Tropical Medicine and International Health doi:10.1111/tmi.12460

VOLUME 20 NO 4 PP 430–447 APRIL 2015

Review

Reframing HIV care: putting people at the centre of antiretroviral delivery

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Summary The delivery of HIV care in the initial rapid scale-up of HIV care and treatment was based on existing clinic-based models, which are common in highly resourced settings and largely undifferentiated for individual needs. A new framework for treatment based on variable intensities of care tailored to the specific needs of different groups of individuals across the cascade of care is proposed here. Service intensity is characterised by four delivery components: (i) types of services delivered, (ii) location of service delivery, (iii) provider of health services and (iv) frequency of health services. How these components are developed into a service delivery framework will vary across countries and populations, with the intention being to improve acceptability and care outcomes. The goal of getting more people on treatment before they become ill will necessitate innovative models of delivering both testing and care. As HIV programmes expand treatment eligibility, many people entering care will not be 'patients' but healthy, active and productive members of society [1]. To take the framework to scale, it will be important to: (i) define which individuals can be served by an alternative delivery framework; (ii) strengthen health systems that support decentralisation, integration and task shifting; (iii) make the supply chain more robust; and (iv) invest in data systems for patient tracking and for programme monitoring and evaluation.

keywords AIDS, antiretroviral treatment, highly active, cascade, decentralisation, HIV, optimised care, patient-centred care, task shifting

Introduction

The widespread devastation caused by the HIV pandemic has led to unprecedented increases in overseas development aid for health, much of it earmarked for care and treatment-related services in low- and middle-income countries [2]. The magnitude of HIV funding allowed for rapid strengthening of under-resourced health systems unaccustomed to providing chronic care and enabled the successful expansion of care and treatment services that have averted an estimated 5.5 million deaths since 1996 [3, 4]. Further expansion of the emergency scale-up, as currently constituted, is constrained by the donor funding environment [5, 6], and subsequent increases in donor resources are unlikely.

A sequel of this success story, however, is that health systems have become even more overburdened. The models of delivery for HIV care developed for the initial rapid scale-up of HIV services were based on traditional clinic-based service models, common in highly resourced settings, and largely not modified to reflect individual needs. Even as the number of people on ART has grown to almost 12 million in low- and middle-income countries, protocols for frequent clinic follow-up have been perpetuated with very few changes, regardless of how long an individual has been on antiretroviral treatment (ART) or their clinical status. After the early rapid growth in clinic sites, expansion has slowed and ever-growing numbers of people receive care in clinics often with insufficient numbers of doctors, clinical officers and nurses [7]. As a result of traditional care models, HIV clinics are crowded and waiting times are long

with many people waiting solely to pick up drug refills. Healthcare workers are overtaxed due to this high workload and, due to weak infrastructure, face challenges to provide care and follow-up according to the guidelines on which they have been trained.

These challenges have led to a mixed picture of effectiveness among the HIV care and treatment systems. On the one hand, individuals who have been linked to care and retained on ART achieve high rates of viral suppression [8–10]. However, studies report substantial loss to follow-up across all steps of the care cascade [6, 11]. Overburdened health systems, lack of patient-focused services, resource limitations and mixed quality of care have led to efforts to modify the delivery of HIV care in a framework that addresses the causes of poor retention. Task shifting is one of the most common approaches [12]. WHO has included task shifting in the 2013 Consolidated Guidelines as a way of providing care to a greater number of people at reduced cost or when there are insufficient healthcare workers in the public sector [13]. Other programmes have focused on decentralisation, shifting care to primary health clinics and to the communities in which people live [14].

We describe a delivery framework which provides differential care and treatment services for specific, well-defined groups of people in an effort to improve service quality and access, adherence and retention, outcomes, efficiency, and cost of services. The framework has been variously termed optimised care, patient-centred/focused care, needs-based care or tiered care.

Problem statements

1. The scale-up of ART in low- and middle-income countries has led to overburdened health systems
   - HIV clinics are overcrowded and waiting times are long
   - Many countries lack sufficient clinical personnel to treat the increasing numbers of patients eligible for ART
   - Health systems are geared to acute disease response rather than to providing chronic care
2. The needs of people who are stable on and adherent to ART are different to those of people who are unwell or non-adherent
   - Current models of care are not patient-centered
   - People with widely divergent needs have only one access point to the clinic to receive care
   - Stable people do not need regular contact with the healthcare facility
3. Alternative care models implemented in resource-limited settings have not been taken to *scale*
   - There are limited robust measures of impact and outcomes of alternative delivery frameworks

A framework for delivering HIV care and treatment

Driven by a desire to provide care which people will use and to increase the efficiency and effectiveness of HIV care delivery, this framework aims to vary the intensity of both ART and pre-ART care based on individual need and to create more flexible, convenient and acceptable models of service delivery for patients, healthcare workers and health systems. In simple terms, the framework describes delivery of the right care at the right frequency to the right individuals by the right care providers in the right location at the right time. Although this concept is not new, it has not been extensively used by HIV care and treatment programmes in low- and middle-income countries to date.

The framework involves providing differential intensity of care and treatment services across defined patient strata. Service intensity is characterised by four components, all centred on the needs of individuals: (i) types of services delivered; (ii) location of service delivery; (iii) provider of health services; and (iv) frequency of health services (Figure 1).

Each of these components represents a flexible lever for adjusting or modifying a model of care to serve a specific patient stratum in a given geographic or health system setting. Health system variables, such as geography, level of health facility and available cadres of health workers, and individual variables (distance to the health facility, clinical condition, social and economic situation, education level, rural/urban context, and mobility pattern) determine how levers are applied in a given location. How the framework is implemented will vary across countries and populations to best serve the needs of individuals. Similarly, individual eligibility criteria will vary by heath setting, with the intention being to improve patient acceptability and care outcomes.

Different intensities of service can be delivered within a single location or between locations. Distribution of individuals into strata for optimised care is determined by the needs and preferences as defined by specific characteristics (Table 1). The distribution of individuals across care strata is dynamic due to the need for periodic up-referral or down-referral to more or less intensive care based on their current needs.

Models of care can be organised into three categories based on the location at which people receive services. *Centralised, facility-based models* can provide differential care within a single health facility, such as reduced frequency of visits or substitution of a clinical assessment visit by a pharmacy-only medication refill visit. *Decentra-*

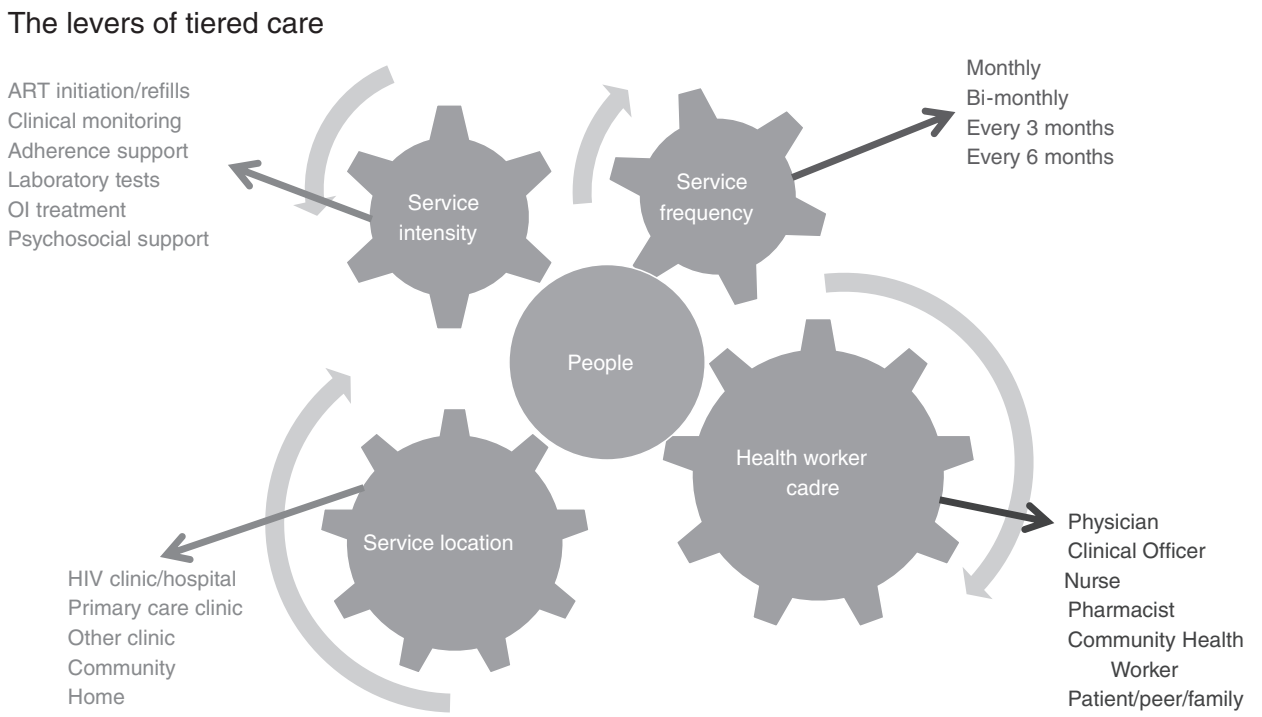

Figure 1 Four levers to tailor or adapt care to people's needs (service frequency, location, intensity and cadre).

Table 1 Key determinants of stratification into different levels of care

Clinical determinants	Social/cultural determinants
Knowledge of HIV status	Individuals' support network
HIV disease severity and current health status	Individuals' preference for specific model of care
Duration of care or treatment	Distance from home to healthcare facility
Treatment tolerance and adherence	Sociocultural factors (family, work, or community barriers to care)

lised models of care provide pre-ART and ART services either by down-referring stable people or initiating and managing people at more peripheral health facilities [15, 16]. Other models decentralise care even further by providing care directly in the *community or in the home* (Figure 2).

There are critical enabling services that are levers for successful HIV health delivery regardless of location, intensity, and frequency of care and who delivers that care. The need for psycho-social support, transportation, child care, nutrition, legal and other services may be as important as how long people wait in clinic.

Examples and evidence from the literature

Application of individual elements of this care framework, notably decentralisation and task shifting, has increased significantly during the past few years and has been widely endorsed by the WHO and other agencies. However, there are few models that represent differential HIV care intensity across patient strata in either the peer-reviewed literature or the grey/conference literature. While not a systematic review, the examples presented in Appendix 1 illustrate the key dynamics and outcomes of innovative models of care in the real world. The studies included in this analysis reported results from approximately 68 000 HIV-positive individuals in eight countries (Democratic Republic of the Congo, Kenya, Malawi, Mozambique, South Africa, Swaziland, Thailand and Uganda). See Appendix 1 for a detailed listing of studies and results.

All of the models analysed differentiated individuals on the basis of clinical stability on treatment to determine eligibility for an alternative framework of care. Eligibility was generally restricted to adults with CD4 count above a certain threshold (ranging from ≥50 to ≥350), a certain length of time on ART (from ≥4 weeks to ≥18 months and adherent), undetectable viral load and/or other

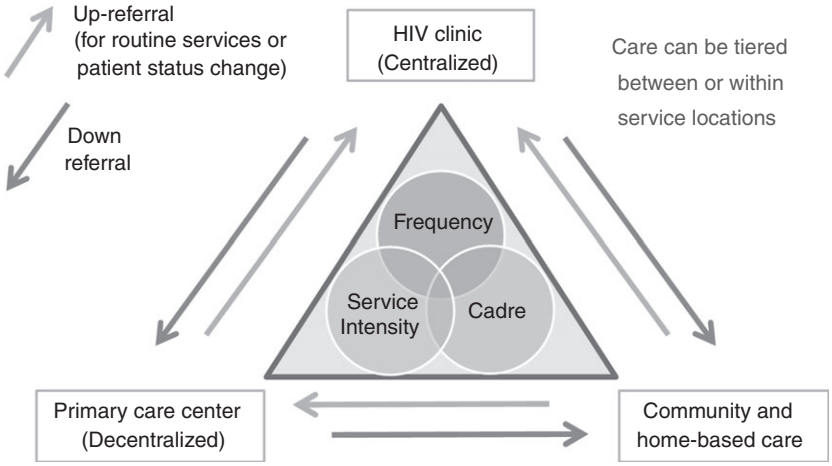

Figure 2 Categories of care models.

clinical considerations (no opportunistic infections, no adverse reactions, not pregnant). The studies generally reported on outcomes (including loss to follow-up, mortality and adherence), and some studies reported changes in resource use (health system and/or cost per person per year, number of clinic visits).

Examples of models and evidence of impact

One study examined the cost-effectiveness of the *centralised, facility-based model* in an urban HIV clinic [17]. At the Infectious Diseases Institutes (IDI) in Kampala, Uganda, stable individuals are offered 3-monthly nurse visits, 6-monthly physician visits and monthly pharmacy-only ART refills. Individual outcomes were similar between those managed with monthly refill visits and standard monthly physician/nurse visits, but the cost per person per year fell from $610 per year to $496 for monthly refill-only visits, a decrease of nearly 20% [17].

A clinic-based model that used a six-monthly clinical appointments (SMA) programme was initiated at the Chiradzulu District Hospital in rural Malawi and supported by Médecins Sans Frontières (MSF) to reduce waiting times and clinic staff workload using visit spacing and pharmacy-only visits [18]. This programme enrolled people stable on ART to receive 6-monthly clinical appointments with nurses and 3-monthly drug refill visits. Between January 2008 and mid-2013, 8528 adults were enrolled in SMA. Cohort retention at 36 months after SMA start was 94%; however, 2722 (33%) people had returned to standard clinical follow-up status. Reasons for SMA discontinuation and long-term treatment outcomes are being evaluated [18].

A number of studies evaluated the impact of a *decentralised, facility-based model* in which stable individuals were down-referred from the HIV clinic (where care was generally provided by a doctor or clinical officer) to a primary care health centre (where the care was generally provided by a nurse). Among the 39 000 individuals included in a meta-analysis of this approach, loss to follow-up per 100 patient years was 7.4 (95% CI 6.0–9.3) in the primary care centre group compared to 13.4 in the HIV clinic group and mortality per 100 patient years was 2.8 (95% CI 1.1–7.3) in the primary care centre group compared to 8.4 in the HIV clinic group [14].

At the Themba Lethu Clinic in Johannesburg, South Africa, stable individuals were down-referred to nurse-managed primary care clinics for treatment maintenance rather than being maintained at the HIV clinic [19–21]. More than 2000 individuals were down-referred as of 2011, and a matched cohort analysis found that down-referred people were less likely to die (HR 0.2; 95% CI 0.04–0.8), or be lost to follow-up (HR 0.3; 95% CI 0.2–0.6) or experience viral rebound (RR 0.6; 95% CI 0.4–0.9) [19]. The cost of care in primary clinics was 11% less than that in the HIV clinic [20]. Similar care models have been introduced in rural areas of South Africa with similar outcomes [21].

A number of different approaches have *decentralised care* to the *community or to the home*. These models minimise the number of required clinic visits by utilising community health workers or peers to deliver care or treatment either at home or at a community meeting point. The community health workers ranged in education and training, and the qualifications and pay for community healthcare workers varied throughout the models. Some models used volunteers with few education

requirements [22], while others recruited paid staff with college degrees [23]. One model provided decision support tools to the community health workers [24]. Two models used groups of people living with HIV (PLHIV) [25, 26], while others used community health workers to deliver medication directly to the house [22, 24, 27] or distributed treatments in community meeting points [18]. All models reported reduced loss to follow-up and reduced number of clinic visits among patients managed in the community or at home.

One decentralised model is of particular interest in urban, high-density areas due to the degree it has been scaled and evaluated. In the Western Cape of South Africa, MSF, driven by the need to provide better patient-centred care and to decongest over crowded HIV clinics, developed a model in which care, including ART drug refills, is provided either at the clinic or in community venues in a group setting [26]. These groups, referred to as ART adherence clubs, are facilitated by a community healthcare worker. Forty-month retention in the clubs in Khayelitsha is 97% (club) *vs.* 83% (clinic) with a 67% reduction in virological rebound among those in clubs compared to clinics [26]. While there is selection bias as those eligible for club care are, by definition, stable and adherent, adherence and retention have remained high despite a reduction in clinic visits. This model has been adopted by the Metro District Health Services[1] from the initial MSF project in Khayelitsha to include 27 800 people (1/4 of total individuals in care by end June 2014) in the Cape Town metropolitan region [26]. Roll-out of the same care model has commenced in some districts in Gauteng and Free State provinces, while Swaziland is likely to implement the model in 2015.

In Mozambique, MSF has collaborated with the Health Ministry to implement and scale Community ART Groups (CAGs) throughout the country [25]. CAGs are groups of six individuals from which one rotating person in the group acts as the monthly ART collector for all members. Thus, each CAG member visits the clinic every 6 months. Eligible people must be stable on ART for >6 months and a CD4 count >200. Retention at 12, 24, 36 and 48 months, respectively, has been 97.7%, 96%, 93.4% and 91.8%, and mortality has been 2.1 per 100 person years [25]. CAGs are being implemented at varied degrees of scale in Lesotho, Zimbabwe, Malawi and South Africa.

[1]Metro District Health Services provides comprehensive primary health service, mainly to lower income groups in the Cape Town metropolitan region.

Limitations of the studies

The field of research on alternative delivery frameworks is nascent, and a number of important questions remain. The articles we found did not discuss the impact on people who remained in standard clinic care or the impact on care providers. Only two studies were randomised, and most were retrospective cohort studies. While models have been implemented in a number of countries, 6 of the 16 models and approximately 48 000 of the 68 000 people who were delivered care in this framework were in South Africa, often in urban settings. A model that is effective in urban South Africa, where resources and infrastructure are generally better, may not be reproducible with similar results in more resource-limited settings, such as Malawi, Mozambique, Zambia or even rural South Africa.

Implementation challenges

Challenges to implementing this framework include defining the most appropriate selection criteria for reduced intensity or non-clinic care, national and local regulatory and policy frameworks around reduced intensity of services, supply chain management and data systems for patient tracking and programme monitoring and evaluation.

Each country has their own regulatory frameworks that establish the scope of work for each cadre of healthcare worker. These regulations determine which cadre can initiate and/or manage antiretroviral therapy, dispense medications and perform laboratory tests. Further, regulations stipulate the frequency at which medications may be dispensed. These regulations significantly impact the ability to decentralise or temporally space care. For example, ARV dispensing for individual patients in Western Cape was maintained centrally at pharmacy level, while distribution of pre-packed and labelled ART was permitted at lower level facilities and through community-based adherence clubs. At present in many clinics in eastern, central and southern Africa, nurses cannot initiate ART, although WHO guidelines support it [28].

Supply chains and stock management must be sufficiently robust to ensure stable ART distribution for decentralised primary health centres and community-delivered ART along with longer durations of refills (ideally three monthly).

Robust data systems are necessary to track individuals across care sites as well as monitor overall programme effectiveness, in particular to ensure that retention in care can be tracked as patients move between care facilities or settings. Community-delivered ART requires simple and

robust data collection. Unique identifiers, referral tools and data management systems are needed.

Conclusions

We believe this framework can guide policymakers into introducing and scaling up new approaches to delivery across the HIV cascade of care. The framework is driven by two needs: first, care that better meets the needs of people and assisting them to access care and remain in care for life; second, with donor funding for HIV expected to remain constant or decline in the coming years, this framework may provide a tool to provide this care more economically. The cost and cost-effectiveness of innovative models delivery of care needs further evaluation.

The framework, with its levers and patient-centredness, addresses the losses described by others across the cascade of testing, linkage and retention in care [6]. Differentiated testing and linking strategies using new testing technologies such as oral self-test may hold promise in helping hard-to-reach populations know their HIV status [28–30]. The framework is equally applicable to pre-ART care as it is to ART care.

Scale-up of innovative models of care should be monitored and evaluated through a robust implementation science framework targeting critical questions about most effective and efficient approaches to providing care in varied settings. As best practices are identified, normative bodies and lead implementers should continue to develop toolkits[2] and guidelines to help countries and providers to implement these approaches.

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Appendix I

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs.* SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
Centralised models									
Kampala, Uganda [29]. June 2006–July 2007 Monthly pickup of medication at pharmacy, where routine screening is completed. SOC is monthly visit to clinic with physician	578 in the intervention group. Urban	Health Service Provider	CD4 ≥ 200; ≥12 months of ART; self-reported adherence ≥95%; adherence to scheduled clinic visits for last 6 months; disclosed status to spouse; not pregnant; no substantial clinical event in last 6 months	Monthly in the pharmacy by a pharmacy-based nurse	Pharmacy-based nurse asked screening questions; Physician visit every 6 months	Favourable immune response after 1 year (CD4 ≥ 500): 18.9% *vs.* 19.6%; comparison group was a matched sample before PRP who were followed for at least 1 year after initiating ART		$496 per year *vs.* $610 per year Costs include: ART, other drugs, radiology, labs, health personnel, and overhead and capital	

Appendix 1 (*Continued*)

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs.* SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
Decentralised models									
Free State, South Africa [21] January 2008–June 2010 In one cohort (top row) ART initiation and management was completed in nurse-led primary care clinic. In the other cohort (bottom row) ART	Initiation and management 5390 Rural and Urban	Health Service Provider, Location	CD4 between 51 and 200; no Stage IV infection; no previous ART ≥1 month; no drugs other than cotrimoxazole or vitamins, not bed-or wheelchair bound; Weight>40 kg; BMI<28	Monthly in the primary care clinic by a nurse	Routine, not discussed in article; care provided in health centre by nurse	Mortality per 100 person years: 1.34 *vs.* 1.44 Programme retention: 63% *vs.* 58% * Random assignment by primary care clinic	Shorter commute to community clinic, not quantified in study		Significant training for nurses and nurse managers (4 sessions), plus 2.5 day train the trainer session
management provided in nurse-led primary care clinic. SOC is initiation and management at physician-led HIV clinic	Management 3029 Rural and Urban	Health Service Provider, Location	Undetectable VL; no severe side effects; no new opportunistic infections	Monthly in a primary care clinic by a nurse	Routine, not discussed in article; care provided in health centre by nurse	Suppressed VL: 71% *vs.* 70% Programme retention: 90% *vs.* 91% Random assignment by primary care clinic	Shorter commute to community clinic, not quantified in study		Significant training for nurses and nurse managers (4 sessions), plus 2.5 day train the trainer session

Appendix 1 (*Continued*)

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs*. SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
South Africa (3), Malawi (1), Swaziland (1), Thailand (1)[14] Study data range from 2004 through 2009 Partial decentralisation – treatment initiation in a hospital with follow-up care provided by a health centre	23 217 individuals decentralised; 15 980 in control; three studies focused only on adults, two on children, one on both Rural, peri-urban, and urban	Health Service Provider, Location	Varies, one study included only treatment naïve patients, three on stable patients with minimum time on ARV between 4 weeks and 11 months, and one with limited requirements	Studies did not vary frequency of care/ART distribution. Initiation was at the hospital by a doctor or clinical officer, while follow-up care provided at health centres by a nurse	Varies, but generally by nurse at health centre	Lost to care per 100 patient years: 7.4 *vs*. 13.4* Mortality per 100 patient years: 2.8 *vs*. 8.4* Note: these amounts are for 12-month follow-up of four of six studies. Account for nearly all participants. Two excluded studies are small and excluded b/c they do not provide 12-month time point			

Appendix 1 (*Continued*)

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs*. SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
South Africa (1), Malawi (2), Ethiopia (2), Kenya, Mozambique, Rwanda, Tanzania, Lesotho [14] Study data range from 2004 through 2010 Full decentralisation – treatment initiation and management provided by health centre	20 448 individuals fully decentralised; 48 096 control; four studies focused only on adults, one only on children, and one on both All studies include rural patients, two include urban patients as well	Task shifting, location	Varies, most studies do not note exclusion criteria, one study required individuals to be on treatment for <6 months, another required treatment naïve patients	Studies did not vary frequency of care/ART distribution. Initiation and follow-up were performed at a primary health centre. All studies used nurses, two also used physicians, three used medical officers, and two used medical assistants	Varies, but generally by nurse at health centre	Lost to care per 100 patient years: 8.1 *vs.* 27.0* Mortality per 100 patient years: 10.6 *vs.* 9.7 Note: these amounts are for 12-month follow-up of four of six studies. Account for nearly all participants. Two excluded studies are small and excluded b/c they do not provide 12-month time point			

Appendix 1 (*Continued*)

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs.* SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
Chiradzulu District, Malawi [18] January 2008–June 2013 Intervention group could pick up medication at health centre every 3 months. Clinic visits every 6 months. Care at health centre provided by CHW. SOC is clinic visit every 1–2 months	5 869 received intervention, which was 21% of active ART cohort; 2722 (33% of original enrollees) returned to standard clinical follow-up status. Rural	Health Service Provider, Frequency, Location	Stable adult patients - ≥15 on first-line ART for ≥12 months; CD4 ≥ 300; no OI or side effects; no pregnancy or breastfeeding	Clinic every 6 months *vs.* 1–2 months; 3-month ART refills at health centres by a community health worker	Monitored via standardised assessment tool at each visit; Clinic visits every 6 months	36-month Retention: 94% *vs.* 83% Lost to follow-up (1, 2, 5 years):– 1.3%, 2.98% and 7.8%; Mortality (1, 2 and 5 years) – .4%, .9% and 2.8%. Comparison with those eligible for but not enrolled in intervention			Paid community health workers; supply chain that can accommodate 3-month prescriptions

Appendix 1 (*Continued*)

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs.* SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
Lubombo, Swaziland [30] January 2007 – November 2007 Intervention group received care in primary care health clinic by nurse. SOC is monthly visit to central HIV clinic and receiving care from clinical officer	317 were included in the study of the 425 invited from the intervention clinic Rural	Health Service Provider, Location	≥14; on ART for ≥4 weeks; CD4 ≥ 100; clinically suitable	Monthly at primary care clinic by a counsellor and nurse evolving to primary care nurse and staff	Blood test, clinical questionnaire; care provided at health centre by nurses	No missed appointments - 89.6% *vs.* 72%* Loss to follow-up: 2.8% *vs.* 1.3% Mortality: 0 *vs.* 2.5%* Comparison population were individuals who would have been eligible for the study, but receive care from a different clinical area	Average cost of round trip transportation was halved ($.74 *vs.* $1.5); 53% of intervention group said transportation cost was lowered. Other benefits reported include being nearer to home, shorter waits, better treatment by staff, better care		Initial training of primary care team

Appendix I (*Continued*)

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs.* SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
South Africa [19, 20] February 2008 through January 2009 (Study timeline, initiation intervention began in 2007) Care and medication distribution provided at nurse-led primary care clinic every 2 months. SOC is bi-monthly visits to HIV clinic with physician	693 in study, approximately 2000 in total down-referred. Urban	Health Service Provider, Location	ART≥11 months; no opportunistic infections; CD4 > 200; stable weight as reflected by <5% weight loss between the last three visits; VL undetectable	Every 2 months at the primary care clinic by a primary care nurse	Weight loss; symptoms other visit to medical facility; blood test every 6 months; care provided at primary care health centre by nurse	Mortality per 100 patient years: .3 *vs.* 1.6*; Lost to follow-up: 1.4% *vs.* 4.2%* Matched cohort using propensity scores based on gender, age, months on ART, ARV regimen, BMI, CD4 count		Costs reduced by 11% – $492 pppy *vs.* 551. Cost-effectiveness increased: $509 to $602 per person in care and responding to treatment Costs included: ARVs, other drugs, labs, outpatient visits, fixed costs	EHR system that enables communication between clinic and initiation site; 6-week ART-specific training for primary care health nurses
Community and home-based models									
Khayelitsha, South Africa [18, 26] 11/2007 – 6/2013 Medications distributed via community health worker-led 30 person support groups bi-monthly. SOC is monthly visits with medical staff	776 clubs have formed as of publication. 18 719 receiving care through the intervention, which is 19% of active ART cohort Urban	Health Service Provider, Location	Adult on 1st line for ≥18 months; two undetectable VL; CD4 > 200; Criteria for return to clinic care: Missed club visit (5 day grace) or clinically unstable including high VL	Every two months at meetings which take place either at clinic or community location, provided by community health workers	Bi-monthly weight, symptom based general assessments; attendance; nurse review twice per year (1 clinical, 1 blood test). Nurse attends meetings only during these sessions	Lost to care (including death, per 100 person years: 2.98 *vs.* 11.69* Virological rebound per 100 person years: 3.18 *vs.* 9.04* Comparison population had been on ARVs for a similar period of time	Shorter waiting times; higher acceptability of services; fewer missed appointments	$58 per year *vs.* $109 in SOC (unclear what is included, citation to a conference abstract)	Pharmacy staff to pre-package drugs for groups, well-trained lay-workers and support for lay-workers, registries

Appendix 1 (*Continued*)

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs.* SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
Kinshasa, Democratic Republic of the Congo [18] 12/2010 – 5/2013 Medications distributed at community distribution points by peers every 3 months. SOC is visits to clinic (timing of SOC is not described.)	2161 referred to community ART distribution sites, which is 43% of active ART cohort Urban	Health Service Provider, Frequency (?), Location	On 1st line ART for ≥6 months; CD4 ≥ 350; no OI or side effects	Every 3 months at community ART distribution points by peers	Basic health indicators monitored by peer distributor; annual clinical consultation and blood test (CD4) at clinic	Retention at 12 months, 24 months: 89.3%, 82.4%; reported retention of 75–85% reported elsewhere Lost to follow-up at 24 months: 7.6%	Reduction from 85 to 14 min to refill prescription; Transportation costs cut to 1/3	HR costs lower, not quantified	Trained PLWH, supply chain that can support 3-month med delivery
Tete Province, Mozambique [18, 25] 2/2008 – 12/2012 PLWH form groups of six who share responsibility of picking up medications and distributing them to group monthly. SOC is monthly clinic visits by all	8181 receiving medication through CAGs in study, which is 50% of active ART cohort within demonstration programme; Overall, 17 272 receiving care this way countrywide, including 276 children. Rural	Frequency, Location	On 1st line ART for ≥6 months; CD4 ≥ 200; no OI or side effects	Monthly, in the community for 5 of 6 members, while one member attends clinic to pick up meds for the group	Clinic visit every 6 months, which includes clinical consultation and blood test (CD4); group card record keeping	Retention at 12, 24, 36, 48 months: 97.7%, 96%, 93.4%, 91.8%; Mortality per 100 person years: 2.1 LTFU per 100 person years: 1.0	Reduced costs and time burden on patients; 28% of members shared transportation costs	49.6% reduction in clinic visits, 62% reduction of ART refill visits	Lay Health Service Providers to ensure links between community groups and health facilities

Appendix 1 (*Continued*)

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs*. SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
Kosirai, Western Kenya [24] March 2006 – March 2007 CHWs deliver medications, screen, and provide adherence support monthly at home. SOC is monthly clinic visits served by full medical staff	100, 5% of active ART cohort in clinic that was studied. Rural	Health Service Provider, Location	≥18 years old; clinically stable on ART for ≥3 months; no adherence issues; household members aware of patients' HIV status; no WHO stage 3 or 4 condition; no pregnancy; no hospitalisations	Monthly, in the home by community health workers with secondary education, training and PDA with decision support tools	CCC assessed patient symptoms (using PDA) vital signs, adherence to ART, and opportunistic infection prophylaxis. Clinical consultation every 3 months with nurse, physician, and pharmacist. Blood test every 6 months	LTFU: 5.2% *vs*. 4.5% No significant difference of results as compared to SOC. Comparison population was based on random sample	6.4 clinic visits *vs*. 12.6	Half the clinic visits	CCCs with secondary education and mobile, computer-based decision support tools

Appendix 1 (*Continued*)

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs.* SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
Karabole, Uganda [22] March 2006-May 2009 Weekly, home-based monitoring and adherence counselling and monthly ARV delivery by unpaid volunteers with 6-monthly appointments at the clinic *vs.* monthly hospital visits in the standard of care	185 enrolled in trial arm Rural	Health Service Provider, Frequency, Location	Eligible for treatment and willing to accept daily treatment support from a family member and weekly visits by a trained community volunteer	Monthly at home by trained community volunteers	Weekly monitoring by trained volunteers looking for adverse reactions, adherence (pill counts), and clinical problems. Six-monthly visits to clinic for blood work and clinical review. Health centre is staffed by two clinical officers, two nurses, and on midwife	Mortality: 17% *vs.* 12% VL suppression (ITT): 64.9% *vs.* 62.0% In multivariate analysis, the only factor significantly related to viral suppression was enrolment in home-based cohort. Odds ratio: 2.47 (1.02–6.04)			Clinic staff was trained on ART as part of the project; training for volunteers; boots, raincoats, bicycles for volunteers. Report forms for volunteers

Appendix 1 (*Continued*)

Location, dates, summary (Source)	Scope/scale; rural/urban	Optimisation component	Stratification metric	ARV distribution frequency, location, and provider	Monitoring and clinical care	Clinical metric: intervention *vs*. SOC for similar population * denotes significant at $P < 0.05$	Costs	System costs	Necessary supports
Jinja, Uganda [23] February 2005 through January 2009 Home-based, monthly follow-up by trained field officers, with six-monthly clinic visits (after visits during months 2 and 6). SOC is 3-monthly visits with monthly ARV pickup	859 enrolled in trial arm Rural and semi-urban	Health Service Provider, Location	Anyone eligible for treatment within 100 km from the clinic	Monthly at home by trained field officers	Monthly monitoring at home, plus clinic visits at months 2, 6, and every 6 months thereafter	Virological failure, LTFU, or withdrew: 24% *vs*. 27% Mortality (24 months): 14% *vs*. 14%	First Year: 29 *vs*. 60 Second Year: 18 *vs*. 54 This includes transportation, lunch, childcare costs, and lost work time	$793 *vs*. $838 This includes staff, transport, drugs, labs, sensitisation, training, utilities, supervision and overheads, and capital. Main cause of higher costs of facility-based model is increased contacts with staff. Home-based patients had 75% fewer clinic visits	4 weeks of training for field officers over and above a college degree; motorcycles for field staff