Int Health
doi:10.1093/inthealth/ihx061

ORIGINAL ARTICLE

Patient-level benefits associated with decentralization of antiretroviral therapy services to primary health facilities in Malawi and Uganda

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Received 19 June 2017; revised 2 November 2017; editorial decision 23 November 2017; accepted 28 November 2017

Background: The Lablite project captured information on access to antiretroviral therapy (ART) at larger health facilities ('hubs') and lower-level health facilities ('spokes') in Phalombe district, Malawi and in Kalungu district, Uganda.

Methods: We conducted a cross-sectional survey among patients who had transferred to a spoke after treatment initiation (Malawi, n=54; Uganda, n=33), patients who initiated treatment at a spoke (Malawi, n=50; Uganda, n=44) and patients receiving treatment at a hub (Malawi, n=44; Uganda, n=46).

Results: In Malawi, 47% of patients mapped to the two lowest wealth quintiles (Q1–Q2); patients at spokes were poorer than at a hub (57% vs 23% in Q1–Q2; p<0.001). In Uganda, 7% of patients mapped to Q1–Q2; patients at the rural spoke were poorer than at the two peri-urban facilities (15% vs 4% in Q1–Q2; p<0.001). The median travel time one way to a current ART facility was 60 min (IQR 30–120) in Malawi and 30 min (IQR 20–60) in Uganda. Patients who had transferred to the spokes reported a median reduction in travel time of 90 min in Malawi and 30 min in Uganda, with reductions in distance and food costs.

Conclusions: Decentralizing ART improves access to treatment. Community-level access to treatment should be considered to further minimize costs and time.

Keywords: HIV services, Antiretroviral therapy, Decentralization, Patient costs, Equity, Malawi, Uganda

Background

Malawi and Uganda, like many sub-Saharan African countries, have high burdens of HIV, with an estimated prevalence among 15–49 year olds of 11% and 7%, respectively.[1,2] Decentralization of antiretroviral therapy (ART) services to all health facilities to ensure universal access is believed to be essential to realize the United Nations sustainable development goal of ending the AIDS epidemic by 2030.[3] ART scale-up to public-sector facilities

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commenced in 2004 in Malawi and in 2003 in Uganda.[4,5] It is noteworthy that the roll-out of the Option B+ strategy (provision of lifelong ART for all pregnant and breastfeeding women) significantly accelerated decentralization of ART to peripheral lower-level health centres in Malawi. Following Option B+ roll-out, the number of facilities providing integrated ART in Malawi doubled within a period of 6 months, from 303 in June 2011 to more than 600 sites by the end of 2011.[6] In Uganda, ART scale-up happened more steadily, 1045 of 1309 (80%) Health Centre IIIs (facilities serving a subcounty) were providing ART for adults by June 2014.[7] Despite significant progress, ART coverage (based on WHO 2013 guidelines criteria for eligibility to start ART; CD4 <500 cells/μL) at the end of 2014 reached only 67% in Malawi and 52% in Uganda.[7,8] Furthermore if we consider the WHO 2015 guidelines of universal treatment,[9] then the ART coverage is even lower. Challenges remain at each step of the HIV treatment cascade, from identifying and testing HIV-positive individuals to retaining those who have started treatment in care.[10–12]

The entry point of ART provision in sub-Saharan Africa was initially at tertiary- and large secondary-level health facilities, many of which were located in urban areas; therefore, individuals living in rural areas and poorer individuals were less likely to access HIV testing and treatment services due to transport costs, distance to facilities and other related socio-economic constraints.[13–15] One of the strategies that has driven ART decentralization to primary care facilities is task-shifting, and this has been shown to reduce patient attrition without compromising clinical outcomes.[16–18] Studies on decentralization of ART to primary care facilities show better clinical outcomes driven by good adherence, retention in care and reduced loss to follow-up.[19–21] However, there is limited information on the challenges for patients, including time and monetary costs, associated with accessing ART under different health service delivery models.[22]

The Lablite project worked with the Ministries of Health in Uganda, Malawi and Zimbabwe to investigate and support strategies to roll out HIV treatment safely and cost-effectively to primary care facilities in rural settings.[23] Project facilities were selected by Ministries of Health, and training of health workers, facility accreditation and ART provision were in accordance with national guidelines. As part of the project, we conducted cross-sectional surveys of patients attending a regular (non-research) larger district-level facility ('hub') and two linked primary care facilities ('spokes') in Malawi and Uganda. Information was collected on patients' characteristics and access to ART. The aims of this study were to describe and compare the characteristics of patients accessing ART at hubs and spokes, to quantify the costs and challenges to patients of accessing ART and to describe any patient-reported differences in time, distance and cost to care following a transfer from hub to spoke.

Methods

Study setting

In Malawi, the project was implemented in Phalombe district in the southeastern region of the country. All the spoke facilities were rural, although the hub was located in the district town centre. The hub, Holy Family Mission Hospital, a secondary referral hospital run by the Christian Hospital Association of Malawi (CHAM), has provided ART since 2008 and serves as the district referral hospital through a service agreement with the Phalombe District Health Office, which supervises all health services in the district (including hub and spoke sites). Within Phalombe district, during the Lablite project period, there were 14 spoke sites providing decentralized ART services, 5 of which had been providing ART services already and 9 of which started decentralization during the project. Decentralization of ART provision from hub to spoke sites was conducted as per Malawi Ministry of Health guidelines and has been previously described.[24,25] The two spoke study sites selected for this survey, Suksanje (45 km from the hub by dirt road) and Mpasa (7 km from the hub by dirt road) Health Centres (HCs), are primary health facilities that began decentralized provision of ART with the roll-out of Option B+ in the last quarter of 2011 and ART to all eligible patients since the second quarter of 2012. Prior to decentralization, HIV testing and counselling services were available but patients were referred for ART to either the hub site or to other larger spoke sites. ART services at the hub site are provided in a dedicated HIV clinic by specialized clinicians and nurses, and with the support of ART clerks and counsellors, and are generally well staffed with dedicated staffing compared with spoke sites. The hub site, as a referral hospital, also provides inpatient surgical, medical, paediatric, and labour and delivery services in addition to multiple specialized outpatient clinics (including general outpatient, antenatal and maternity care). In spoke sites, ART services are provided by District Health Office staff working at the site. Typically spoke sites may have one medical assistant/clinical officer and one or two nurses providing general outpatient, antenatal and maternity care. Health surveillance assistants, a formal community health worker cadre, provide ART clerk and counsellor support in spoke sites in addition to their other duties in health promotion and prevention. In Uganda, the study was implemented in Kalungu district, in the central region of the country. Bukulula HC IV (hub) supervises six HC IIIs (spokes); the two spokes, Lukaya HC III (4 km to hub) and Kiragga HC III (26 km to hub), were chosen in collaboration with the Ministry of Health and the District Health Office as part of planned decentralization of ART to lower-level facilities. The hub and one of the spokes (Lukaya HC III) were peri-urban, while Kiragga HC III was rural. In Uganda, a HC III is headed by a clinical officer, serves a subcounty and provides inpatient care and outpatient, antenatal, immunization and outreach services and environmental health; a HC IV is headed by a medical officer, serves a subdistrict and provides surgery, supervision of the lower-level HCs, data collection and health service planning, in addition to the services provided at the HC IIIs. The hub has provided ART since 2005. The two spokes started ART provision as outreach sites in the third quarter of 2012; Option B+ provision at the facilities began in the fourth quarter of 2012 and general ART onsite commenced in the first quarter of 2013. At the spokes, ART services are provided by a team led by a clinical officer and one or two nurses providing general outpatient, antenatal and maternity care; two to three community liaison volunteers/expert patients offer counselling services, provide health talks and participate in home visits. At the hub, the team is more advanced in HIV treatment and care, and is led by a medical officer supported by a larger team consisting of a clinical officer, two to three

nurses and four to five community liaison volunteers/expert patients with similar roles as in the spokes.

At the end of 2013 there were 6348 patients registered on ART at the hub in Malawi, 1312 at Sukasanje HC and 648 at Mpasa HC. At the end of 2014 there were 998 patients registered on ART at the hub in Uganda, 68 at Kiragga HC and 182 at Lukaya HC.

Study design

We conducted a cross-sectional survey among three groups of ART patients at the health facilities: patients who were on ART at the hub, patients who had initiated ART at a spoke and patients who had transferred to a spoke on ART. We collected sociodemographic information and information on access to ART at the current facility (time, cost, mode of transport) and at any previous facility. At the spokes, we purposively sampled approximately 50% of patients newly initiating ART and 50% of patients transferring into the facility having started treatment elsewhere (in Uganda, patients who started ART at the spokes during ART outreach provision and had not previously been treated elsewhere were not included as transfers). Patients newly initiating ART were approached if they had started treatment within the last 12 months (although when we looked at matched clinic data this requirement was not always met). Interviewers visited the facilities on ART clinic days and approached patients identified as eligible from patient registers and patient clinic cards until the quota was reached. We aimed to collect data on 50 patients at each facility. Sample sizes were pragmatic to allow us sufficient numbers to describe key outcomes, including travel time and distance to facility, while limited by researcher time and patient availability. Recruitment at the spokes proved difficult in Uganda because facilities were small. The interviews were conducted between January 2013 and January 2014 in Malawi and between February and October 2014 in Uganda.

Statistical analysis

The survey included most (but not all) questions used to derive the asset index in the Demographic Health Survey (DHS) data. In order to calculate a national asset index score for each study participant, we had to map participants in the corresponding DHS.[1,26] The same approach was followed for Malawi and Uganda. In brief, we identified the overlapping questions between our survey and the DHS (collapsing response categories where necessary). We applied principal component analysis within the DHS data to estimate a national asset index score and corresponding wealth quintile cut-offs based on the variables common to the DHS and our survey. Correlations between the asset scores generated from the common set of variables and the asset scores for the full set of variables in the DHS data were very high (Malawi, r=0.93; Uganda, r=0.95). We applied the factor weights extracted from the DHS data set to our corresponding data set to assign each survey respondent a national asset index and then assigned a wealth quintile based on the cut-offs in the DHS data.[27,28]

Most analyses were descriptive. Within each country we tested for differences in patient characteristics and variables describing access to care between facilities, between hubs and spokes, and, at spokes, between patients newly initiating ART and patients who transferred into the facility on ART. Access to care pre- and post-transfer was compared among patients who transferred in at the spokes. Proportions were compared using χ^2 tests. The Wilcoxon rank sum test or Kruskal–Wallis test (>2 groups) was used to compare distributions of continuous variables between groups. The Wilcoxon signed-rank test was used to compare continuous variables pre- and post-transfer in the same individuals. All data were analysed using Stata 12.0 (StataCorp, College Station, TX, USA).

Results

In Malawi, 44 patients were interviewed at the hub and 104 patients were interviewed at the spokes; 54/104 (52%) patients at the spokes had started ART elsewhere and transferred in for care (20% of transfers had received treatment at the hub prior to transfer, 67% had transferred from other large primary care facilities in the district with longer-established ART provision and 13% had transferred from other facilities, including some out of the district). In Uganda, 46 patients were interviewed at the hub and 77 patients were interviewed at the spokes; 33/77 (45%) patients at the spokes had transferred into care (36% of transfers had received treatment at the hub prior to transfer and the remainder had transferred from a variety of facilities; see Table 1).

Characteristics of patients

The majority of patients were female (74% in Malawi, 72% in Uganda). The median age at interview was 36 y (IQR 30–46) in Malawi and 35 y (IQR 28–44) in Uganda. Education levels were low (82% in Malawi, 67% in Uganda had not completed primary

Table 1. Number of participants interviewed at the hub and spokes in Malawi and Uganda

	Malawi (n=148)			Uganda (n=123)		
	Holy Family Hospital (hub)	Sukasanje HC (spoke)	Mpasa HC (spoke)	Bukulua HC (hub)	Kiragga HC (spoke)	Lukaya HC (spoke)
New ART initiations		24	26		22	22
Transfers in		29	25		18	15
Total patients	44	53	51	46	40	37

education) and the principal occupation was farming (68% in Malawi, 62% in Uganda).

Characteristics of the patients are shown in Table 2 by facility and in Table 3 for patients at the spokes split by those newly initiating ART and those transferring into the facility on ART. In Uganda, patients interviewed at spokes tended to be younger than patients at the hub (p=0.002); there was no difference by facility in Malawi (p=0.21) (Table 2). Proportionally more females were interviewed at the spokes than at the hubs (79% vs 61% [p=0.03] in Malawi; 81% vs 59% [p=0.009] in Uganda), probably related to Option B+ provision, which rolled out at the spokes ahead of general ART. Where information on the reason for ART initiation was available, higher proportions of women initiated for Option B+ at the spokes than the hubs (45% vs 24% [p=0.06] in Malawi, 66% vs 10% [p<0.001] in Uganda). Education levels were similar across facilities in Malawi (p=0.57). In Uganda, education levels differed between facilities (p=0.01); patients at the rural spoke (Kiragga HC) had lower levels of education than patients at the other two peri-urban facilities.

In Malawi, the asset index differed by facility. Patients tended to be poorer at the spokes than at the hub (p<0.001) (Figure 1a); 25% of patients at the spokes were in the lowest national wealth quintile and 57% fell into one of the two lowest quintiles. This difference in asset index between hub and spokes persisted if Option B+ women and women with an unknown reason for ART initiation were excluded (p<0.001). In Uganda, the asset index also differed by facility (p<0.001) (Figure 1b). Patients at the rural spoke (Kiragga HC) were on average poorer than patients at the other peri-urban facilities; 15% of patients at the rural spoke were in one of the two lowest quintiles, compared with only 4% at the other peri-urban facilities. Excluding Option B+ women and women with an unknown reason for ART initiation, evidence of patients at Kiragga HC being poorer remained (p=0.002).

Characteristics of the patients at the spokes who started ART at the facility were no different from those who transferred into the spokes for follow-up on ART, with the exception of time on ART; transfers in were more likely to have been on ART longer at the time of interview (Table 2). There was no evidence that transfers were wealthier than patients newly initiating ART (p=0.90, Malawi; p=0.22, Uganda).

Access to ART services

The distance patients travelled and time taken to travel to their current ART facility are summarized in Table 4. In Malawi, the median distance travelled was 6 km (IQR 2–11) and the time taken was 1 h (IQR 30–120 min); the majority of patients walked (66%). There was no difference between facilities in either distance to the facility (p=0.14) or time to travel to the facility (p=0.11). A higher proportion walked to the spokes (74%) than to the hub (48%; p=0.002). In Uganda, the median distance travelled was 4 km (IQR 1.5–8) and time taken was 30 min (IQR 20–60); 40% of patients walked, 13% travelled by bike and the remaining 47% used motorized transport (mostly motorbike taxi). Patients travelled further to the hub on average than to the spokes (p<0.001) and took longer to travel there (p<0.001). The majority used motorized transport to travel to the hub (61%), with only 22% walking to the hub. More walked to the spokes (51%; p=0.007).

In Malawi, only five patients paid for transport (all at the hub). The cost of food per visit was higher at the spokes than at the hub (p<0.001) (Table 4); 21% of hub patients reported incurring food costs, compared with 63% of patients attending spokes. In Uganda, transport costs were incurred by 46% of patients; the average transport costs were higher at the hub than at the spokes (p<0.001). The expenditure on food per visit was also higher at the hub than at the spokes (p<0.001); 89% of patients reported incurring food costs at the hub compared with 45% of patients at the spokes.

In Malawi, 67% of patients at the hub said there was a closer ART facility to home and none at the spokes; corresponding numbers for Uganda were 35% and 16%, respectively. At the hubs, most patients who gave a reason for not moving to a facility closer to home said they liked the facility they were at (23 in Malawi, 6 in Uganda). Five patients at the Ugandan hub were in the process of transferring closer to home. Only three patients (all in Malawi) reported that they did not want to receive ART close to home for fear of people knowing they were on HIV treatment. Seven of the 12 patients at the spokes in Uganda reported their nearest clinic was a 'Uganda Cares clinic', which is less than a 5 min walk from Lukaya HC where they were being seen; 2 liked the clinic they were at and 2 worked at the clinic they were at.

Patient-level benefits of decentralizing ART

All 54 patients at the spokes in Malawi who had transferred in for care while already on ART had moved to receive treatment closer to home (62% patient request, 38% clinician referral). In Uganda, 58% had moved to be closer to home (52% patient request, 6% clinician referral); other reasons for transferring included a change in circumstances (15%), reducing travel or clinic costs (12%), reducing clinic waiting time (9%) and other (6%).

In Malawi, patients who transferred to a spoke reported significant savings in time spent travelling to the clinic post-transfer (median 90 min [IQR 40–145]; p<0.001) (Table 5 and Figure 2). Corresponding reductions in distance to the health facility were also reported (median 7.6 km [IQR 3–11]; p<0.001). The majority of patients walked (70%) to their ART facility pre-transfer and to their current facility (74%); although there were no patient-borne costs of travel pre- or post-transfer, two patients were taken by ambulance pre-transfer, and this was no longer necessary. In Uganda, the median reductions in time (30 min [IQR 10–60]) and distance (4 km [IQR 3.5–6]) were less than in Malawi, but there were substantial changes in the mode of transport, with only 6% of patients walking or using their own or a borrowed bike pre-transfer compared with 58% post-transfer, leading to significant savings in transport costs. The median travel costs per round trip in Uganda decreased by US$1.80 (Table 5). In both countries there were reported reductions in the median cost of food per visit among patients who transferred to the spoke, although reductions were less in Malawi than in Uganda (from US$0.25 to 0.23 in Malawi and by US$0.40 in Uganda) (Table 5).

Discussion

Barriers to ART access that affect different subgroups of people disproportionately can exacerbate inequality in access and

Table 2. Characteristics of participants at interview by current ART facility

	Malawi					Uganda				
	Hub (n=44)	Sukasanje HC (n=53)	Mpasa HC (n=51)	Spokes combined (n=104)	Hub vs spokes, p-value	Hub (n=46)	Kiragga HC (n=40)	Lukaya HC (n=37)	Spokes combined (n=77)	Hub vs spokes, p-value)
Age, median (IQR), y	38 (30–46)	38 (31–50)	35 (29–40)	36 (30–47)	0.91	40 (31–49)	33 (28–45)	33 (25–39)	33 (26–42)	0.002
Sex, n (%)										
Male	17 (39)	12 (23)	10 (20)	22 (21)	0.03	19 (41)	10 (25)	5 (14)	15 (19)	0.009
Female	27 (61)	41 (77)	41 (80)	82 (79)		27 (59)	30 (75)	32 (87)	62 (81)	
Reason for starting ART, n (%)										
Male for own health	17 (39)	12 (23)	10 (20)	22 (21)	0.04	19 (41)	10 (25)	5 (14)	15 (19)	<0.001
Female for own health	19 (43)	29 (55)	14 (27)	43 (41)		18 (39)	6 (15)	7 (19)	13 (17)	
Female for Option B+	6 (14)	12 (23)	23 (45)	35 (34)		2 (4)	14 (35)	11 (30)	25 (32)	
Female, not known	2 (5)	0 (0)	4 (8)	4 (4)		7 (15)	10 (25)	14 (38)	24 (31)	
Time on ART, n (%)										
<6 months	26 (81)	21 (41)	22 (49)	43 (45)	0.002	9 (29)	14 (67)	5 (22)	19 (43)	0.003
6–12 months	3 (9)	11 (22)	7 (16)	18 (19)		3 (10)	2 (10)	7 (30)	9 (20)	
12–24 months	3 (9)	10 (20)	14 (31)	24 (25)		10 (33)	5 (24)	10 (44)	15 (34)	
≥24 months	0 (0)	9 (18)	2 (4)	11 (11)		9 (29)	0 (0)	1 (4)	1 (2)	
Highest education attained, n (%)										
None/pre-primary	7 (17)	13 (25)	10 (20)	23 (22)	0.66	8 (17)	12 (30)	6 (16)	18 (23)	0.75
Some primary	27 (64)	32 (60)	30 (59)	62 (60)		23 (50)	22 (55)	12 (32)	34 (44)	
Completed primary	4 (10)	3 (6)	4 (8)	7 (7)		8 (17)	1 (3)	5 (14)	6 (8)	
Some secondary	3 (7)	4 (8)	6 (12)	10 (10)		3 (7)	5 (13)	14 (38)	19 (25)	
Completed secondary	1 (2)	1 (2)	1 (2)	2 (2)		3 (7)	0 (0)	0 (0)	0 (0)	
Higher	0 (0)	0 (0)	0 (0)	0 (0)		1 (2)	0 (0)	0 (0)	0 (0)	
Main occupation, n (%)										
Farmer	35 (80)	35 (66)	31 (61)	66 (63)	0.14	33 (72)	33 (83)	10 (27)	43 (56)	0.11

Continued

Table 2. *Continued*

	Malawi					Uganda				
	Hub (n=44)	Sukasanje HC (n=53)	Mpasa HC (n=51)	Spokes combined (n=104)	Hub vs spokes, p-value	Hub (n=46)	Kiragga HC (n=40)	Lukaya HC (n=37)	Spokes combined (n=77)	Hub vs spokes, p-value)
Employee	3 (7)	3 (6)	2 (4)	5 (5)		4 (9)	4 (10)	13 (35)	17 (22)	
Family business/ self-employed	4 (9)	10 (19)	16 (31)	26 (25)		6 (13)	1 (3)	8 (22)	9 (12)	
Causal labour	2 (5)	5 (9)	2 (4)	7 (7)		3 (7)	1 (3)	2 (5)	3 (4)	
Other	0 (0)	0 (0)	0 (0)	0 (0)		0 (0)	1* (3)	4** (11)	5 (6)	
Asset index score, median (IQR)	0.3 (–1.0–1.3)	–1.1 (–1.7–0.1)	–1.1 (–1.5 to –0.2)	–1.1 (–1.6 to –0.2)	<0.001	0.9 (0.3–1.8)	0.6 (–0.1–1.1)	1.9 (0.9–3.1)	0.9 (0.3–1.9)	0.99
Wealth quintile, n (%)										
Lowest	4 (9)	14 (26)	12 (24)	26 (25)		0 (0)	1 (3)	0 (0)	1 (1)	
2	6 (14)	18 (34)	15 (29)	33 (32)		1 (2)	5 (13)	2 (5)	7 (9)	
3	11 (25)	7 (13)	15 (29)	22 (21)		14 (30)	10 (25)	5 (14)	15 (19)	
4	16 (36)	11 (21)	7 (14)	18 (17)		17 (37)	20 (50)	8 (22)	28 (36)	
Highest	7 (16)	3 (6)	2 (4)	5 (5)		14 (30)	4 (10)	22 (59)	26 (34)	

Unless specified percentages are of non-missing values.
*Housewife; **one fisherman, three housewives.

Table 3. Characteristics of participants at interview at the spokes by status at ART registration at the facility

	Malawi				Uganda			
	New ART initiation (n=50)	Transfer in on ART (n=54)	All patients (n=104)	New ART initiation vs transfer in, p-value	New ART initiation (n=44)	Transfer in on ART (n=33)	All patients (n=77)	New ART initiation vs transfer in, p-value
Age, median (IQR), y	35 (28–48)	36 (31–45)	36 (30–47)	0.31	30 (25–41)	35 (29–42)	33 (26–42)	0.12
Sex, n (%)								
Male	9 (18)	13 (24)	22 (21)	0.45	8 (18)	7 (21)	15 (19)	0.74
Female	41 (82)	41 (76)	82 (79)		36 (82)	26 (79)	62 (81)	
Reason for starting ART, n (%)								
Male for own health	9 (18)	13 (24)	22 (21)	0.60	8 (18)	7 (21)	15 (19)	0.98
Female for own health	22 (44)	21 (39)	43 (41)		8 (18)	5 (15)	13 (17)	
Female for Option B+	16 (32)	19 (35)	35 (34)		14 (32)	11 (33)	25 (32)	
Female, not known	3 (6)	1 (2)	4 (4)		14 (32)	10 (30)	24 (31)	
Time on ART, n (%)								
<6 months	35 (76)	8 (16)	43 (45)	<0.001	17 (59)	2 (13)	19 (43)	<0.001
6–12 months	8 (17)	10 (20)	18 (19)		7 (24)	2 (13)	9 (20)	
12–24 months	3 (7)	21 (42)	24 (25)		5 (17)	10 (67)	15 (34)	
≥24 months	0 (0)	11 (22)	11 (11)		0 (0)	1 (7)	1 (2)	
Highest education attained, n (%)								
None/pre-primary	17 (34)	6 (11)	23 (22)	0.06	10 (23)	8 (24)	18 (23)	0.45
Some primary	24 (48)	38 (70)	62 (60)		18 (41)	16 (48)	34 (44)	
Completed primary	4 (8)	3 (6)	7 (7)		3 (7)	3 (9)	6 (8)	
Some secondary	4 (8)	6 (11)	10 (10)		13 (30)	6 (18)	19 (25)	
Completed secondary	1 (2)	1 (2)	2 (2)		0 (0)	0 (0)	0 (0)	
Main occupation, n (%)								
Farmer	35 (70)	31 (57)	66 (63)	0.34	23 (52)	20 (61)	43 (56)	0.06
Employee	1 (2)	4 (7)	5 (5)		14 (32)	3 (9)	17 (22)	
Family business/self-employed	12 (24)	14 (26)	26 (25)		4 (9)	5 (15)	9 (12)	
Causal labour	2 (4)	5 (9)	7 (7)		0 (0)	3 (9)	3 (4)	
Other	0 (0)	0 (0)	0 (0)		3* (7)	2** (6)	5 (6)	
Asset index score, median (IQR)	−1.1 (−1.7–0.1)	−1.2 (−1.6 to −0.5)	−1.1 (−1.6 to −0.2)	0.90	1.0 (0.5–2.4)	0.7 (0.1–1.5)	0.9 (0.3–1.9)	0.22
Wealth quintile, n (%)								
Lowest	14 (28)	12 (22)	26 (25)		1 (2)	0 (0)	1 (1)	
2	13 (26)	20 (37)	33 (32)		2 (5)	5 (15)	7 (9)	
3	11 (22)	11 (20)	22 (21)		6 (14)	9 (27)	15 (19)	
4	10 (20)	8 (15)	18 (17)		17 (39)	11 (33)	28 (36)	
Highest	2 (4)	3 (6)	5 (5)		18 (41)	8 (24)	26 (34)	

Unless specified, percentages are of non-missing values.
*Three housewives; **one fisherman, one housewife.

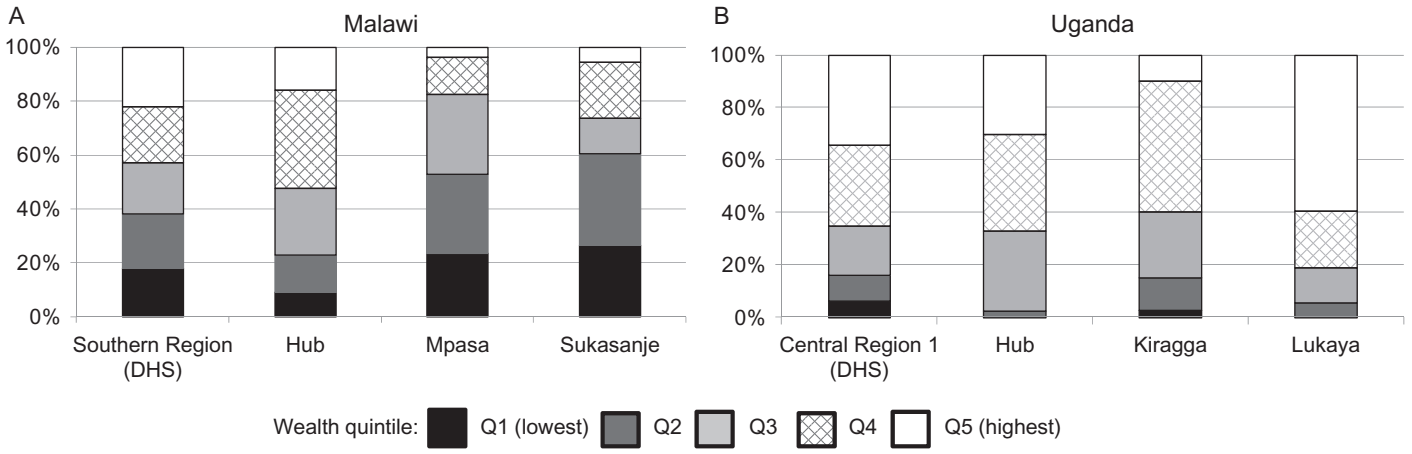

Figure 1. Proportion of patients interviewed by wealth quintile at the study facilities compared with population figures for the corresponding region.

ultimately health outcomes. One of the most commonly cited barriers to accessing ART services is the cost associated with travel to the health facility.[13,15,29–31] Travel to the health facility presents both direct monetary and indirect opportunity costs (such as time taken off from work). In this study we captured information on access to ART before and after transferring into lower-level health facilities in 87 patients in Malawi and Uganda; the majority of these patients transferred as a result of decentralization of ART services to facilities nearer to where they live.

In both countries, patients who had transferred to the primary care facilities (spokes) for follow-up after initiating ART elsewhere reported significant savings in time spent travelling to their ART facility and reductions in the distance from home to the facility post-transfer. In Uganda, a substantial proportion was able to walk to care, having previously used paid transport, resulting in savings in transport costs; a median saving per round trip of US$1.80 is substantial when 33% of the population lives on less than US$2 per day and 63% on less than US$3.[32] Although in Malawi most patients walked to their health facility, an earlier study in Malawi found that patients accessing care at a tertiary referral hospital incurred significantly higher travel-related expenses than patients in decentralized care.[13] In both countries there were reductions in the cost of food per visit to the health facility; although reductions were less in Malawi than in Uganda, the population in Malawi is poorer, with 70% living on less than US$2 per day.[32] These direct benefits to patients may explain why some studies on decentralization of ART have shown reduced loss to follow-up and better adherence and retention in care in local vs centralized care.[19–21]

Despite the benefits of decentralization, patients at the primary care facilities in Malawi were still travelling (one way) on average for 1 h to access ART services, mostly on foot, similar to findings for patients accessing ART in decentralized care in Zomba district, Malawi.[13] In Uganda, patients travelled for half an hour. If one adds this to the time spent at the facility, a substantial amount of time is still required to access ART services and most patients collect drugs at least every 3 months, often more frequently, particularly if drug supplies are low. Although children were not included in this study, children and some adults need to be accompanied to the facility, increasing the burden on the population. Pinto et al.[13] reported additional barriers to accessing care, including missing work and lost income, which we did not measure. As patients will be on ART for life, there is an urgent need to consider alternative ways to deliver ART to stable patients, for example drug collection points within the community or supplies of ART for longer periods of time.[33]

At the hubs, significant proportions of patients reported not accessing ART at their nearest ART facility. There seemed to be reluctance to move to a new facility having started ART in secondary care, which we have found previously in northern Uganda and others have also reported.[34–36] In contrast to some previous studies,[37] stigma did not appear to be a major barrier to treatment close to home. It may be that despite poverty, some patients prefer accessing treatment at secondary facilities (hubs), even if further from home, due to their perceived higher quality of care. The extent to which the interplay between these factors affects access is not yet fully understood.[38]

Anonymous HIV testing in DHS studies in the past has shown that HIV is present disproportionately among individuals of higher socio-economic status.[39] It is not clear to what extent, because in the past ART was initially only available to wealthier individuals; this may now be changing with the availability of free treatment and greater ART coverage. Patients included in this study in Malawi represented the region's socio-economic distribution. Patients receiving care at the spokes were poorer than those at the hub. This suggests that decentralization is benefiting poorer individuals; an alternative, less likely explanation is that richer patients are more able to stay at hubs, particularly if fee-paying, which is the case for some in Malawi. Patients in Uganda appeared better off on average than others in the region, with the possible exception of the rural spoke. Notably, 82% of the population in Uganda resides in rural areas, so decentralization is probably also benefiting the poorer population here.[40] The peri-urban spoke is located closer to the hub, close to a major highway to Kampala and is a truck driver's stopping point, providing opportunities for income for inhabitants, and is therefore not typical of primary care facilities.

Prior to collecting the data, we hypothesized that patients transferring into the spokes on ART might be wealthier than patients newly initiating ART at the spokes, reasoning that some

Table 4. Access to current ART facility

	Malawi				Uganda			
	Hub (n=44)	Sukasanje HC (n=53)	Mpasa HC (n=51)	Spokes combined (n=104)	Hub (n=46)	Kiragga HC (n=40)	Lukaya HC (n=37)	Spokes combined (n=77)
Distance, median (IQR), km	5 (2–17)	7 (4–10)	5 (1–8)	6 (2–9.5)	7 (4–17)	3 (1.5–7)	2.5 (1–5)	3 (1–5)
Time, median (IQR), min	60 (30–120)	80 (60–120)	60 (20–100)	60 (30–120)	60 (30–60)	30 (18–105)	20 (10–30)	30 (15–40)
Mode of transport, n (%)								
On foot	21 (48%)	40 (75%)	36 (72%)	76 (74%)	10 (22%)	20 (50%)	19 (51%)	39 (51%)
Own/borrowed bicycle	18 (41%)	12 (23%)	14 (28%)	26 (25%)	8 (17%)	7 (18%)	0 (0%)	7 (9%)
Bicycle taxi	2 (5%)	1 (2%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	1 (3%)	1 (1%)
Motorbike/motorbike taxi	0 (0%)	0 (0%)	0 (0%)	0 (0%)	18 (39%)	12 (30%)	15 (41%)	27 (35%)
Bus/car taxi	3 (7%)	0 (0%)	0 (0%)	0 (0%)	10 (22%)	0 (0%)	2 (5%)	2 (3%)
Lift	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (3%)	0 (0%)	1 (1%)
Cost of transport per round trip ($US)*[1]								
Median (IQR)	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)	1.40 (0–2.40)	0 (0–0.80)	0 (0–1.20)	0 (0–0.80)
Mean (SD)	0.09 (0.27)	0 (0)	0 (0)	0 (0)	1.97 (3.03)	0.42 (0.73)	0.61 (0.79)	0.51 (0.76)
Cost of food per visit ($US)*								
Median (IQR)	0 (0–0)	0.25 (0–0.50)	0.11 (0–0.38)	0.20 (0–0.38)	0.80 (0.4–1.20)	0 (0–0.80)	0 (0–0.40)	0 (0–0.70)
Mean (SD)	0.13 (0.34)	0.30 (0.32)	0.19 (0.23)	0.25 (0.28)	0.78 (0.46)	0.32 (0.37)	0.30 (0.42)	0.31 (0.39)

Malawi missing time to facility for 1 individual at the hub; missing distance to facility for 1 individual at the hub; missing costs for food for 16 at the hub and 1 at Mpasa. Uganda data were incomplete for distance (available for n=33, 27 and 34 in the three facilities) and cost of food (n=45,39 and 27 in the three facilities)

*Conversion rates: 400 MKW to US$1 (April 2013); 2500 UGX to US$1 (April 2014) (www.exchangerates.org.uk).

[1]Costs of transport were only incurred for bicycle taxi, motorbike/motorbike taxi or bus/car taxi; five individuals at the hub in Malawi incurred costs ($0.5 [n=2]; $1 [n=3]). All individuals using these forms of transport incurred costs in Uganda.

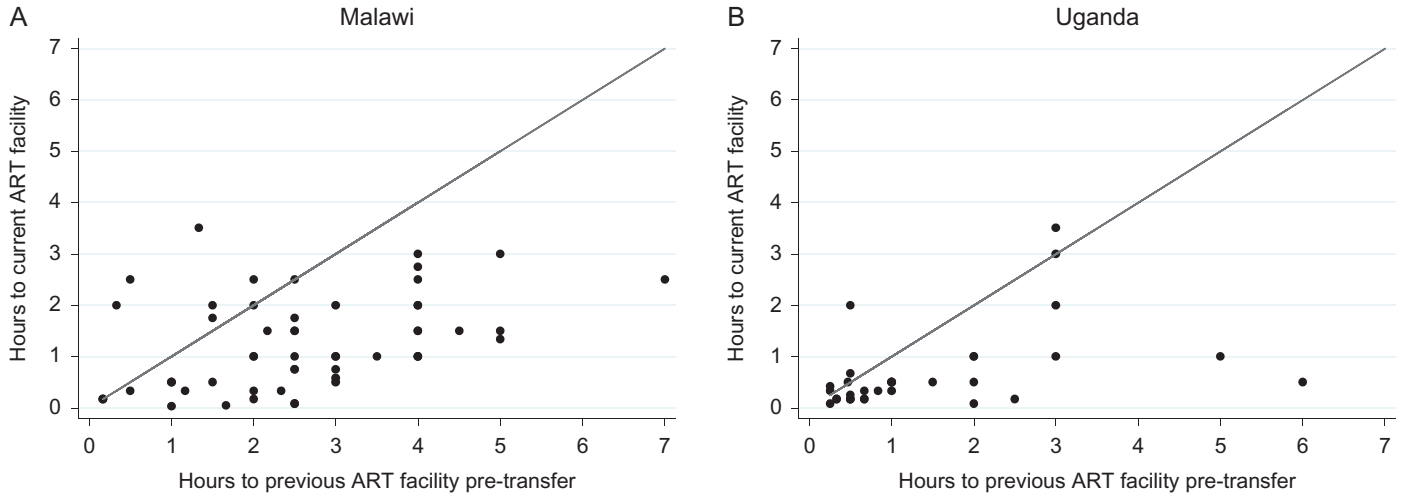

Figure 2. Comparison between travel time to current ART facility and travel time to previous ART facility in patients who have transferred into primary care facilities for follow-up on ART. All points below the lines are patients who spend less time travelling after transfer.

Table 5. Benefits in access for patients transferring into the spokes from other health facilities

	Malawi (n=54)			Uganda (n=33)		
	Pre-transfer	Post-transfer	Reduction[a]	Pre-transfer	Post-transfer	Reduction[a]
Distance, median (IQR), km	13 (8–18)	6 (2–8.4)	7.6 (3–11)***	7.5 (4.5–11)	2 (1–4)	4 (3.5–6)**
Time, median (IQR), min	150 (90–240)	60 (30–120)	90 (40–145)***	55 (30–120)	30 (10–40)	30 (10–60)***
Mode of transport, n (%)						
On foot	37 (70)	39 (74)		1 (3)	15 (45)	
Own/borrowed bicycle	14 (26)	13 (25)		1 (3)	4 (12)	
Bicycle taxi	0 (0)	1 (2)		2 (6)	0 (0)	
Motorbike/motorbike taxi	0 (0)	0 (0)		19 (58)	13 (39)	
Bus/car taxi	0 (0)	0 (0)		10 (30)	1 (3)	
Lift	0 (0)	0 (0)		0 (0)	0 (0)	
Workstation ambulance	2 (4)	0 (0)		0 (0)	0 (0)	
Cost of transport per round trip (US$)*						
Median (IQR)	0 (0–0)	0 (0–0)	0 (0–0)	2.80 (1.20–5.60)	0 (0–1.00)	1.80 (1.20–4.0)***
Mean (SD)	0 (0)	0 (0)	0 (0)	3.83 (3.35)	0.59 (0.81)	3.24 (3.41)
Cost of food per visit (US$)*						
Median (IQR)	0.25 (0.15–0.50)	0.23 (0–0.50)	0 (0–0.15)**	0.80 (0.60–1.20)	0 (0–0.80)	0.40 (0.40–0.80)***
Mean (SD)	0.33 (0.24)	0.27 (0.31)	0.06 (0.23)	0.96 (0.58)	0.35 (0.43)	0.61 (0.59)

[a]Change pre-transfer to post-transfer.
*Conversion rates: 400 MKW to US$1 (April 2013); 2500 UGX to US$1 (April 2014) (www.exchangerates.org.uk).
**p<0.01; ***p<0.001 (signed-rank test).
Distance data were only available for 12 patients pre-transfer and 11 patients post-transfer in Uganda.

new ART patients may not have been able to access ART previously due to cost. We found no evidence for this in either Malawi or Uganda. However, we conducted the surveys soon after general ART provision started (8 months in Malawi, 11 months in Uganda); it is possible that it may take longer for such patients to come forward (particularly if they had resisted testing until local ART services became available). A Lablite population survey in northern Uganda showed an increase at the population level in HIV testing at primary health care facilities after decentralization of ART.[36]

This study did not compare clinical or laboratory outcomes between participants at spokes and hubs. Cross-sectional measures were not easily available, as viral loads were not measured at any of these sites during the study period; in Malawi, CD4 monitoring was not available for patients on ART and, in Uganda, CD4 monitoring was incomplete. It is likely that participants who

transferred into spokes on ART were stable on ART at the time of transfer and patients with complications would have remained at the hub. Other longitudinal studies have reported better outcomes for patients at decentralized facilities.[24]

Other limitations of the study include the sampling frame, which was not random, but purposeful and convenience-based, and the limited number of facilities included per country. Because ART provision at the spokes started with Option B+, women starting ART for Option B+ were probably over-represented at the spokes, although this may continue for some time to come. It is also possible that women and/or individuals with no education were more willing to be interviewed. We relied on patient reports, which may be inaccurate, particularly for questions relating to distance travelled and time taken to travel to the facility. We only collected information from patients at the facilities, so we had no information on HIV-positive individuals not accessing ART; this limits our ability to assess equitable coverage of ART by socio-economic factors. Furthermore, the demographic health surveys in both countries were conducted in 2011 and our survey was conducted in 2013–2014; there may have been improvements in the wealth index over this period (particularly in Uganda, where Kalungu district is close to Masaka and Kampala), which would have caused us to underestimate the proportions of patients accessing ART from the lower socio-economic strata. Descriptions of the benefits of transferring from hub to spoke are based on those who chose to transfer and may therefore overestimate average benefits attributable to decentralization. In particular, we did not collect data on patient satisfaction with ART services, which is an important driver of the choice of facility.

Conclusions

Decentralization of ART services closer to home was shown to be beneficial to patients who transferred to their local facility, with reductions in distance to the facility, travel time and out-of-pocket expenses. In Malawi, patients receiving care at the spokes were poorer than those at the hub and, in Uganda, patients at the rural spoke were poorer than those in the peri-urban facilities, suggesting that decentralization is benefiting poorer individuals. Our findings show that Malawi's national ART programme is reaching all socio-economic strata. In Uganda, we found less evidence for equal access to ART across all socio-economic strata, although we had no population-level information on the socio-economic status of HIV-infected individuals in the facility catchment areas. Models of community-level access to ART and reductions in clinic visit frequency (e.g., adoption of the WHO differentiated model of care)[41] aimed at further minimizing distance and patient-related costs in accessing ART should be studied.

Supplementary data

Supplementary data are available at International Health Online (http://inthealth.oxford journals.org/).

Author's contributions: GA and LC contributed to the proposal writing, participated in interviews, conducted the literature review and contributed to interpretation and analysis of the results and writing of the manuscript. ET and MN contributed to the proposal writing and participated in interviews and supervision of data entry. DF contributed substantially towards the proposal writing, supervision of data entry, analysis and interpretation of the data and writing of the manuscript. JS and DMG contributed to the study design, proposal writing, interpretation of the results and writing of the manuscript. PR, AKC, FC and TM provided technical advice for the proposal writing and editing of the manuscript. JO, CK, JH, RC and CG contributed to the study design, interpretation of results and reviewing of the manuscript. All authors read and approved the final manuscript.

Funding: Lablite was funded by the UK Department for International Development (DFID) for the benefit of developing countries [GB-1-202037] and core support to the UK Medical Research Council [MC_UU_12023/23]. The views expressed in this article are not necessarily those of DFID.

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

Ethics approval and consent to participate: Approval for this study protocol was obtained from the Malawi National Health Sciences Research Committee. In Uganda it was approved by the Joint Clinical Research Centre/Research Ethical Committee (JCRC/REC) and the Uganda National Council for Science and Technology (UNCST). All study participants signed a written informed consent.

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