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Exploring Sustainability in the Era of Differentiated HIV Service Delivery in Sub-Saharan Africa: A Systematic Review

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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 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 and 2019 assessing DSD interventions targeting HIV-positive individuals who are established in ART in sub-Saharan Africa. We evaluated them through a comprehensive sustainability framework of constructs categorized into 6 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.

Key Words: sustainability, differentiated service delivery, HIV/AIDS, sub-Saharan Africa, patient-centered care

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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 therapy (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 health care system. Several DSD interventions have been implemented since the 2000s and show encouraging programmatic and clinical outcomes.[3–5] DSD anchors on 4 pillars: the person who provides care ["who"; health care workers (HCWs), doctors,

nurses, community health workers (CHWs), peers, etc.], the location of care ("where"; clinic or community), the frequency of care ("when"; monthly or multimonthly), 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 HCWs. Currently, 4 main DSD intervention types exist including.[6]

(1) HCW managed groups, eg, adherence clubs in clinics or communities.
(2) Facility-based individual models delivered by HCWs eg, fast track refills, six-month appointments, and multimonth scripting.
(3) Client-managed groups in communities, eg, community ART groups.
(4) Community-based individual models, eg, 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 6 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 6 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.[11] In brief, 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 summarized in Box 1.

Box 1. Eligibility Criteria

Inclusions

- Observational, qualitative, experimental, or quasiexperimental 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. Although, 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 eg, adolescents, children, pregnant women, men who have sex with men, commercial sex workers, etc
- Studies using data retrospectively collected in electronic databases with little description of the actual intervention

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 (ie, clinician, client) is maintained; the program and individual behavior change may evolve or adapt while continuing to produce benefits for individuals/systems."[12] We adopted the consolidated framework for sustainability constructs in health care to structure our evaluation. The framework was developed in 2018 based on a systematic review of sustainability frameworks, tools, and models in health care. 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 health care interventions and settings, it has been tested within various health care studies.[13–19] 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 (see File 1, Supplemental Digital Content, 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 consolidated framework for sustainability constructs for each study and DSD intervention type (see calculation details below). In addition, the median of the scores was

estimated for the 6 domains per intervention. All construct and domain names are present in this article in italics. The secondary outcomes included (1) a descriptive summary of the main study outcome measures (eg, retention in care, viral suppression, loss-to-follow-up, and client-related or provider-related costs), (2) narrative synthesis of qualitative outcomes (eg, clients and HCW perspectives about DSD interventions and challenges), and (3) 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[20] and the Joanna Briggs Institute (JBI) checklist for qualitative studies.[21]

Data Extraction and Synthesis

We adapted a scoring method using a pretested checklist to assign scores per construct ranging from 1 to 3: 1, little to no evidence; 2, some or moderate evidence; and 3, sufficient evidence that the construct was realized.[11,22]

The scores assigned aimed to facilitate the prioritization of constructs and domains based on frequencies.[23] There are no standards published for ranking sustainability. Studies measuring similar complex constructs in health interventions used mean scores or percentage scores, eg, >75% as cut-offs to determine performance and trends.[24–26] 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 ($3 \times 40 = 120$). We derived 3 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 (1) within the highest percentile ≥108, (2) between the eighth and highest percentile (≥99.6–107), and (3) below the eighth 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, whereas <2.2. was regarded as less likely sustainable. R version 4.0.3 was used for analysis and visualized using the ggplot2 package.[27,28] A narrative synthesis was conducted by using 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, eg, opportunistic infections, weight, adherence, residence) were categorized as base+, and studies with no definition as base−. The sensitivity of sustainability scores to these 3 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 3088 publications identified by our search, 34 articles were included reporting 39 different DSD interventions across 10 SSA countries (Fig. 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 File 2, Supplemental Digital Content, http://links.lww.com/QAI/B644. Articles were published between 2010 and the end of 2019, describing interventions started between 2006 and 2018, except for one intervention that started in 2001.[29] Most studies were observational cohorts 41% (16/39), followed by qualitative studies (including realist evaluations, 10/39) and experimental studies (3 cluster-randomized studies, 1 quasi-experimental study, and 1 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), whereas the remainder was 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 File 3, Supplemental Digital Content, 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.

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.

The intervention types adherence club and down referral were conducted mostly in urban settings except for one adherence club intervention.[50] Of the 2 community drug distribution point interventions, one was conducted in a large urban center, whereas the other was a multicenter study spanning both rural and urban settings.[57] 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

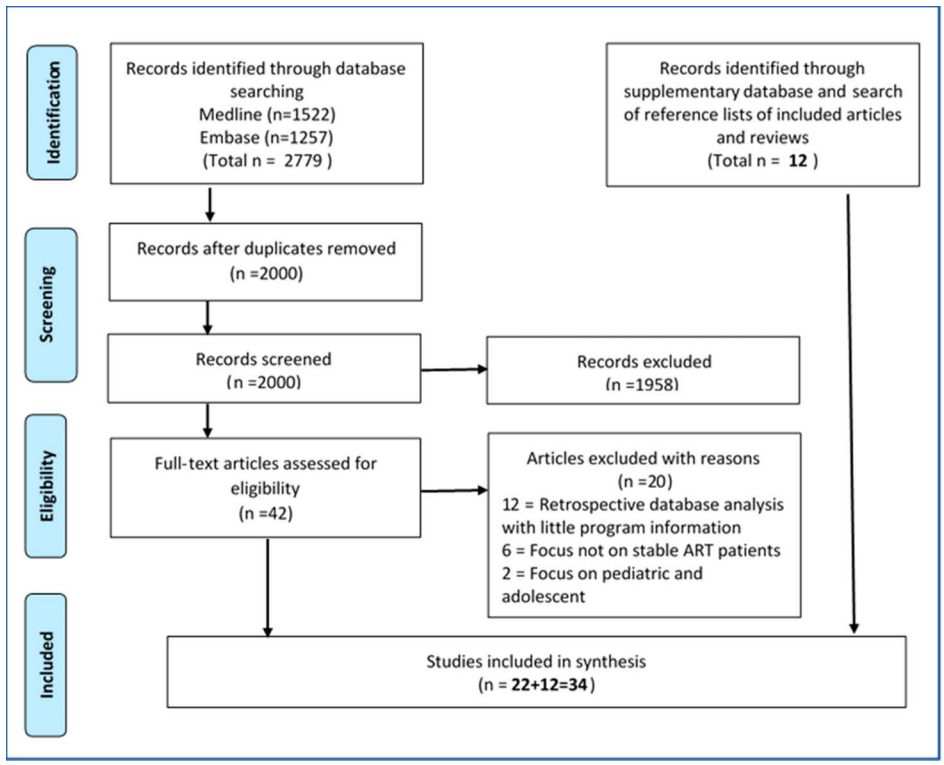

FIGURE 1. PRISMA diagram. Description of search strategy and article retrieval. full color online

in South Africa, a situation reflecting the funding status of HIV programs in general.

Outcome measures reported included 1-year retention (in 20/29 studies, of which 8 were comparative), 1-year viral suppression and 1-year loss-to-follow-up (in 10 studies each), and 1-year mortality (in 8 studies). Three studies reported costs, of which only 1 article reported both provider and client-incurred costs.[9,38,43]

Overall Sustainability Scores per Intervention Type and Study

Across the 9 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, for example, 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%).[4,9,35,44,51,52,55] Conversely, interventions with minimal engagement of key stakeholders, for example, home delivery, 6-month appointments, and down referral, scored the lowest with 67.5%, 71.8%, and 73.3%, respectively. The scores per study are shown in Table 2, Supplemental Digital Content, http://links.lww.com/QAI/B644.

Sustainability Scores—Top-Scoring Constructs

The top 12 constructs scored between 95% and 100%. Evidence for sustainability was reported across all interventions for 6 constructs, namely, *value system, no opposition, problem awareness, project type, expertise,* and *client-related outcomes* (see details in Fig. 2A).

Sustainability Scores—Least Scoring Constructs

The least 12 scoring constructs scored between 15% and 53%. Sustainability constructs were least reported in the following areas (Fig. 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[7,36,52]; 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.[4,9,40]

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 and 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%).

TABLE 1. Characteristics of Articles Included in Review

Author/Year (Ref)	Intervention Site/Town/Country	DSD Type	DSD Start	Study Design	Study Aim
Bango F, 2016[9]	Ubuntu clinic, Khayelitsha, Cape Town, South Africa	AC	2007	Cost-effectiveness analysis (CEA) and access analysis (AA)	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.
Bekolo C, 2017[30]	Matam out-patient clinic, Conakry, Guinea	SMA	2013	Comparative cohort study	Report a 6-monthly appointment for clinic and drug refill adapted locally as Rendezvous de Six Mois (R6M) 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
Bemelmans M, 2014[31]	Chiradzulu Malawi; Khayelitsha, South Africa; Kinshasa, Congo; Tete, Mozambique.	SMA	2008	Retrospective cohort study	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
Bochner AF, 2019[32]	10 facilities—2 rural hospitals, 6 rural clinics, and 2 urban clinics in 5 provinces of Zimbabwe	CARG	2018	A qualitative evaluation	Evaluate the perceived effects of the CARG model for both HCWs and ART clients.
Bock P, 2019[33]	1 PHC and 3 CAC in Cape Winelands district, South Africa	AC	2014	A retrospective cohort analysis	Determine clinical outcomes among ART clients attending adherence clubs and client experiences and health care worker perceptions of factors key to successful adherence club implementation in the Cape Winelands District, South Africa.
Brennan A, 2011[34]	Themba Lethu Clinic/Crosby Clinic, Johannesburg, South Africa	DR	2007	Comparative Cohort study	Compare 1-year treatment outcomes among individuals down-referred for treatment maintenance at a nurse-managed PHC to patient's eligible for down-referral who remained at the doctor-managed treatment-initiation site
Decroo T, 2011[35]	12 facilities in 6 districts of Tete Province, Mozambique	CAG	2008	Observational cohort study	Describe the implementation of the community ART group (CAG) model and report preliminary outcomes
Decroo T, 2014[36]	Peri-urban, district, and rural clinics in Tete Province, Mozambique	CAG	2008	Retrospective program evaluation	Analyze long-term retention in CAG, estimate individual-level and CAG-level risk factors associated with attrition, and describe the circumstances in which CAG members died.
De Jager GA, 2018[37]	14 PHCs in Eden district, Western Cape, South Africa	AC	2013	Analytical cross-sectional study	Investigate treatment adherence and patient satisfaction of stable patients living with HIV on ART in ART adherence clubs and clinics
Fox MP, 2019[38] AC	24 PHCs in 4 provinces (Gauteng, North West, Limpopo, and KwaZulu Natal), South Africa	AC	2015	Unblinded cluster-randomized evaluation for AC;	Evaluate retention and viral suppression in AC and DMD compared with standard clinic-based care
Fox DMD		DMD		Observational study for DMD	

(*continued on next page*)

TABLE 1. (*Continued*) Characteristics of Articles Included in Review

Author/Year (Ref)	Intervention Site/Town/Country	DSD Type	DSD Start	Study Design	Study Aim
Geldsetzer P, 2018[39]	18, 16, and 14 facilities in Temeke, Kinondoni, and Ilala municipalities, Dar es Salam, Tanzania	HD	2016	Cluster randomized trial	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 (noninferior) risk of virological failure compared with the standard of care (standard facility-based care for all ART patients).
Grimsrud A, 2014[7]	Community Health Centre (CHC) Gugulethu, Cape Town, South Africa	DR	2006	Comparative cohort study	Compare a nurse-managed, decentralized model of care for stable ART patients with a doctor-managed ART clinic, for patients receiving ART in primary care in Cape Town, South Africa
Grimsrud A, 2015[40]	Hannan Crusaid Treatment Centre (HCTC), CHC Gugulethu, Cape Town South Africa	CAC	2012	Descriptive study	Describe the implementation, early outcomes, and lessons learned from the community adherence clubs (CAC)s given the limited evidence base for community-based models
Grimsrud A, 2016[41]	Community Health Centre (CHC) Gugulethu, Cape Town South Africa	CAC	2012	Comparative cohort study	Describes outcome loss to follow-up (LTFU) and viral rebound over the first 18 months of CAC implementation in Cape Town, South Africa, and compares patient outcomes under the CAC model of care to those of patients managed in facility-based primary care
Hanrahan CF, 2018[42]	Witkoppen Health and Welfare Centre Johannesburg, South Africa	AC	2014	A pragmatic, open-label, parallel randomized controlled trial	Compare the effectiveness of community- versus clinic-based adherence clubs concerning loss from club-based care and viral suppression
Long L, 2011[43]	Themba Lethu Clinic/Crosby Clinic, Johannesburg, South Africa	DR	2008	Quasiexperimental	Evaluate the implications of this down-referral strategy for treatment outcomes and costs
Luque-Fernandez MA, 2013[44]	Ubuntu clinic, Khayelitsha, Cape Town, South Africa	AC	2007	Retrospective cohort evaluation	Evaluate the effectiveness of adherence clubs compared with traditional clinic-based care in maintaining or improving long-term retention-in-care and virologic suppression
Mantell JE, 2019[45]	3 clinics in 2 rural districts in Mashonaland Central and Mashonaland West Provinces, Zimbabwe	CARG	2014	An exploratory qualitative study	Identify facilitators and barriers to CARG participation by HIV-positive men, with inputs from recipients of HIV care, community members, HCWs, donors, and policymakers
Mudavanhu M, 2019[46]	Witkoppen Health and Welfare Centre Johannesburg, South Africa	AC	2014	A mixed-methods study	Explore patient acceptability and attitude toward the community and clinic-based adherence clubs

TABLE 1. (*Continued*) Characteristics of Articles Included in Review

Author/Year (Ref)	Intervention Site/Town/Country	DSD Type	DSD Start	Study Design	Study Aim
Mukumbang FC, 2018[47]	Western Cape District Hospitals (WCDOH), South Africa	AC	2011	Realist evaluation (Case study)	Test the hypothesis (the initial program theory) of the adherence club to validate, reject, or modify the initial program theory. To obtain a refined program theory of the adherence club intervention based on the operation of the intervention in the identified primary health care facility
Mukumbang FC, 2019_SAJHIVM[48]	1 Provincial PHC in Western Cape province, South Africa	AC	2014	Retrospective cohort analysis and an explanatory qualitative approach	Test a theory on how and why the adherence club intervention works and in what health system context(s) in a primary health care facility in the Western Cape Province
Mukumbang FC, 2019_Plos1[49]	1 PHC in Mitchell's Plain, Cape Town, South Africa	AC	2012	Retrospective cohort analysis and an explanatory qualitative approach	Unravel the mechanisms explicating how, why, for whom, and in what circumstance the adherence club program works at a community health center in Cape Town
Pasipamire L, 2018[50] (CAG)	16 Primary care centers in the Shiselweni region, Swaziland	CAG	2015	Program evaluation (Retrospective analysis	Compare retention in care model and retention on ART among 3 care models, ie, CAG, Outreach, and Treatment clubs and to determine factors associated with all-cause attrition.
Pasipamire Outreach	1 Primary and 1 secondary care facility	OR	2015		
Pasipamire AC	1 large health centre	AC	2015		
Pellecchia U, 2017[51]	Mikolongwe Health Centre and Khonjeni Health center, Thyolo, Malawi	CAG	2012	Qualitative study	Report the findings of a qualitative study to assess the perceived benefits and limitations of CAGS from a patient and a health care worker (HCW) perspective.
Prust ML, 2018,[5] CAG	30 heterogeneous sites in Malawi—8 CAGs	CAG	2012	Qualitative study	Describe the qualitative component of the process evaluation that explored patients and provider perspectives on the key benefits and challenges associated with models of differentiated care for stable patients
Prust FTR	30 heterogeneous sites in Malawi—4FTR	FTR	2012		
Prust MMS	30 heterogeneous sites in Malawi	MMS	2012		
Rasschaert F, 2014[52]	20 clinics in Tete province, Mozambique	CAG	2008	Qualitative study	Assess the relevance, the dynamic, and the impact of CAG
Rasschaert F, 2014[53]	MSF Project Tete province, Mozambique	CAG	2008	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
Selke HM, 2010[29]	Mosoriot rural health centre, Kosirai, Kenya	HD	2006	Community randomized clinical trial	Evaluate the clinical outcomes of patients enrolled in an innovative HIV care delivery system which used 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
Sharp J, 2019[54]	Ubuntu clinic, Khayelitsha, Cape Town, South Africa	AC	2012	A descriptive retrospective cohort study	Describe the outcomes of patients referred directly to ACs after viral suppression after specific adherence support

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TABLE 1. (*Continued*) Characteristics of Articles Included in Review

Author/Year (Ref)	Intervention Site/Town/Country	DSD Type	DSD Start	Study Design	Study Aim
Tsondai PR, 2017[4]	Cape town health district, South Africa	AC and CAC	2007	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
Vandendyck M, 2015[55]	Health Centre (HC) Nazareth clinic, Roma District, Lesotho	CAG	2012	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.
Venables E., 2019[56]	Ubuntu ART clinic, Khayelitsha and Gugulethu CHC, Western Cape Province	AC	2016	A qualitative study	1. Explore perceptions of ACs among former and current AC members, as well as those who had never joined a club, in 2 settings in Cape Town, South Africa, including the perceived advantages and disadvantages of the differentiated model mechanisms. 2. Explore the experiences of patients referred out of ACs back to routine clinical care
Vogt F, 2017[57]	Kabinda Referral Hospital, Kinshasa, DRC	CDDP	2010	Cohort study	Assess outcomes and risk factors for attrition after decentralization in this project
Wringe A, 2018[58]	District Hospital and 10 health centers in Chiradzulu, Malawi	SMA	2008	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 to 2015. To estimate the number of clinic appointments "saved" as a result of SMCC

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, multimonth scripting; OR, outreach; SMA, 6-monthly appointment; SMCC, 6-monthly clinical consultation; LTFU, lost-to-follow-up.

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 6 sustainability domains across the 9 unique DSD intervention types. Median scores are highlighted as 6 separate boxplots with different colors representing the 6 domains per DSD intervention type.

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.[5,9,31,35,37,43–47] 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.[5,59,60]

Fear of stigma because of unintentional disclosure by participating in the intervention was a recurrent challenge across studies. Other challenges were mostly health system–related including protocol violations because of 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 cotrimoxazole 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.[5,29–31,34,36,39,40,50,51,55] A few client-related challenges were reported, for example, group conflicts and low male participation.

TABLE 2. DSD Intervention Type Description

Intervention Type	DSD model[6]	Country	Number of Studies in Review n,% (Citation)	DSD Intervention Description
Adherence clubs (AC)—clinic and community-based	Health care worker managed groups	South Africa, Swaziland	16, 41[4,9,40,41,44,47,50]	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
Community ART groups (CAG)	Client-managed groups	Mozambique, Lesotho, Swaziland, Malawi	8, 21[5,35,36,50–53,55]	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-mo
Community ART refill groups (CARG)	Client-managed groups	Zimbabwe	2, 5[32,45]	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, whereas the whole group visits the clinic for annual consultation.
Community drug distribution points/decentralized medication delivery (CDDP/DMD)	Community-based individual model	South Africa, DR Congo	2, 5[38,57]	Peer-led centers within the community where stable adult patients come for 3-monthly ART refills with 1-yearly clinical consultation at the facility
Down-referral (DR)	Facility-based individual model	South Africa	3, 8[7,34,43]	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.
Home delivery (HD)	Community-based individual model	Tanzania, Kenya	2, 5[29,39]	Monthly delivery of ART by CHW to stable adult patients at home or any other location within the community
Multimonth scripting (MMS)	Facility-based individual model	Malawi	1, 3[5]	Three-monthly clinical consultation with drug refill at the health facility
Outreach (OR)	Community-based individual model	Swaziland	1, 3[50]	ART drug refill integrated into existing outreach programs held in the community
Six monthly appointment/fast track refill (SMA/FTR)	Facility-based individual model	Malawi, Guinea	4, 10[5,30,31,58]	Six-monthly clinical consultation with 3-monthly ART refill by CHW

Sensitivity Analysis

The definitions of stable on ART varied across included studies (see File 4, Supplemental Digital Content, http://links.lww.com/QAI/B644). Seven interventions used the base definition, whereas 4 (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 3 categories (Fig. 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 for the domains *design and delivery*, *organizational setting*, *external environment*, and *intervention process*. The domains of

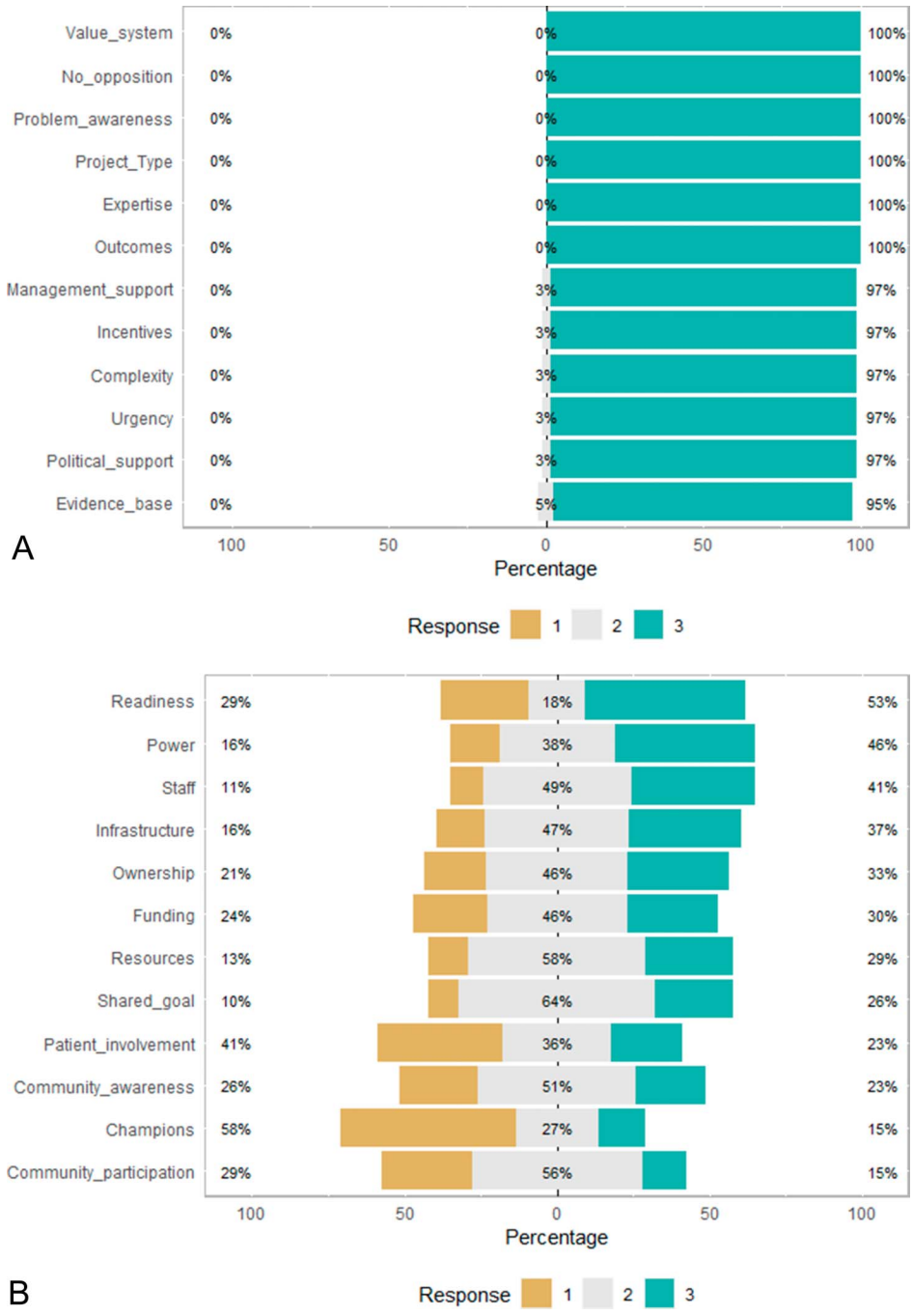

FIGURE 2. Scoring of sustainability constructs including (A) the highest and (B) the lowest scoring constructs of 40 constructs assessed. The 3 numbers displayed for each bar in the 2 figures from left to right represents (1) percentage of all DSD interventions evaluated reporting little/no evidence, (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, and (3) sufficient evidence. full color online

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 multidimensional examination of sustainability.[12,13] Although distilled primarily with evidence from high-income countries, the constructs and domains proposed by the framework remain relevant in low-income and middle-income settings. First, it is recognized that similar processes drive sustainability across settings,[61] and second, the domains align with key areas highlighted in the sustainability discourse about donor-funded interventions in Africa.[62–65] The framework allowed us to expand sustainability assessment from a sole resource perspective to a more comprehensive view of program continuation.[66] 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.[66] Domains are not mutually

TABLE 3. Sustainability Scoring Across all DSD Intervention Types by Domains

Domain	Overall Scores	Least Scoring DSD Interventions and Constructs within Domain Challenging	Top Scoring DSD Interventions and Constructs within Domain Supporting
Intervention design and delivery	Range—2.3 to 3. Four of 9 constructs in this domain scored maximally across all interventions.	Least scoring—SMA, MMS HD, and CAG. Dependence on donor-driven systems, eg, for monitoring and reliable drug supply makes sustainability doubtful.	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.
External environment	Range from 2.0 to 3. Two of 4 constructs in this domain were top scorers	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.	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.
Organizational setting	Range from 2.2 to 3. Two of 6 constructs in this domain had maximum scores with another top scoring	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.	AC scored highest. Similarly, CAG, CDDP, SMA, MMS, and OR all score ≥2.7 benchmark High *acceptability, management support, and flexibility* to adapt and expand existing resources to reach more patients characterize DSD DSD objectives align with health system priorities and strategic plans Observable benefits provide visibility that patients are a priority. No opposition to DSD was documented.
Intervention process	Range from 2.3 to 3. Two of 7 constructs in this domain were top scorers	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.	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
Resources	Range from 1.2 to 3.0. Four of 5 constructs in this domain scored least Least performing across all models in this review.	HD, DR, CAG, and CARG were all low scoring *Funding*, *infrastructure*, *resources*, and *staff* required were mostly provided by an external donor.	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
People	Range from 1.5 to 3.0. Five of 9 constructs in this domain were among the least scoring	DR, HD, and 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	CAG scored optimally followed by AC likely because of 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

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, multimonth scripting; OR, outreach; SMA, 6-monthly appointment.

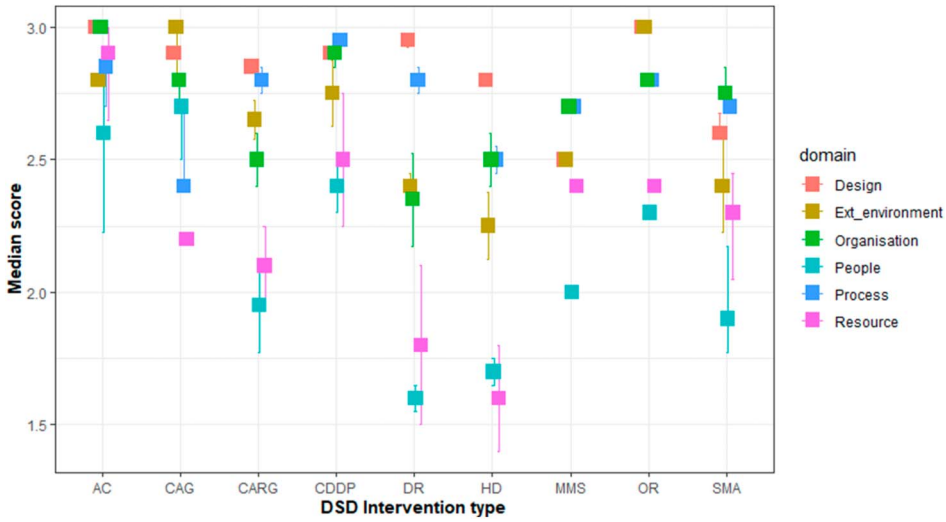

FIGURE 3. Plot of median scores (with IQR???) obtained per domain for the 9 unique DSD intervention types in the review. The DSD intervention types include AC, ie, adherence clubs both facility and community based; CAG, ie, community ART groups; CARG, ie, community ART refill groups; CDDP, ie, community drug distribution points; DR, ie, down-referral; HD, ie, home delivery; MMS, ie, multimonth scripting; OR, ie, outreach; and SMA, ie, 6-monthly appointment. Plotted scores were derived by obtaining the average of total construct scores making up each of the 6 domains as indicated by the colors, ie, (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. AC, facility-based adherence clubs. full color online

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.[67,68] Other constructs in this domain, that is, *capacity building, improvement methods, and project duration*, were reported as accomplished by most studies, whereas the existence of structured *monitoring* systems was instrumental to highlighting achievements toward the 90-90-90 targets.[46,58,69]

External Environment

This domain relates to laws and policies impacting vulnerability to HIV (eg, among sex workers, lesbian, gay, bisexual, and transgender and access to HIV-related services (ie, demand and supply))[70] and scored moderately. Unfavorable legislation targeting vulnerable groups has been documented in several countries such as Eswatini, Tanzania, Kenya, and Malawi.[71–73] Reassuringly, nearly all studies score high for *political support* with reports of policy updates to incorporate DSD and enabling requirements into national

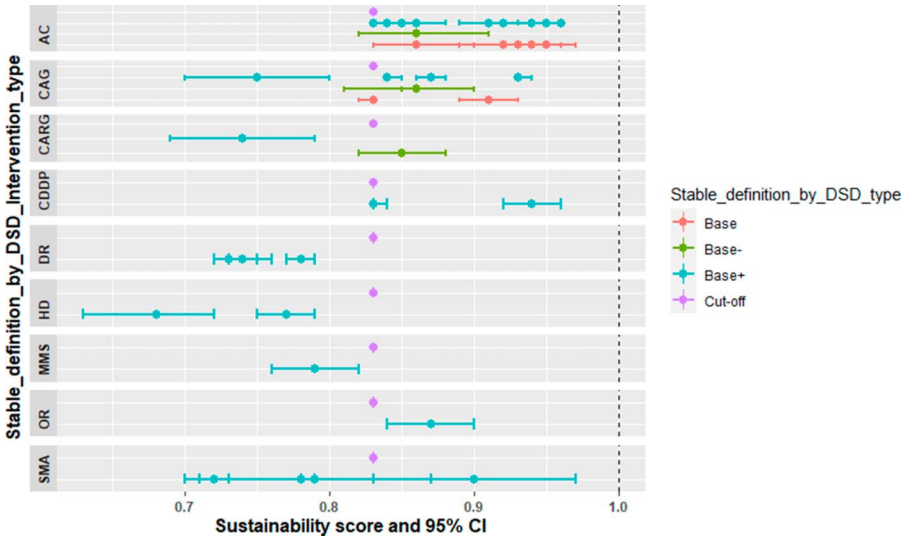

FIGURE 4. Sensitivity analysis showing sustainability scores vs studies applying varying detail in criteria used for stable patient definition. Base = stable patient definition given by specifying CD4 count or VL, and months on ART specified. Base+ = base stable definition plus other criteria specified, for example, opportunistic infection, weight, adherence, and 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. full color online

HIV strategic plans, for example, Mozambique, DRC, South Africa, Eswatini, and Zimbabwe.[4,52,57] The limited *community awareness* (besides the PLHIV and HCW directly involved) is likely linked to the sociocultural context within which interventions are implemented and the behavior and perspectives of stakeholders in which stigma cannot be overlooked.[5,45,46] Stigma is a complex social construct that remains an issue.[74–77] Pantelic et al[78] recommended prioritizing a combination of interventions at different levels to tackle stigma. Although participants acknowledge the benefit of DSD, fear of unintentional disclosure was a recurrent reason for nonparticipation.[51,55] Poverty is another relevant structural issue which not only increases vulnerability to HIV but also limits access to services.[79,80] Gender-based violence, gender inequality, and cultural beliefs that condone oppressive male dominance disproportionately affect women.[81] Despite these, included studies across countries report the spread of DSD interventions to multiple sites within districts and regions.[5,32,37,43,50,58]

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 such as *intervention process and resources.* Most health system *values and 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 such as DSD are poorly integrated into the formal health system in many African countries.[82–84] Apart from South Africa, studies show that governments have been unable to facilitate this *integration*.[50,53] 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.[29,43,52,55,85] 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, multimonth scripting, and adherence club interventions although successful, were mostly funded externally which poses a risk for sustainability.[5,30,31]

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. Although 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.[47] Despite evidence that program *champions* help reinforce positive behavior, there was little report of their engagement in our review.[86] A right-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.[87]

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.[88] Ambiguity in *roles and responsibilities* and not updating *job descriptions* to reflect current roles were challenges especially the community ART groups.[5,51] Having a *shared vision* among stakeholders is advocated for sustainable DSD but poorly described in studies.[62,89,90]

Resources

This was the lowest scoring domain. *Funding* underlies most other aspects of sustainability, for example, *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,[4] stigma reduction,[47,51] and establishment of new management structures.[9,44] 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.[91]

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. In addition, materializing universal health coverage, leveraging the influence of opinion leaders, and tapping into local partnerships will all be crucial to sustaining DSD. (Table 4).

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

TABLE 4. Recommendations to Support the Sustainability of DSD Interventions

Domain	Recommendation
Design	Innovate and monitor—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, eg, 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.[29,92]
External environment	Communicate and collaborate—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.[89,90]
Organization	Integrate and capacitate—the need to formalize roles already played by LHCW and to recruit and train them in adequate numbers is advocated to secure current achievements[34,51] and support initiative continuity.[93–95] Capacitate health system with an efficient and reliable supply chain management system to minimize stock-outs[96] and conduct routine surveillance of drug resistance as an integral part of HIV programs.[1,97]
People	Engage and empower—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 toward HIV necessary to curb stigma within the larger society.[98–100]
Process	Assign and define—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.[62]
Resources	Horizontalize and diversify—although 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).[101,102]

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. Because we could only evaluate items that were included in published reports, other sustainability constructs could have been fulfilled, but not reported in the publication. Nonreport of constructs implies that the sustainability scores calculated may have been underrated as a result. This likely had minimal effect on our findings because nonreport followed a random pattern across studies. This review did not assign weights to the individual sustainability domains, which may have influenced the conclusions.[66] Limited evidence suggests that domains rank differently in importance in the sustainability of community-based programs.[86,103] The nonuniform domains used in different studies however by make extrapolation challenging. Similarly, we used 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 using 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.[104] 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.[105–107] Therefore, future work should also explore the dynamic nature of sustainability constructs and the interaction between them.

CONCLUSIONS

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.

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