclusion and exclusion criteria are summarised in Box 1.

Rayyan QCRI was used to manage this process. The review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for reporting systematic reviews.

Sustainability definition and framework

We used the following comprehensive definition of sustainability: “after a defined period – especially after initial funding, the program, clinical intervention, and/or implementation strategies continue to be delivered and/or; individual behavior change (i.e. clinician, client) is maintained; the program and individual behavior change may evolve or adapt while continuing
to produce benefits for individuals/ systems” 14. We adopted the Consolidated Framework for Sustainability Constructs in Healthcare (CFS) to structure our evaluation. The Framework was developed in 2018 based on a systematic review of sustainability frameworks, tools, and models in healthcare. It is the first framework to consolidate a comprehensive list of sustainability constructs which are organized into 6 broad domains with 40 individual constructs which may influence sustainability outcomes. The framework provides a mechanism to conceptualize and analyze sustainability data. To test validity and understand how representative the framework is of diverse healthcare interventions and settings, it has been tested within various healthcare studies 15–21. We seek to add to this literature by testing it within this work, with the constructs and domains providing a simple set of evaluation questions that formed the evaluation benchmark (Supplementary File I, http://links.lww.com/QAI/B644).

**Study outcomes**

The primary outcome was an overall ‘sustainability score’. This was calculated by summing the scores assigned to the 40 CFS constructs for each study and DSD intervention type (see calculation details below). Additionally, the median of the scores was estimated for the six domains per intervention. All construct and domain names are present in this paper in *italics*. The secondary outcomes included (i) a descriptive summary of the main study outcome measures (e.g. retention in care, viral suppression, loss-to-follow-up, client or provider-related costs); (ii) narrative synthesis of qualitative outcomes (e.g. clients and HCW perspectives about DSD interventions and challenges), and (iii) sensitivity of sustainability scores per intervention to the cut-off points (see data synthesis section below) with variations in definitions of individuals established on ART used across studies.
Quality appraisal

The risk of bias was assessed using the Downs and Black checklist for quantitative studies and the Joanna Briggs Institute (JBI) checklist for qualitative studies.

Data extraction and synthesis

We adapted a scoring method using a pretested checklist to assign scores per construct ranging from one to three: 1, little to no evidence; 2, some or moderate evidence; 3, sufficient evidence that the construct was realized.

The scores assigned aimed to facilitate the prioritization of constructs and domains based on frequencies. There are no standards published for ranking sustainability. Studies measuring similar complex constructs in health interventions used mean scores or percentage scores e.g. >75% as cut-offs to determine performance and trends. We considered percentages an appropriate measure to rank constructs since we calculated total scores, and median to rank domains since the 3-point scores were non-normally distributed. Per intervention, we calculated an overall percentage of the total score possible across all constructs (3*40=120). We derived three cut-offs to indicate sufficient evidence for at least 75%, 50%, and <50% of all constructs which we deemed set a high standard for our evaluation. This translated into total scores falling (i) within the highest percentile ≥108; (ii) between the 8th and highest percentile (≥99.6-107) and (iii) below the 8th percentile (<99.6). Consequently, we regarded percentage total scores as follows: ≥90%: likely sustainable, ≥83%: potentially sustainable, and <83%: less likely to sustain. Similarly, we regarded a median domain score ≥2.7 for each unique DSD intervention as suggestive of being likely sustainable, ≥2.2 as suggestive of potentially sustainable, while
<2.2. was regarded as less likely sustainable. R version 4.0.3 was employed for analysis and visualized using the ggplot2 package\textsuperscript{28,29}. A narrative synthesis was conducted by employing thematic analysis to summarize sustainability facilitators and challenges.

**Sensitivity analysis**

To determine the impact of varying definitions of individuals established on ART, we assumed a minimum set of criteria (specifying CD4 count or VL, and months on ART or adherence status) as the base definition for individuals established on ART. Studies specifying additional criteria (about e.g. opportunistic infections, weight, adherence, residence) were categorized as base+, and studies with no definition as base-. The sensitivity of sustainability scores to these three categories was analyzed by constructing a forest plot setting the cut-off score of 83\% as indicative of the potential for sustainability to assess for trends.

**Registration**

This systematic review was registered on the PROSPERO database; number CRD42019120891.

**Results**

**Characteristics of included articles**

Of 3,088 publications identified by our search, 34 articles were included reporting 39 different DSD interventions across ten SSA countries (Figure 1). South Africa, Malawi, and Mozambique contributed about 75\% of included articles. Characteristics of included studies are summarized in Table 1 and full data extraction details are available in Supplementary File II.http://links.lww.com/QAI/B644. Articles were published between 2010 and the end of 2019, except for one intervention that started
in 2001. Most studies were observational cohorts 41% (16/39), followed by qualitative studies (including realist evaluations, 10/39) and experimental studies (three cluster-randomized studies, one quasi-experimental study, and one pragmatic open-label study, 5/39). The remainder were mixed-methods studies, program evaluations, and cost-effectiveness studies. Studies with a comparison group comprised 44% (17/39) while the remainder were descriptive. Finally, 51% of studies were conducted in single sites.

**Risk of bias in included studies**

Over 90% of quantitative studies had a high to moderate risk of bias (See Supplementary File III, http://links.lww.com/QAI/B644). The risk of bias in qualitative studies was considered moderate. All qualitative studies did not state the philosophical perspective from which the studies were conducted or the theoretical perspective of the researcher within the research.

**Table 1: Characteristics of studies included in the review**

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<td>AC - Facility-based Adherence clubs; CAC - Community-based Adherence clubs; CAG – Community ART group; CARG – Community ART refill group; CDDP – Community drug distribution point; DMD – Decentralized medication delivery; DR - Down referral (DR) from Hospital to PHC; FTR – Fast track refills; HD – Home delivery; MMS – Multi-month scripting; OR – Outreach; SMA - Six monthly appointment; SMCC – Six monthly clinical consultations; LTFU – Lost-to-follow-up</td>
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**Characteristics of included interventions**

Of the 39 interventions (Table 2), Adherence Club (41%) and Community ART Group (20%) were the most commonly reported intervention types.
Table 2: DSD intervention type description

The intervention types Adherence Club and Down Referral were conducted mostly in urban settings except for one adherence club intervention. Of the two Community Drug Distribution Point interventions, one was conducted in a large urban center, while the other was a multi-center study spanning both rural and urban settings. Community ART Groups, Community ART Refill Groups, and Outreach interventions were predominantly in rural settings. Primary care providers in over 85% of interventions were peers and/or lay health care workers (Lay-HCW). Interventions were mostly funded externally, apart from locally funded adherence clubs in South Africa, a situation reflecting the funding status of HIV programs in general.

Outcome measures reported included one-year retention (in 20/29 studies, of which eight were comparative), one-year viral suppression and one-year loss-to-follow-up (in 10 studies each), and one-year mortality (in 8 studies). Three studies reported costs, of which only one article reported both provider and client-incurred costs.9,33,34

Overall sustainability scores per intervention type and study

Across the nine DSD intervention types, sustainability scores ranged from 67.5% for home delivery in Kenya to 95.8% for adherence clubs in South Africa. DSD interventions implemented in South Africa, e.g. adherence clubs and decentralized medication delivery, scored the highest (94.2 – 95.8%), followed by the community ART groups implemented in Mozambique (93.3%) and those in Lesotho (90.8%). Conversely, interventions with minimal engagement of key stakeholders, e.g. home delivery, six-month appointments, and down-referral, scored the lowest with 67.5%, 71.8%, and 73.3%, respectively. The scores per study are shown in Supplementary Table II, http://links.lww.com/QAI/B644.
**Sustainability scores – top-scoring constructs**

The top twelve constructs scored between 95-100%. Evidence for sustainability was reported across all interventions for six constructs namely: *value system, no opposition, problem awareness, project type, expertise,* and *client-related outcomes* (see details in Figure 2a).

**Sustainability scores - least scoring constructs**

The least twelve scoring constructs scored between 15-53%. Sustainability constructs were least reported in the following areas (see Figure 2b): *Community participation* and the involvement of *program champions* (15% of studies); *Community awareness* of interventions and clients *involvement* in intervention design, planning, and processes - 23% of studies\(^7,36,40\); *A shared goal* developed with all stakeholders, *resources*, and adequate *funding* necessary to continue interventions (30% of studies); Other constructs with minimal evidence included *ownership* of interventions, *infrastructure*, *satisfaction* among staff, *power* and *readiness* to continue delivering the intervention with little or no external support\(^4,41,42\).

**Constructs not described across studies**

Over 50% of studies provided some form of evidence for all constructs. Of the remainder, 14 studies did not describe between 1 to 3 constructs. The involvement of *champions* was the construct most frequently not described (13, 33.3%). *Community awareness* followed a similar trend. Other constructs not commonly described include *readiness* (30%), *funding* (25%), *community participation* (13%), *roles/responsibilities* (13%) *job description* (10%), and *shared goals* (10%).

**Comparing sustainability domains across DSD intervention types**

In Figure 3 we present the median and interquartile ranges for domain-specific scores per intervention type. In Table 3, we describe the domain scores in detail. The Figure highlights the
relative performance of the six sustainability domains across the nine unique DSD intervention
types. Median scores are highlighted as six separate boxplots with different colors representing
the six domains per DSD intervention type.

Table 3: Sustainability scoring across all DSD intervention types by domains

Facilitators of and challenges to sustaining DSD interventions
Across studies, DSD interventions were mostly acceptable to clients and staff alike. Among
clients, preference for DSD was explained as representing a convenient option, reduced time
spent accessing care, reduced frequency of clinic visits, reduced transport cost, increased peer
support, reduced absenteeism from work, material support among members, and improved self-
management. For staff, the reduced workload was the most commonly cited reason
for preference in addition to more effective use of HCW time attending to sicker patients,
reduced number of clients lost-to-follow-up, and decongestion of clinic. Fear of stigma due to unintentional disclosure by participating in the intervention was a recurrent
challenge across studies. Other challenges were mostly health system-related including protocol
violations due to pressure from clients to be enrolled, staff shortage, long viral load result turn-
around-time, poor documentation and data quality, inadequate understanding of intervention by
staff, insufficient supervision, ARV and co-trimoxazole stock-out, differences in implementation
across facilities, inadequate awareness, and low community involvement, inefficient drug supply
chain, restrictive policies limiting the roles of CHW, unconducive venue for intervention and
lack robust monitoring systems. A few client-related challenges were reported e.g. group conflicts and low male participation.
**Sensitivity analysis**

The definitions of stable on ART varied across included studies (see Supplementary File 4, http://links.lww.com/QAI/B644). Seven interventions used the base definition, while four (10%) did not give a specific definition (Base-) and 28 (72%) provided a more detailed definition (Base+). We did not observe any trend in the likelihood of sustainability when comparing across the three categories (Figure 4).

**Discussion**

Our review shows that DSD interventions targeting HIV-positive individuals established on ART in sub-Saharan Africa may be sustainable but may require additional support in aspects such as resources and stakeholder involvement to enhance sustainability. Indeed, we found that DSD interventions were potentially sustainable in terms of the domains *design and delivery, organizational setting, external environment,* and *intervention process.* The domains of *resources* and *people involved,* however, received lower sustainability scores.

The comprehensive definition by Moore et al, and the framework by Lennox et al, captures the complexity of the sustainability concept and enabled our multi-dimensional examination of sustainability\textsuperscript{14,15}. Though distilled primarily with evidence from high-income countries, the constructs and domains proposed by the framework remain relevant in low and middle-income settings. First, it is recognized that similar processes drive sustainability across settings\textsuperscript{51}, and second, the domains align with key areas highlighted in the sustainability discourse about donor-funded interventions in Africa\textsuperscript{52–55}. The framework allowed us to expand sustainability assessment from a sole resource perspective to a more comprehensive view of program
continuation. Financing considerations no doubt matter when discussing other sustainability domains in SSA where HIV programs rely heavily on external funding. However, securing funding has been shown not necessarily translate to systemic efficiency or deal with other drivers of sustainability such as social norms and practices. Domains are not mutually exclusive, although they are presented separately. We proceed to discuss our findings across domains adopting a broad view.

**Intervention design and delivery** – This was the highest-scoring domain. DSD interventions show effective client-related outcomes, adequate problem awareness and expertise, sufficient evidence, and appropriate design types, all of which are factors that enhance sustainability. Other constructs in this domain i.e. capacity building, improvement methods, and project duration were reported as accomplished by most studies, while the existence of structured monitoring systems was instrumental to highlighting achievements towards the 90-90-90 targets.

**External environment** – This domain relates to laws and policies impacting vulnerability to HIV (e.g. among sex workers, lesbian, gay, bisexual, and transgender (LGBTs) and access to HIV-related services (i.e. demand and supply) and scored moderately. Unfavorable legislation targeting vulnerable groups has been documented in several countries like eSwatini, Tanzania, Kenya, Malawi. Reassuringly, nearly all studies score high for political support with reports of policy updates to incorporate DSD and enabling requirements into national HIV strategic plans e.g. Mozambique, DRC, South Africa, eSwatini, and Zimbabwe. The limited community awareness (besides the PLHIV and HCW directly involved) is likely linked to the
socio-cultural context within which interventions are implemented and the behavior and perspectives of stakeholders in which stigma cannot be overlooked\(^{59,65,66}\). Stigma is a complex social construct that remains an issue\(^{67–70}\). Pantelic et al. recommended prioritizing a combination of interventions at different levels to tackle stigma\(^71\). Although participants acknowledge the benefit of DSD, fear of unintentional disclosure was a recurrent reason for non-participation\(^{37,39}\). Poverty is another relevant structural issue which not only increases vulnerability to HIV but also limits access to services\(^{72,73}\). Gender-based violence, gender inequality, and cultural beliefs that condone oppressive male dominance disproportionately affect women\(^{74}\). Despite these, included studies across countries report the spread of DSD interventions to multiple sites within districts and regions\(^{33,60,66,75–77}\).

**Organizational setting** – The deliberate inclusion of DSD interventions in the policies and guidelines of primary care systems was evident across studies. In our review, the *organizational setting* domain provided most constructs that enabled the evaluation of DSD sustainability, alongside domains like *intervention process and resources*. Most health system *values & culture* align with the DSD strategy which may explain *management support* and having *no opposition* reported in studies. Also, *adaptations* that optimize intervention’s fit within the environment were frequently reported. CHW-driven programs like DSD are poorly integrated into the formal health system in many African countries\(^{78–80}\). Apart from South Africa, studies show that governments have been unable to facilitate this *integration*\(^{31,46}\). DSD models require health systems with *readiness and capacity* adapted to community services. Paper-based data management systems are common across Africa and do not support the level of tracking required in DSD\(^{30,33,36,39,81}\). Investment in a robust electronic health information system is desirable for
ensuring the retention of clients who receive ART out-of-facility. Conversely, the large quantities of ART dispensed at once to PLHIV in DSD demand an efficient logistics system to prevent stock-out. Six-month appointments, Fast-track refills, Multi-month scripting, and Adherence Club interventions though successful, were mostly funded externally which poses a risk for sustainability.

People - The people domain scored poorly across interventions. The extent of participation, ownership, collaboration, and power exercised by stakeholders, in DSD interventions were found to be generally less than optimal. Apart from Adherence Clubs in South Africa and Community ART Groups in Mozambique which reported evidence of stakeholder engagement and good client involvement, PLHIV participation appeared passive. While there were reports involving networks of PLHIV, community awareness and involvement of the larger community where these interventions were implemented was rarely reported. Even within facilities, an adaptation of the Adherence Clubs which was integrated with other chronic diseases faced similar challenges. Despite evidence that program champions help reinforce positive behavior, there was little report of their engagement in our review. A rights-based approach to health, as promoted by WHO is desirable and involves meaningful stakeholder participation to guarantee the values and preferences of beneficiaries are incorporated in the design, planning, implementation, monitoring, and evaluation of any intervention.

Process – This domain performed moderately and involves processes necessary for the continued delivery of interventions. DSD interventions show minimal complexity to implement. They reveal incentives including perceived reduction of workload which may explain the wide acceptance and belief in the interventions. Simplicity and belief in the value an intervention add
to sustainability\textsuperscript{85}. Ambiguity in roles and responsibilities and not updating job descriptions to reflect current roles were challenges especially the Community ART Groups\textsuperscript{37,66}. Having a shared vision among stakeholders is advocated for sustainable DSD but poorly described in studies\textsuperscript{86–88}.

\textbf{Resources} - This was the lowest scoring domain. Funding underlies most other aspects of sustainability, e.g. staff, infrastructure, all of which were currently supported by donor funds. A system sensitive to changes in epidemiological trends (especially within subgroups) will inform targeted interventions and facilitate sustainability. DSD interventions report encouraging retention rates and close monitoring but realizing the full potential of DSD requires funds\textsuperscript{4}; stigma reduction\textsuperscript{37,82}; establishment of new management structures\textsuperscript{38,41}. The call for shared responsibility by the UN in agreement with the African Union is a step in the right direction and has facilitated an increase in domestic investment in HIV programs\textsuperscript{89}.

\textbf{Recommendations for sustainable DSD interventions}

A clear vision for institutionalizing DSD, innovative monitoring as PLHIV remotely access various DSD services, and capacitating the health system with basic human and material resources will be required to facilitate DSD sustainability. Additionally, materializing universal health coverage, leveraging the influence of opinion leaders, and tapping into local partnerships will all be crucial to sustaining DSD. (see Table 4).
Table 4: Recommendations to support the sustainability of DSD interventions

**Limitations**

DSD entails an assortment of interventions in the literature and it is possible our search missed some relevant articles. However, the wide variety of search terms used aimed to describe many known DSD terminologies likely minimized the articles missed. The Community ART Groups and Adherence Clubs being the most implemented may have biased our findings. Since we could only evaluate items that were included in published reports, other sustainability constructs could have been fulfilled, but not reported in the publication. Non-report of constructs implies that the sustainability scores calculated may have been underrated as a result. This likely had minimal effect on our findings since non-report followed a random pattern across studies. This review did not assign weights to the individual sustainability domains, which may have influenced the conclusions. Limited evidence suggests that domains rank differently in importance in the sustainability of community-based programs. The non-uniform domains used in different studies however by make extrapolation challenging. Similarly, we utilized cut-offs which we assumed set the standard high to estimate which construct, domain, or overall score was indicative of sustainability. We conducted a sensitivity analysis to investigate trends in sustainability with variations in definitions of individuals established on ART among DSD interventions. Most studies included were observational in design, and therefore we can draw no firm conclusions on causality as a result. Our evaluation, we believe nevertheless provides useful constructs and domains to consider for DSD sustainability.

By employing an existing framework, this review complements existing sustainability research and moves the discourse from theory to practice. Future sustainability research will benefit from
leveraging this framework to build consensus on if a minimum set of sustainability constructs can be developed; validating constructs by weighting according to relevance and significance and recommending benchmarks.\textsuperscript{91} Such a standard toolkit could provide the basis for measuring and comparing the sustainability of interventions across settings. There has also been debate in the literature about the extent to which complex phenomena can be described and understood by lists of constructs or factors alone.\textsuperscript{92–94} Therefore, future work should also explore the dynamic nature of sustainability constructs as well as the interaction between them.

**Conclusion**

We reviewed DSD interventions to identify, score and rank the constructs and domains reported in included studies which can be used to estimate the likelihood of sustainability. The Community ART Groups and Adherence Clubs were found to be most likely to be sustainable. With the right investment, DSD models were generally observed to be potentially sustainable. This work provides insight into how specific constructs and domains support or hinder the sustainability DSD of different DSD types. Our results provide a resource that policymakers can use to inform decisions about which DSD intervention to implement based on their potential sustainability.

**Competing interests**

The authors declare that they have no competing interests.

**Acknowledgments**

The authors would like to thank Rene Spijker of the Amsterdam UMC library for his contribution in conducting both the initial and final search for articles included in this review.
Funding:

This work was supported by Erasmus Mundus Joint Doctorate Fellowship, Framework Partnership Agreement 2013-0039, Specific Grant Agreement 2014-0681.

Disclaimer:

Though this research was funded by the Erasmus Mundus Joint Doctorate (EMJD) Fellowship program of the European Union (EU), the views expressed in this article are those of the author(s) and not necessarily those of the EMJD or EU.

This research was supported by the NIHR Applied Research Collaboration Northwest London. The views expressed in this publication are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care.

Additional files

All data generated or analyzed during this study are included in this published article (and its supplementary information files as listed below).

Supplementary file I: Description of sustainability constructs and domains used in evaluation (Primary study outcomes) 25kb xlsx

Supplementary file II: Full data extraction table. 50kb xlsx

Supplementary file III: Risk of bias assessment for Quantitative and Qualitative studies. 20kb xlsx

Supplementary file IV: Criteria used in the definition of the individual established on ART. 22kb xlsx
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Tables and Figures Titles and Legends

Tables

1. **Table 2: Characteristics of studies included in the review**

**Legend:** AC - Facility-based Adherence clubs; CAC - Community-based Adherence clubs; CAG – Community ART group; CARG – Community ART refill group; CDDP – Community drug distribution point; DMD – Decentralized medication delivery; DR - Down referral (DR) from Hospital to PHC; FTR – Fast track refills; HD – Home delivery; MMS – Multi-month scripting; OR – Outreach; SMA - Six monthly appointment; SMCC – Six monthly clinical consultation; LTFU – Lost-to-follow-up

2. **Table 2: DSD intervention type description**

3. **Table 3: Sustainability scoring across all DSD intervention types by domains**
**Legend:** AC - Facility-based Adherence clubs; CAC - Community-based Adherence clubs; CAG – Community ART group; CARG – Community ART refill group; CDDP – Community drug distribution point; DMD – Decentralized medication delivery; DR - Down referral (DR) from Hospital to PHC; FTR – Fast track refills; HD – Home delivery; MMS – Multi-month scripting; OR – Outreach; SMA - Six monthly appointment

4. **Table 4: Recommendations to support the sustainability of DSD interventions:**

**Figures**

1. **Figure 1:** PRISMA diagram. Description of search strategy and article retrieval

2. **Figure 2:** Scoring of sustainability constructs including (a) the highest and (b) the lowest scoring constructs out of 40 constructs assessed.

Legend: The 3 numbers displayed for each bar in the two figures from left to right represents 1- percentage of all DSD interventions evaluated reporting little/no evidence, 2 - percentage reporting moderate and 3 – percentage reporting sufficient evidence that the construct was achieved.

*Response refers to the score as described in methods: 1, little evidence; 2, moderate evidence; 3, sufficient evidence

3. **Figure 3:** Plot of median scores (with IQR???) obtained per domain for the 9 unique DSD intervention types in the review.

Legend: The DSD intervention types include AC i.e. Adherence clubs both facility and community based; CAG i.e. Community ART groups; CARG i.e. Community ART refill groups;
CDDP i.e. Community Drug Distribution Points; DR i.e. Down-referral; HD i.e. Home delivery; MMS i.e. Multi-month scripting; OR i.e. Out-reach and SMA i.e. Six-monthly appointment.

Plotted scores were derived by obtaining the average of total construct scores making up each of the six domains as indicated by the colors i.e. (Orange) intervention design and delivery, (Brown) external environment, (Green) organizational setting, (Teal blue) people involved, (Blue) intervention processes and (Violet) resources as described in methods.

4. **Figure 4:** Sensitivity analysis showing sustainability scores vs studies applying varying detail in criteria used for stable patient definition.

**Legend:**
- **Base** = Stable patient definition given by specifying CD4 count or VL, and Months on ART specified
- **Base+** = Base stable definition plus other criteria specified e.g. Opportunistic infection, Weight, Adherence, Residence
- **Base-** = Stable patient not defined or no CD4/VL specified
- **Benchmark** = Score above which DSD is likely to be sustainable

The teal blue, green and red dots represent the sustainability scores per DSD intervention. Multiple dots per intervention types represents the scores for included studies. The purple dots represent the benchmark score above which we assumed that interventions are likely to be sustained.
Boxes

**Box 1: Eligibility criteria**

**Inclusions** –
- Observational, qualitative, experimental, or quasi-experimental studies.
- Studies involving stable adult ART clients accessing HIV care in SSA.
- Studies describing or assessing HIV services delivered through models other than standard clinic-based care
- Studies which compare the performance of these other service delivery models with standard clinic-based HIV service delivery accessed by other clients. Though, lack of this comparison is not an exclusion criterion.

**Exclusions** –
- Reviews, editorials, protocol studies and clinical guidelines
- Studies describing or assessing interventions focussed on special population groups e.g. adolescents, children, pregnant women, men who have sex with men, commercial sex workers etc
- Studies utilising data retrospectively collected in electronic databases with little description of the actual intervention
<table>
<thead>
<tr>
<th>Author/Year (ref)</th>
<th>Intervention site/ Town/ Country</th>
<th>DSD type</th>
<th>DSD start</th>
<th>Study design</th>
<th>Study aim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bango F., 2016 8</td>
<td>Ubuntu clinic, Khayelitsha, Cape Town, South Africa</td>
<td>AC</td>
<td>2007</td>
<td>Cost-effectiveness analysis (CEA) and access analysis (AA)</td>
<td>From a provider's perspective, (i) to assess the cost-effectiveness of clubs in comparison with Standard of care and (ii) to present perceived accessibility differences associated with each model of care.</td>
</tr>
<tr>
<td>Bekolo C., 2017 20</td>
<td>Matam out-patient clinic, Conakry, Guinea</td>
<td>SMA</td>
<td>2013</td>
<td>Comparative Cohort study</td>
<td>Report a 6-monthly appointment for clinic and drug refill adapted locally as Rendezvous de Six Mois (RSM) for stable HIV patients receiving ART, as a decongestion scheme to relieve pressure on its overstretched referral Centre of Matam in Conakry and to improve retention in care during the Ebola outbreak.</td>
</tr>
<tr>
<td>Decroo T., 2014 25</td>
<td>10 facilities - 2 rural hospitals, 6 rural clinics and 2 urban clinics in 5 provinces of Zimbabwe</td>
<td>CARG</td>
<td>2018</td>
<td>A qualitative evaluation</td>
<td>Evaluate the perceived effects of the CARG model for both HCWs and ART clients.</td>
</tr>
<tr>
<td>Bock P., 2019 23</td>
<td>1 PHC and 3 CAC in Cape Winelands district, South Africa</td>
<td>AC</td>
<td>2014</td>
<td>A retrospective cohort study</td>
<td>Describe several community-supported models of ART delivery developed by Medecins Sans Frontieres (MSF) together with Ministries of Health (MoH) in public health facilities in sub-Saharan Africa.</td>
</tr>
<tr>
<td>Brennan A., 2011 24</td>
<td>Themb Lethu Clinic/Crosby Clinic, Johannesburg, South Africa</td>
<td>DR</td>
<td>2007</td>
<td>Comparative Cohort study</td>
<td>Determine clinical outcomes among ART clients attending adherence clubs and client experiences and healthcare worker perceptions of factors key to successful adherence club implementation in the Cape Winelands District, South Africa.</td>
</tr>
<tr>
<td>Decroo T., 2014 26</td>
<td>14 PHCs in Eden district, Western Cape, South Africa</td>
<td>CAG</td>
<td>2008</td>
<td>Retrospective program evaluation</td>
<td>Analyze long-term retention in CAG, estimate individual-and CAG-level risk factors associated with attrition, and describe the circumstances in which CAG members died.</td>
</tr>
<tr>
<td>De Jager GA., 2018 27</td>
<td>24 PHCs in 4 provinces (Gauteng; North West, Limpopo, and KwaZulu Natal), South Africa</td>
<td>AC</td>
<td>2015</td>
<td>Unblinded cluster-randomized evaluation for AC; Observational study for DMD</td>
<td>Evaluate retention and viral suppression in AC and DMD compared with standard clinic-based care.</td>
</tr>
<tr>
<td>Fox DMD, 2018 28</td>
<td>-</td>
<td>DMD</td>
<td>2016</td>
<td>Cluster randomized trial</td>
<td>Determine whether an ARV community delivery model (lay health workers deliver ARVs to the homes of patients who are clinically stable on ART and nurses and physicians deliver standard facility-based care for patients who are clinically unstable on ART) leads to a lower or equal (non-inferior) risk of virological failure compared to the standard of care (standard facility-based care for all ART patients).</td>
</tr>
</tbody>
</table>

Table 1: Characteristics of articles included in review
<table>
<thead>
<tr>
<th>Study Details</th>
<th>Setting</th>
<th>Methods</th>
<th>Outcomes</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grimsrud A., 2014</strong>&lt;sup&gt;6&lt;/sup&gt;</td>
<td>Community Health Centre (CHC) Gugulethu, Cape Town, South Africa</td>
<td>DR</td>
<td>2006</td>
<td>Comparative Cohort study</td>
</tr>
<tr>
<td><strong>Grimsrud A., 2015</strong>&lt;sup&gt;30&lt;/sup&gt;</td>
<td>Hannan Crusaid Treatment Centre (HTC), CHC Gugulethu, Cape Town South Africa</td>
<td>CAC</td>
<td>2012</td>
<td>Descriptive study</td>
</tr>
<tr>
<td><strong>Grimsrud A., 2016</strong>&lt;sup&gt;31&lt;/sup&gt;</td>
<td>Community Health Centre (CHC) Gugulethu, Cape Town South Africa</td>
<td>CAC</td>
<td>2012</td>
<td>Comparative Cohort study</td>
</tr>
<tr>
<td><strong>Hanrahan CF., 2018</strong>&lt;sup&gt;32&lt;/sup&gt;</td>
<td>Witkoppen Health and Welfare Centre Johannesburg, South Africa</td>
<td>AC</td>
<td>2014</td>
<td>A pragmatic, open-label, parallel randomized controlled trial</td>
</tr>
<tr>
<td><strong>Luque-Fernandez MA., 2013</strong>&lt;sup&gt;33&lt;/sup&gt;</td>
<td>Ubuntu clinic, Khayelitsha, Cape Town, South Africa</td>
<td>CARG</td>
<td>2014</td>
<td>An exploratory qualitative study</td>
</tr>
<tr>
<td><strong>Mantell JE., 2019</strong>&lt;sup&gt;34&lt;/sup&gt;</td>
<td>3 clinics in 2 rural districts in Mashonaland Central and Mashonaland West Provinces, Zimbabwe</td>
<td>CAC</td>
<td>2014</td>
<td>Identifiers, facilitators, and barriers to CARG participation by HIV-positive men, with inputs from recipients of HIV care, community members, HCWs, donors, and policymakers</td>
</tr>
<tr>
<td><strong>Mudavanhu M., 2019</strong>&lt;sup&gt;35&lt;/sup&gt;</td>
<td>Western Cape District Hospitals (WCDOH), South Africa</td>
<td>AC</td>
<td>2014</td>
<td>A mixed-methods study</td>
</tr>
<tr>
<td><strong>Mukumbang FC., 2018</strong>&lt;sup&gt;36&lt;/sup&gt;</td>
<td>1 Provincial PHC in Western Cape, South Africa</td>
<td>AC</td>
<td>2014</td>
<td>Retrospective cohort analysis and an explanatory qualitative approach</td>
</tr>
<tr>
<td><strong>Mukumbang FC., 2019</strong>&lt;sup&gt;37, 38&lt;/sup&gt;</td>
<td>1 PHC in Mitchell's Plain, Cape Town, South Africa</td>
<td>CAC</td>
<td>2012</td>
<td>Descriptive study</td>
</tr>
<tr>
<td><strong>Pasipamire L., 2018</strong>&lt;sup&gt;39&lt;/sup&gt;</td>
<td>16 Primary care centers in the Shiselweni region, Swaziland</td>
<td>CAC</td>
<td>2015</td>
<td>Program evaluation (Retrospective analysis)</td>
</tr>
<tr>
<td><strong>Pasipamire Outreach</strong></td>
<td>1 Primary and 1 secondary care facility</td>
<td>OR</td>
<td>2015</td>
<td></td>
</tr>
<tr>
<td><strong>Pasipamire AC</strong></td>
<td>1 large health centre</td>
<td>AC</td>
<td>2015</td>
<td></td>
</tr>
<tr>
<td><strong>Pellecchia U., 2017</strong>&lt;sup&gt;40&lt;/sup&gt;</td>
<td>Mikolongwe Health Centre and Khonjeni Health center, Thyolo, Malawi</td>
<td>CAG</td>
<td>2012</td>
<td>Qualitative study</td>
</tr>
<tr>
<td>**Prust ML., 2018, **&lt;sup&gt;41&lt;/sup&gt;</td>
<td>30 heterogeneous sites in Malawi – 8 CAGs</td>
<td>CAG</td>
<td>2012</td>
<td>Qualitative study</td>
</tr>
<tr>
<td><strong>Prust FTR</strong></td>
<td>30 heterogeneous sites in Malawi – 4FTR</td>
<td>FTR</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td>Setting/acronym</td>
<td>Year</td>
<td>Study type</td>
<td>Objective</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----------------------</td>
<td>------</td>
<td>-------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Prust MMS</td>
<td>30 heterogeneous sites in Malawi</td>
<td>MMS</td>
<td>2012</td>
<td>Differentiated care for stable patients</td>
</tr>
<tr>
<td>Rasschaert F, 2014</td>
<td>20 clinics in Tete province, Mozambique</td>
<td>CAG</td>
<td>2008</td>
<td>Qualitative study Assess the relevance, the dynamic, and the impact of CAG</td>
</tr>
<tr>
<td>Rasschaert F, 2014</td>
<td>MSF Project Tete province, Mozambique</td>
<td>CAG</td>
<td>2008</td>
<td>Qualitative evaluation Highlights the components, which might facilitate and/or jeopardize the sustainability of the CAG model, and formulates recommendations to guarantee its long-term sustainability</td>
</tr>
<tr>
<td>Selke HM., 2010</td>
<td>Mosoriot rural health centre, Kosirai, Kenya</td>
<td>HD</td>
<td>2006</td>
<td>Community randomized clinical trial Evaluate the clinical outcomes of patients enrolled in an innovative HIV care delivery system which utilized PLWAs as Community Care Coordinators (CCCs), aided by an electronic decision support tool, to deliver medications and provide follow-up care to patients on ART in the community</td>
</tr>
<tr>
<td>Sharp J., 2019</td>
<td>Ubuntu clinic, Khayelitsha, Cape Town, South Africa</td>
<td>AC</td>
<td>2012</td>
<td>A descriptive retrospective cohort study Describe the outcomes of patients referred directly to ACs after viral suppression following specific adherence support</td>
</tr>
<tr>
<td>Tsondai PR., 2017</td>
<td>Cape town health district, South Africa</td>
<td>AC and CAC</td>
<td>2007</td>
<td>A retrospective observational cohort study Describe and explore possible predictors of LTFU and viral rebound for a representative sample of patients receiving their ART within ACs in Cape Town, South Africa</td>
</tr>
<tr>
<td>Vandendyck M., 2015</td>
<td>Health Centre (HC) Nazareth clinic, Roma District, Lesotho</td>
<td>CAG</td>
<td>2012</td>
<td>Mixed methods Study how CAG dynamic was perceived by different stakeholders, and study retention among patients in conventional care and CAG members in HC Nazareth.</td>
</tr>
<tr>
<td>Venables E., 2019</td>
<td>Ubuntu ART clinic, Khayelitsha and Gugulethu CHC, Western Cape Province</td>
<td>AC</td>
<td>2016</td>
<td>A qualitative study Describe the outcomes of patients referred directly to ACs after viral suppression following specific adherence support</td>
</tr>
<tr>
<td>Vogt F., 2017</td>
<td>Kabinda Referral Hospital, Kinshasa, DRC</td>
<td>CDDP</td>
<td>2010</td>
<td>Cohort study Assess outcomes and risk factors for attrition after decentralization in this project</td>
</tr>
<tr>
<td>Wringe A., 2018</td>
<td>District Hospital and 10 health centers in Chiradzulu, Malawi</td>
<td>SMA</td>
<td>2008</td>
<td>A retrospective cohort analysis Describe long-term retention in care, and risk factors for attrition from care among clinically stable ART patients accessing SMCC over the period from 2008-2015. To estimate the number of clinic appointments “saved” as a result of SMCC</td>
</tr>
</tbody>
</table>

Legend: AC - Facility-based Adherence clubs; CAC - Community-based Adherence clubs; CAG – Community ART group; CARG – Community ART refill group; CDDP – Community drug distribution point; DMD – Decentralized medication delivery; DR - Down referral (DR) from Hospital to PHC; FTR – Fast track refills; MMS – Multi-month scripting; OR – Outreach; SMA - Six monthly appointment; SMCC – Six monthly clinical consultation; LTFU – Lost-to-follow-up
<table>
<thead>
<tr>
<th>Intervention type</th>
<th>DSD model description</th>
<th>Country</th>
<th>Number of studies in review n,% (citation)</th>
<th>DSD intervention description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherence clubs (AC) – Clinic and Community-based</td>
<td>Healthcare worker managed groups</td>
<td>South Africa, Swaziland</td>
<td>16, 41</td>
<td>Groups of 25-30 stable adult ART patients led by a Health Care Worker or peer who meets every 2-3 months within or out of the facility for group counseling and ART refill</td>
</tr>
<tr>
<td>Community ART groups (CAG)</td>
<td>Client managed groups</td>
<td>Mozambique, Lesotho, Swaziland, Malawi</td>
<td>8, 21</td>
<td>Self-formed groups of 2-6 stable adult ART patients living within the same geographical area who meet within the community monthly for group counseling and drug distribution. One CAG member visits the clinic monthly to collect ART refill for the group and consultation on a rotational basis so that each member visits the clinic at least once every 6 months</td>
</tr>
<tr>
<td>Community ART Refill groups (CARG)</td>
<td>Client managed groups</td>
<td>Zimbabwe</td>
<td>2, 5</td>
<td>Self-formed groups of 4-12 stable adult ART patients who live and meet within the same community for group counseling. A group member is appointed for a clinical visit every 3 months for drug-refills while the whole group visits the clinic for annual consultation.</td>
</tr>
<tr>
<td>Community Drug distribution points/Decentralized medication delivery (CDDP/DMD)</td>
<td>Community-based individual model</td>
<td>South Africa, DR Congo</td>
<td>2, 5</td>
<td>Peer-led centers within the community where stable adult patients come for 3 monthly ART refills with one-yearly clinical consultation at the facility</td>
</tr>
<tr>
<td>Down-referral (DR)</td>
<td>Facility-based individual model</td>
<td>South Africa</td>
<td>3, 8</td>
<td>Referral of stable adult ART patients from secondary health facilities to primary health centers for the continuation of care, one of the first models tried.</td>
</tr>
<tr>
<td>Home delivery (HD)</td>
<td>Community-based individual model</td>
<td>Tanzania, Kenya</td>
<td>2, 5</td>
<td>Monthly delivery of ART by Community Health Workers to stable adult patients at home or any other location within the community</td>
</tr>
<tr>
<td>Multi-month scripting (MMS)</td>
<td>Facility-based individual model</td>
<td>Malawi</td>
<td>1, 3</td>
<td>Three-monthly clinical consultation with drug refill at the health facility</td>
</tr>
<tr>
<td>Outreach (OR)</td>
<td>Community-based individual model</td>
<td>Swaziland</td>
<td>1, 3</td>
<td>ART drug refill integrated into existing outreach programs held in the community</td>
</tr>
<tr>
<td>Six monthly appointment/Fast track refill (SMA/FTR)</td>
<td>Facility-based individual model</td>
<td>Malawi, Guinea</td>
<td>4, 10</td>
<td>Six-monthly clinical consultation with three-monthly ART refill by Community Health Workers</td>
</tr>
</tbody>
</table>
Table 3: Sustainability scoring across all DSD intervention types by domains

<table>
<thead>
<tr>
<th>Domain</th>
<th>Overall scores</th>
<th>Least scoring DSD interventions and constructs within domain challenging</th>
<th>Top scoring DSD interventions and constructs within domain supporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention design and delivery</td>
<td>- Range - 2.3 to 3. - 4 of 9 constructs in this domain scored maximally across all interventions.</td>
<td>- Least scoring – SMA, MMS HD, CAG. - Dependence on donor-driven systems e.g. for monitoring and reliable drug supply makes sustainability doubtful.</td>
<td>- High scorers include AC, CAG, DR, and OR. - All intervention types had clear designs, good outcomes, and displayed intended benefits - There were adequate expertise, capacity building, and use of improvement methods.</td>
</tr>
<tr>
<td>External environment</td>
<td>- Range from 2.0 to 3. 2 of 4 constructs in this domain were top scorers</td>
<td>- SMA and DR scored least closely followed by MMS, HD, and CDDP. - There was generally minimal involvement of the larger community in design and implementation.</td>
<td>- CAG and OR were top scorers likely because - The urgency for DSD was acknowledged and there was strong political support and motivation to explore DSD options. - Many interventions have already been scaled up regionally and countrywide.</td>
</tr>
<tr>
<td>Organizational setting</td>
<td>- Range from 2.2 to 3. 2 of 6 constructs in this domain had maximum scores with another top scoring</td>
<td>- HD, DR, and CARG performed the least. The readiness to sustain the interventions with minimal external support was however doubtful in most countries except South Africa.</td>
<td></td>
</tr>
<tr>
<td>Intervention process</td>
<td>- Range from 2.3 to 3. 2 of 7 constructs in this domain were top scorers</td>
<td>- AC, CAG, HD, and DR scored the least. - Structures for coordinating and monitoring are still mostly donor-funded - Lack of clarity in roles with the existing system especially in CAG. - A shared goal across stakeholders including PLHIV with clear responsibilities for sustainability was reported minimally.</td>
<td>- CDDP scored highest followed by AC and CARG - Clients are motivated to participate as models create safe outlets for ART refill even where HIV stigma is high. - The simplicity of interventions and reduced workload promote the buy-in of facility staff. - Many countries have updated guidelines and developed other job aides to promote DSD</td>
</tr>
<tr>
<td>Resources</td>
<td>- Range from 1.2 to 3.0. 4 of 5 constructs in this domain scored least Least performing across all models in this review.</td>
<td>- HD, DR, CARG were all low scoring - Funding, infrastructure, resources, and staff required were mostly provided by an external donor.</td>
<td>- AC in south Africa scored highest - Interventions were embedded and implemented within the routine HIV service delivery. - Peers engaged as human resource in care provision process reducing the need for highly skilled staff - Reduced client burden in clinics free limited staff to do more work</td>
</tr>
<tr>
<td>People</td>
<td>- Range from 1.5 to 3.0. 5 of 9 constructs in this domain were among the least scoring</td>
<td>- DR, HD, CARG were the least scoring - Patients are mostly involved at the level of implementation and rarely in design and planning. - Power to adapt and will to own limited - Limited report of the use of champions beyond the immediate community of PLHIV across intervention types</td>
<td>- CAG scored optimally followed by AC likely due to adequate engagement of key stakeholders in implementation in Mozambique and South Africa - Good collaboration, acceptability, and stakeholder engagement - Client satisfaction as DSD promote active participation with HCW as allies</td>
</tr>
</tbody>
</table>

Legend: AC - Facility-based Adherence clubs; CAC - Community-based Adherence clubs; CAG – Community ART group; CARG – Community ART refill group; CDDP – Community drug distribution point; DMD – Decentralized medication delivery; DR - Down referral (DR) from Hospital to PHC; FTR – Fast track refills; HD – Home delivery; MMS – Multi-month scripting; OR – Outreach; SMA - Six monthly appointment

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Table 4: Recommendations to support the sustainability of DSD interventions:

<table>
<thead>
<tr>
<th>Domain</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design</strong></td>
<td><strong>Innovate and monitor</strong> – An investment in electronic health information systems will facilitate adequate DSD monitoring and tracking of all PLHIV as they maintain minimal contact with the health system. Portable devices e.g. mobile phones, PDAs, etc. can be programmed for real-time data collection with appropriately validated decision support algorithms for service delivery to absolve LCHW from making clinical decisions requiring more trained personnel [21,83].</td>
</tr>
<tr>
<td><strong>External environment</strong></td>
<td><strong>Communicate and collaborate</strong> – The relevance of DSD should be conveyed to opinion leaders within the community where DSD is conducted to raise awareness and tap into appropriate local capital and partnerships beyond the health sector crucial for sustainability [80,81].</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td><strong>Integrate and capacitate</strong> – The need to formalize roles already played by LHCW and to recruit and train them in adequate numbers is advocated to secure current achievements [30,37] and support initiative continuity [84-86]. Capacitate health system with an efficient and reliable supply chain management system to minimize stock-outs [87,88] and conduct routine surveillance of drug resistance as an integral part of HIV programs [1,89].</td>
</tr>
<tr>
<td><strong>People</strong></td>
<td><strong>Engage and empower</strong> - Engaging influential people as champions at different levels to reinforce messages will promote the acceptance of HIV as a normal disease and support a positive attitude towards HIV necessary to curb stigma within the larger society [90-92].</td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td><strong>Assign and define</strong> – Having a clearly articulated vision shared among different stakeholders involved in DSD and clarifying roles and responsibilities will streamline activities and stimulate suitable adaptations necessary to institutionalize DSD [79].</td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td><strong>Horizontalize and diversify</strong> - While global financing mechanisms such as the Global Funds, PEPFAR will remain relevant, it will be crucial to explore horizontalizing such vertical funds into general risk pools, operationalize “shared responsibility” as articulated by the AU, and scale up universal health coverage (UHC) [93,94].</td>
</tr>
</tbody>
</table>