

# HIV care and support services offered in mobile health clinics: a systematic review

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## Abstract

**Introduction:** This systematic review was undertaken based on available data on human immunodeficiency syndrome (HIV) care, management, and support services provided by mobile health clinics (MHCs) in various countries globally, to identify available HIV care and support services, as outlined by PEPFAR's 'universal' framework for MHCs. The review question was "What universal HIV care and support is available at MHCs?"

**Material and methods:** The search yielded 34,954 articles and was conducted within four databases, including EBSCOhost (UKZN library), Google Scholar, PubMed, and CINAHL. The search yielded 25 studies, which met the inclusion criteria, from 2011 to 2020.

**Results:** Seven themes were identified relating to HIV care and support services offered by MHCs. Theme 1: Fragmented or selected universal HIV care and support services available at mobile health clinics, Theme 2: Lack of local support for HIV care and support services from ministries of health. Theme 3: Success relies on multiple stakeholders' engagement. Theme 4: Excellent platform to reach marginalized population and expanding healthcare access. Theme 5: Possible multi-health program delivery. Theme 6: Implementation of critical viable point-of-care services. Theme 7: Follow-up care leads to successful health outcomes for patients attending MHCs.

**Conclusions:** Intentional and carefully planned HIV services delivered by MHCs ensure that minimum universal HIV care and support is achieved for people living with HIV. Local access to healthcare services is improved and yielding positive impact by reducing HIV-related morbidity and mortality rates in the communities, while at risk-populations are considered.

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**Key words:** antiretroviral therapy, community-based HIV care, HIV care and support, mobile health clinics, community-based clinics.

## Introduction

A review of the literature was undertaken by three independent reviewers to ascertain the nature of universal human immunodeficiency syndrome (HIV) care and sup-

port services provided by mobile health clinics (MHCs) in various countries of the world. MHCs is a part of community-based and clinic-based integrated HIV care model [1, 2]. In the South African context, MHCs are well situated to bridge the gap between healthcare system and community [3],

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and they have been widely adopted worldwide as an effective strategy to render effective healthcare services. Recently, MHCs are seen as a strategy that could aid in reaching the goal of achieving universal access to healthcare, especially in BRICS countries (Brazil, Russia, India, China, and South Africa) [2]. MHCs are utilized heavily towards eliminating inequality within healthcare systems and attaining universal health coverage [4] through moving health vehicles. These purposefully built vans or vehicles go to different community settings and build a link between community and healthcare delivery systems [3]. The link is built by ensuring that essential health services are delivered into the community. An MHC is a vehicle with a driver and clinical equipment, with a healthcare provider, such as a doctor or nurse, who visits areas regularly to provide health services [5]. Registered nurses are the main drivers of MHCs in the South African public health system [6].

According to the UNAIDS [2], HIV care and support are a comprehensive set of services, including medical, psychosocial, physical, socio-economical, nutritional, and legal supports. These services are crucial to well-being and survival of people living with HIV and their caregivers as well as orphans and other vulnerable children. Care and support services are needed from the point of diagnosis throughout HIV-related illness, regardless of the ability to access antiretroviral therapy. These services are divided into universal and contextual services.

The main aim of this work was to review the literature on available HIV care and support services delivered by MHCs utilizing the United States President's Emergency Plan for AIDS Relief (PEPFAR) 'universal' HIV care and support framework [7]. Four main areas are described under this framework: 1. Linkage to care for immediate initiation of antiretroviral therapy for newly diagnosed with HIV people, with clinical and laboratory monitoring, including viral load monitoring; 2. Tuberculosis screening; 3. Cotrimoxazole prophylaxis; 4. Optimization of retention in care and adherence to antiretroviral therapy.

## Review question

The review question for this study was: 'What universal HIV care and support services are available at MHCs?'. SPICE conceptual framework tool [8] was used for defining the review question, as depicted in Table 1.

**Table 1.** SPICE conceptual framework tool

Criteria	Determinant
Setting	Mobile health clinics globally
Perspective	People living with HIV
Intervention	Universal HIV care and support
Comparison	None
Evaluation	Provision of at least one component of universal HIV care and support

## Inclusion and exclusion criteria

Studies were eligible for inclusion if they reported data on at least one of the following outcomes linked to universal HIV care: Linkage to care for immediate initiation of antiretroviral therapy for newly diagnosed with HIV people, with clinical and laboratory monitoring, including viral load monitoring; TB screening; Provision of cotrimoxazole prophylaxis; Optimization of retention in care and adherence to antiretroviral therapy. Furthermore, published studies not more than ten years old (2011-2020) offering HIV care services within the mobile health clinic setting globally were considered. Studies were limited to those written and published in the English language. All studies, which were older than ten years were excluded from the review, including studies reporting on universal HIV care not in mobile health clinics.

## Study selection and search strategy

Study selection was conducted between January and July 2020, with the last search done on July 20, 2020, with a help of a librarian. Two independent reviewers conducted study selection process by screening titles and abstracts from EBSCOhost (UKZN library), Google Scholar, PubMed, and CINAHL search engines, guided by review inclusion and exclusion criteria. A total of 34,954 research articles were found, which matched the search words: HIV care/ and support, antiretroviral therapy, mobile health clinics, NIMART trained nurses, community-based HIV, community-based clinic. All the abstracts were read, and 17,288 articles were eliminated. One hundred and two studies remained, and were read in full by all three reviewers. This resulted in further 77 studies being excluded as they did not meet the required criteria, which left 25 studies that provided HIV care and support by MHCs, and a consensus was reached by all three reviewers. A 5-step search process was applied, followed PRISMA flow diagram of 2010 [9], as displayed in Figure 1, to identify data included and excluded, with their rationale for exclusion. Since all the included studies were publicly available, they did not need approval from authors for use. All the full-text studies that met inclusion criteria were subjected to quality appraisal (Table 2).

## Data extraction

A study protocol was developed to document the study. Multiple types of studies were included for this review since multiple aspects of HIV care and support were required. Therefore, cross-sectional descriptive studies, randomized clustered trials, and mixed methods studies were included in the review. All the studies were used to discover what aspect of HIV care and support is being rendered in MHCs. Setting was MHCs globally, perspective was people living with HIV, and interventions were finding out information regarding the nature of HIV and support services. There were no comparisons, and outcome measures were for

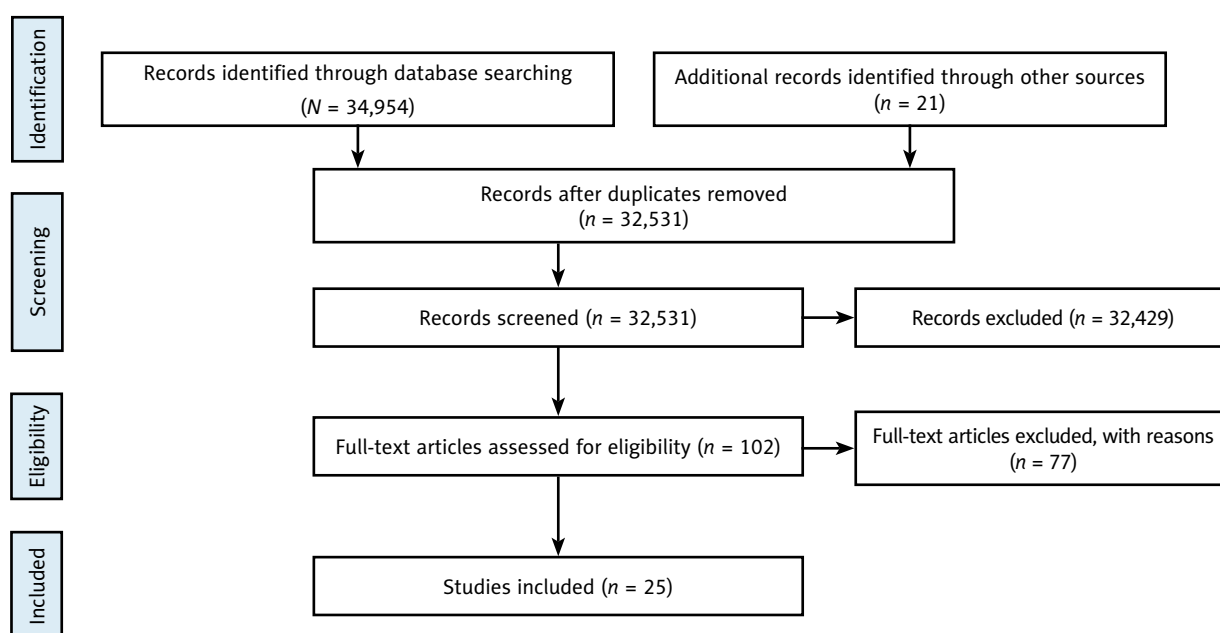


Figure 1. PRISMA flow diagram

Table 2. Assessment of studies using Critical Appraisal Skills Programme (CASP)

Authors, year	Study design	Assessment of studies
Gibson <i>et al.</i> , 2014	Retrospective cross-sectional study	10/12 (83%)
Billioux <i>et al.</i> , 2015	Retrospective observational study	12/12 (100%)
Geoffroy <i>et al.</i> , 2014	Retrospective cross-sectional study	11/12 (92%)
Van Dijk, 2014	Prospective cohort study	9/12 (75%)
Parker <i>et al.</i> , 2015	Cross-sectional study	9/12 (75%)
Labhardt <i>et al.</i> , 2014	Cluster-randomized trial study	8/11 (73%)
Moon <i>et al.</i> , 2014	Descriptive evaluation study	8/12 (67%)
Barnabas <i>et al.</i> , 2016	Randomized multi-site open-label trial study	8/11 (73%)
Sanga <i>et al.</i> , 2017	Prospective mixed-method study	9/12 (75%)
Bassett <i>et al.</i> , 2014	Prospective cohort study	8/12 (67%)
Wasantioopapakorn <i>et al.</i> , 2018	Descriptive evaluation study	10/12 (83%)
Bajunirwe <i>et al.</i> , 2020	Descriptive evaluation study	9/12 (75%)
Hatcher <i>et al.</i> , 2012	Cross-sectional study	8/12 (67%)
Maughan-Brown <i>et al.</i> , 2019	Multimethod study	9/12 + 8/10 (78%)
Gorman <i>et al.</i> , 2015	Retrospective non-experimental, observational	12/12 (100%)
Govindasamy <i>et al.</i> , 2011	Non-experimental retrospective, observational	12/12 (100%)
Govindasamy <i>et al.</i> , 2013	Observational cohort	11/12 (92%)
Kohli <i>et al.</i> , 2012	Descriptive study	10/12 (83%)
Kojima <i>et al.</i> , 2017	Descriptive study	9/12 (75%)
Kranzer <i>et al.</i> , 2012	Cross-sectional study	10/12 (83%)
Larson <i>et al.</i> , 2012	Retrospective pilot study	11/12 (92%)
Nakigozi <i>et al.</i> , 2011	Cohort survey study	8/12 (67%)
Nglazi <i>et al.</i> , 2012	Retrospective observational study	10/12 (83%)
Freeman-Romilly <i>et al.</i> , 2017	Retrospective cohort study	9/12 (75%)
Schwartz <i>et al.</i> , 2017	Cross sectional study	9/12 (75%)

MHCs to provide at least one component of universal HIV care and support. The search yielded 25 studies published between 2011 and 2020, which met inclusion criteria. Sabinet, PRISMA (preferred reporting items for the systematic review and meta-analysis) tool was used for the review process and results. The search was conducted twice with the help of UKZN-based librarian through databases/search engines, followed by a manual search of a reference list of eligible studies. Titles, abstracts, methods, and results of different studies were screened by the two reviewers independently for inclusion of potential articles as well as for removal of duplicates.

## Quality appraisal

The Critical Appraisal Skills Programme (CAPS) tool [10] was applied for all the eligible studies. CAPS' set of eight critical appraisal tools are designed to be used when reading a research, and include tools for systematic reviews, randomized controlled trials, cohort studies, case-control studies, economic evaluations, diagnostic studies, qualitative studies, and clinical prediction rule. For this review, a cohort study, case-control, and qualitative checklists were used to assess the articles thoroughly and systematically, to ensure their relevance and trustworthiness. Table 2 depicts the 25 studies assessed to confirm their relevance.

## Results

There were 25 eligible studies identified from the search activities illustrated in Figure 1 and Table 2. Twenty-one studies were cross-sectional cohort studies, two were mixed method, and two were randomized trials.

### Characteristics of included studies

Characteristics of the included studies shown in Table 2 have seven entries for each study, including author(s), aims, design, sampling, setting, major findings, and limitations. The studies were from various regions and different variables were explored in relation to HIV care and support services offered by MHCs.

### Brief description of status of knowledge

Seven themes emerged from the findings of the review: Fragmented or selected universal HIV care and support services available at mobile health clinics ( $n = 21$ ); lack of local support for HIV care and support services by ministries of health ( $n = 25$ ); success relies on multiple stakeholders' engagement ( $n = 10$ ); excellent platform to reach marginalized population and expanding health care access ( $n = 7$ ); possible multi-health program delivery ( $n = 16$ ); implementation of critical viable point-of-care services ( $n = 9$ );

follow-up care leads to successful health outcomes for patients attending MHCs ( $n = 8$ ).

### Theme 1: Fragmented or selected universal HIV care and support services available at mobile health clinics

In this review, it was noted that there was a shortfall in HIV care provided by MHCs, as they were not delivering the entire package specified in PEPFAR's framework on HIV care and support. Limitations of four out of 25 studies demonstrated to have incorporated and adopted full-service package according to PEPFAR's universal HIV care and support framework, which contains all four components described in the framework. These studies were conducted in separate countries, such as Mozambique [11], Zambia [12], Uganda [13], and the United States of America [14]. The remaining 84% of the studies included either focused on single, double, or triple services according to the HIV care and support framework [15-22].

This could be due to multiple factors, such as human and skills shortages, and infrastructure, amongst others. As a result, only three studies successfully demonstrated that virological and immunological monitoring of the disease is possible in MHCs [11, 15, 18]. Such monitoring plays a key role in understanding management and treatment of the condition. Findings from such studies indicated that viral load monitoring yielded positive results while early adherence counselling was initiated early, and during the routine 24 weeks, viral load improved and adherence was noted as patients remained virally suppressed for a mean time of 4.6 years [18]. Other researchers have recommended that such point of care services (viral load and CD4+ count) would improve linkage [23]. Even though Jani *et al.* [24] and Moon *et al.* [11] reported an increase by 25% of people who received their CD4+ count and this was not sustained through the continuum of HIV care. Likewise, 32% was reported by Nakigozi *et al.* [13], while Govindasamy *et al.* [25] reported those with CD4+ counts  $\leq 200$  cells/ $\mu$ l took on average less than a month (3 weeks) to access care.

Screening of TB is essential for people with HIV, as up to 73% of individuals with TB are co-infected with HIV, especially in South Africa [26]; however, only seven MHCs provided incorporated TB management in their services [11-14, 25, 27, 28]. This means fragmented care is rendered to HIV-infected patients, even though they are provided with MHC, which could prove very costly for both patients and healthcare system, as patients would still require to visit different fixed health facility for omitted services; meanwhile, one of the greatest advantages of MHCs was reported convenience and reducing cost for transportation [12, 29]. Cotrimoxazole prophylaxis is used to reduce morbidity and mortality in people with HIV [30]; therefore, it is considered important in the management of HIV-infected individuals, and is incorporated in their care. However, it was found that only six MHCs were offering such added services [11-14, 20, 31].

The question should be asked whether MHCs providing HIV care and support can deliver comprehensive HIV care needed by patients, or just a partial service.

### **Theme 2: Lack of local support for HIV care and support services by ministries of health**

The major observation noted was that all the HIV care and support services were mainly from external donor funding through various non-government organizations. Local HIV care and support services through MHCs were not evident as a part of or an extension of every day national, provincial, or district health services delivery system. External funding is most beneficial since it provides a platform for initiation and implementation of universal HIV care and support services either partially or comprehensively. On most occasions, the project is available for more than 12 months and provides sustained opportunity beyond its' existence. People living with HIV become the greatest beneficiaries in the process, since significant clinical outcomes can be yielded. Furthermore, local health delivery systems receive support and chance to expand, strengthen their health delivered programs, and sometimes even introduce new programs with a special focus, such as men who have sex with men (MSM) or transgender individuals [22, 32].

### **Theme 3: Success relies on multiple stakeholders' engagement**

More favorable HIV care and support outcomes were attained especially when there was a strong partnership between the health services provider and the local community at various levels, either through local leadership or partnering with existing local healthcare institutions/existing NGOs, and through training and mentorship.

#### *Involvement of local community leadership*

Over 90% HIV linkage to care was reported in studies where local leaders, such as chiefs, were involved [11, 20, 23, 33, 34], as opposed to 10-37% reporting no such involvement [17]. Community leaders were instrumental before launching a project and during implementation phases. Project uptake by community members is easier if they see buy-in from their leaders. It should be highlighted that the success of any MHC services depends on acceptability of that service by community members. Community engagement and participation is key to success of MHC services, as demonstrated by Kojima *et al.* [34] and Schwartz *et al.* [35], where community leaders, providers, traditional healers, and patients formed a partnership, and full involvement with sense of ownership was felt. This is of the essence since HIV stigmatization is prevalent in certain communities. Various studies reported that patients preferred to test 5 km away MHC [14, 32, 36], yet patients diagnosed with

HIV in a community setting needed culturally appropriate support to ensure they access to HIV care [14, 32]. This helps further when collaborating with community organizations for required mitigation strategies [10]. The above-mentioned evidence demonstrates that the mere availability of the services did not guarantee their uptake unless local support was embraced. Several studies have reported poor linkage to HIV care support services from MHCs [13, 20, 23, 37, 38] despite monetary incentives in some instances [35, 38-40]. However, good linkage to HIV care support and treatment has been reported in various studies proving HIV care in MHCs [11, 19, 21, 25, 27, 32, 41].

#### *Partnership with existing healthcare institutions*

Partnership with existing healthcare institutions is done so there can be extension/ expansion of healthcare services, as demonstrated in Congo, Tanzania, Swaziland, Mozambique, Zambia, Lesotho, and Thailand [11, 12, 20, 22, 23, 33, 41]. This is critical in ensuring that the services will continue beyond NGO's term of office. Furthermore, Geoffroy *et al.* [31] demonstrated how effective MHCs can be in complementing the fixed clinic during drug stock-out periods, as people were able to get their cotrimoxazole prophylaxis supply from them. Furthermore, according to Gibson *et al.* [14] and Maru *et al.* [42], patients living near MHCs were twice as likely to adhere to directly administered antiretroviral therapy (DAART), which is desired in HIV care for achieving better health outcomes as a result of increased service availability. A study on HIV-infected children on ART in Zambia was conducted to compare those receiving the same care from a hospital and others from MHC. It was found that children attained similar CD4+ counts and weight for age Z-scores, which confirmed HIV care and support rendered at MHC was no less superior than that received at the fixed-based facility [12]. MHCs and fixed clinics can play an important supplementary role for each other, especially since no statistical difference has been noted in HIV care from MHCs and fixed health facilities [37]. However, studies reported favor of one over the other [14, 37].

#### *Training and mentorship*

Sustainability of HIV care and support programs can be achieved through partnering with the existing local institution and skills transferring models. Training and mentorship form a part of the skills transfer. This was demonstrated successfully in Mozambique by Moon and colleagues, where local healthcare and non-health workers were trained in various skills, including clinical management of HIV, phlebotomy, counselling, and follow-up of HIV-infected people [11]. It has been documented that training of staff members, especially in sensitive issues, such as gender-based violence (GBV) and men who have sex with men (MSM), leads to decreased homophobic attitudes and increased knowledge of MSM-related health issues, specifically amongst those who demonstrated strongest negative



Table 3. List of studies included in the review

No.	Author(s), year	Aim/ Objective	Design	Sampling	Setting	Major findings	Limitations
1	Gibson <i>et al.</i> , 2014	To identify the population that relies on MHC for health needs and testing their health-seeking behaviors and motivation to seek such services.	Cross-sectional retrospective study	Non-probability	North America	<ol style="list-style-type: none"> <li>'High frequency' users were significantly more likely to be men (66.7%, <math>p \leq 0.01</math>) and were nearly all foreign-born (94.4%, <math>p &lt; 0.01</math>). About 15% were travelling more than 8 km to receive care at MHC.</li> <li>Two main groups visited MHCs, i.e., those who travelled between 8-80 km tended to be substance abusers and racial minorities who travel greater than 80 km to access services because there are no other options.</li> <li>Majority of patients were vulnerable groups: unstably housed, unemployed, with history of drug use, injecting drugs, recent incarceration, sex solicitation, sex work, domestic violence, and sexual assault, and 75% of them were HIV-positive</li> <li>MMC provided a wide range of services, such as HIV testing and treatment, assistance with HIV treatment adherence (i.e., DAART), treatment for STDs, and screening and treatment for tuberculosis, hepatitis, hypertension, and diabetes.</li> </ol>	<p>Ability to describe other sources of healthcare utilization before, simultaneous with, or after MHC visitation.</p> <p>Does not describe linkages to care for patients who were effectively linked by MHC staff.</p> <p>Unable to track and report patients' mobility.</p> <p>MHC patients who solely use harm reduction services (e.g., condom or clean syringe distribution) were not included in clinical database.</p>
2	Billoux <i>et al.</i> , 2015	To determine whether patients in MHC ART clinics in rural Rakai District, Uganda, with slow initial virologic response to therapy maintained long-term viral suppression after targeted adherence interventions.	Observational-retrospective cohort	Quota sampling	Uganda	<ol style="list-style-type: none"> <li>92% had a 24-week viral load &lt; 400 copies/ml and were termed 'early suppressors'.</li> <li>'Late suppressors' achieved suppression at 48 weeks (5%). Most late suppressors, 71/85 (84%) remained suppressed well beyond 48 weeks, with median sustained suppression of 4.6 years (IQR: 3.7-5.5 years).</li> <li>Virological failure was (3%) termed non-suppressors. Patients receiving ART support, early viral load monitoring, and targeted adherence programs in resource-limited settings.</li> </ol>	<p>Strong causal inferences about the impact of adherence counselling on viral suppression in patients with persistent viremia precluded, and high rates of suppression could result from close monitoring of viral load itself, rather than the added counselling.</p>
3	Geoffroy <i>et al.</i> , 2014	To describe the feasibility of clinic operations, and utilization of expanded HIV and malaria services provided through donors specifically to assess: 1. Feasibility of service provision; 2. Volume of services and utilization by type of service provided in relation to age and sex; 3. HIV testing and counselling, and administration of cotrimoxazole preventive therapy (CPT) for HIV-positive; 4. Malaria screening and treatment.	Cross-sectional analysis of retrospective data	Purposive	Malawi	<ol style="list-style-type: none"> <li>MHCs operated for 675 (93%) of the 723 expected clinic days. Missed days were due to planning meetings (<math>n = 24</math>), vehicle servicing (<math>n = 10</math>), death of a clinical officer, a national day of mourning for the president's death (<math>n = 9</math>), and countrywide fuel shortages (<math>n = 5</math>).</li> <li>Large catchment area served by MHCs, long period of observation, and closely monitored and comprehensive record keeping.</li> <li>An average of over 100,000 patients' visits per year for primary healthcare, of which 75% were paired with health education.</li> <li><math>\leq 5</math> years, primary healthcare visits often included child growth monitoring.</li> <li>Visits for HIV counselling, testing, and pre-ART care represented roughly the same proportion of annual visits, between 9% and 12%. In each quarter, significantly more females than males were tested for HIV (<math>p \leq 0.001</math>). In contrast, in each quarter, significantly more males were found to be HIV-positive (<math>p \leq 0.001</math>): in total, 27% of males were HIV-positive compared with 14% of females.</li> <li>Of the 76,294 MHC visits in the 3 years for children aged <math>\leq 5</math> years, 26,421 (35%) were for malaria diagnosis and treatment.</li> </ol>	<p>Lack of comparative data from fixed clinics in the district, lack of qualitative data to explain the overall decline in patients' visits, and lower male participation, which limited the analysis in relation to season, age, and gender.</p>
4	Van Dijk <i>et al.</i> , 2014	To compare outcomes for children receiving care in mobile and hospital-affiliated HIV clinics in rural Zambia.	Prospective cohort	Purposive	Zambia	<p>Travel time to the outreach clinics was significantly shorter and fewer caretakers used public transportation, resulting in lower transportation costs and fewer obstacles accessing the clinic. Some caretakers and healthcare providers reported inferior quality of service provision at the outreach clinics. Sixty-eight children received ART at the outreach clinics compared to 41 children in the hospital-affiliated clinic group. At ART initiation, median age, weight-for-age Z-scores (WAZ), and CD4+ T cell percentages were similar for children in the hospital-affiliated and outreach clinic groups. Children in both groups experienced similar increases in WAZ and CD4+ T cell percentages.</p>	<p>A small sample size of 77 children.</p>

Table 3. Cont.

No.	Author(s), year	Aim/ Objective	Design	Sampling	Setting	Major findings	Limitations
5	Parker <i>et al.</i> , 2015	To evaluate the feasibility (population reached, costs) and effectiveness (positivity rates, linkage to care) of two strategies: community-based HIV testing and counselling (HTC) in rural Swaziland.	Cross-sectional	Quota sampling	Swaziland	<p>1. A total of 9,060 people were tested: 2,034 through M-HTC and 7,026 through HB-HTC. A higher proportion of children and adolescents (&lt; 20 years) were tested through HB-HTC than M-HTC (57% vs. 17%; <math>p &lt; 0.001</math>). M-HTC reached a higher proportion of adult men than HB-HTC (42% vs. 39%; <math>p = 0.015</math>). Of 398 HIV-positive individuals, only 135 (34%) were enrolled in HIV care within 6 months. Of 42 individuals eligible for antiretroviral therapy, 22 (52%) started treatment within 6 months. Linkage to care was lowest among people, who had tested previously and those aged 20-40 years. HB-HTC was 50% cheaper (US\$11 per person tested; \$797 per individual enrolled in HIV care) than M-HTC (\$24 and \$1,698, respectively).</p> <p>2. Community-based testing appears to be an effective and affordable way to improve HTC coverage in high-prevalence settings.</p> <p>3. M-HTC, although more expensive, can still be a useful strategy to reach specific target groups with poor access to HTC (e.g., young men or people with work-related barriers).</p>	Lack of availability of CD4+ or WHO staging to determine eligibility for ART in relation to linkage to care. Costing analysis was limited to the service provider's perspective.
6	Labhardt <i>et al.</i> , 2014	To test the hypothesis of higher HTC uptake in HB-HTC campaigns than in MC-HTC campaigns.	Cluster-randomized trial	Clustered sampling	Lesotho	<p>Of the 3,197 participants from 12 clusters, 2,563 (80.2%) were eligible (HB-HTC: 1,171; MC-HTC: 1,392). Results of the primary outcomes were as follows: Overall HTC uptake was higher in the HB-HTC group than in the MC-HTC group (92.5% vs. 86.7%; adjusted odds ratio [AOR]: 2.06; 95% CI: 1.18-3.60%; <math>p = 0.01</math>). Among adolescents and adults <math>\geq 12</math> years, HTC uptake did not differ significantly between the two groups; however, in children &lt; 12 years, HTC uptake was higher in the HB-HTC arm (87.5% vs. 58.7%; AOR: 4.91; 95% CI: 2.41-10.0%; <math>p &lt; 0.001</math>). Out of those in HTC, 114 (4.9%) tested HIV-positive, 39 (3.6%) in the HB-HTC arm and 75 (6.2%) in the MC-HTC arm (AOR: 0.64; 95% CI: 0.48-0.86; <math>p = 0.002</math>). Ten (25.6%) and 19 (25.3%) individuals in the HB-HTC and the MC-HTC arms, respectively, were linked to HIV care within 1 month after testing positive. Findings for secondary outcomes were as follows: HB-HTC reached more first-time testers, particularly among adolescents and young adults, and had a higher proportion of men among participants. However, after adjusting for clustering, the difference in male participation was not significant anymore.</p>	The campaigns' restriction to weekdays and a relatively low HIV prevalence among participants, the latter indicating that both arms may have reached an underexposed population.
7	Moon <i>et al.</i> , 2014	To report on 18 months of experience using one mobile clinic.	Report on lessons from the field	Purposive	Mozambique	<p>1. The mobile clinic strategy enabled the rapid start-up of HIV care and treatment at fixed-site clinics, while the clinics were being renovated for HIV services and their staff were being trained.</p> <p>2. Early engagement of health authorities to map out the resources needed for fixed clinics to function independently as well as engagement of community leaders to facilitate community acceptance of the mobile clinic strategy, were fundamental to program's success.</p> <p>3. Use of mobile clinic staff as mentors to the local clinic staff enabled the transfer of skills and rapid exit of the mobile clinic personnel, allowing mobile clinic to quickly move to new sites.</p>	Onsite unavailability of laboratory testing capacity.

Table 3. Cont.

No.	Author(s), year	Aim/ Objective	Design	Sampling	Setting	Major findings	Limitations
8	Barnabas <i>et al.</i> , 2016	To evaluate the relative effectiveness of enhanced linkage strategies for HIV-positive persons diagnosed through MHCs versus standard of care on clinically relevant outcomes of linkage to an HIV clinic, ART initiation and viral suppression.	Randomized multi-site open-label trial	Random	South Africa and Uganda	15,332 participants were tested; 1,325 HIV-positive individuals and 750 HIV-negative uncircumcised men were randomized to linkage strategies. Among HIV-positive persons, overall clinic linkage was 93% (1,218/1,303), but ART initiation was only in 37% (488/1,303). The proportion of patients, who were virally suppressed ranged from 47-52% (214/422 in the clinic referral arm, 219/419 in the clinic facilitation arm, and 202/431 in the lay counsellor follow-up arm; $p = 0.668$ and $p = 0.273$ , for the clinic facilitation and lay counsellor follow-up arms, respectively, compared with clinic referral). There was no difference in viral suppression at 9 months by study arm. In the male circumcision clinic referral (standard of care) arm, 62/224 men (28%) were circumcised, compared to 137/284 (48%) in the text message reminder arm (RR = 1.72, 95% CI: 1.36-2.17%), and 106/226 (47%) in the lay counsellor follow-up arm (RR = 1.67, 95% CI: 1.29-2.14%). All the community-based strategies achieved very high rates of linkage of HIV-positive persons to HIV clinics, approximately one-third of whom initiated ART, and approximately half were virally suppressed by 9 months. Clinic barriers to ART initiation must be addressed in future strategies to increase knowledge of HIV serostatus and linkage to HIV care. Uptake of male circumcision was almost two-fold higher among men, who received text message reminders or lay counsellor visits.	Lack of electronic clinic data to verify patient's profiles and ART compliance- relied on empty bottles and clinic cards for the information. A substantial proportion (311/1,325, 24%) of HIV-positive persons enrolled in the study had a suppressed viral load at enrolment, despite reporting that they were not on ART (an inclusion criterion for the study).
9	Sanga <i>et al.</i> , 2017	To assess linkage into care among newly diagnosed HIV-positive individuals tested through outreach and facility-based HIV testing model.	Prospective mixed-method cohort	Random sampling	Tanzania	At the end of 6 months, 78% of all respondents had been linked into care, with differences across testing models. 84% (CI: 81-87%, $n = 512$ ) of individuals tested at the facility-based site were linked to care compared to 69% (CI: 65-74%, $n = 281$ ) of individuals tested at mobile/ outreach facility. The median time to linkage was 1 day (IQR: 1-7.5) for the facility-based site and 6 days (IQR: 3-11) for mobile/outreach sites. Participants tested at the facility-based site were 78% more likely to link than those tested at mobile/outreach, when other variables were controlled (AHR = 1.78; 95% CI: 1.52-2.07%). HIV status disclosure to family/relatives was significantly associated with linkage to care (AHR = 2.64; 95% CI: 2.05-3.39%).	1. Not able to see all patients during the study period, despite efforts to track them through telephone calls by the study team, CTC, and community-based healthcare providers in their respective areas. 2. Not able to ascertain the exact name of the linkage site and linkage beyond the study sites. 3. Random selection of facility-based sites yielded a sample where all facilities had on-site CTCs.
10	Bassett <i>et al.</i> , 2014	To assess HIV prevalence, disease stage, and linkage to HIV care following diagnosis at a mobile HIV testing unit, compared with results for clinic-based testing.	Prospective cohort study	Purposive	South Africa	6,957 subjects were tested for HIV (4,703 mobile and 2,254 clinic); 55% were females. Mobile testers had a lower HIV prevalence than clinic testers (10% vs. 36%, respectively), were younger (median: 23 vs. 27 years, respectively), and were more likely to live > 5 km or > 30 min from the clinic (64% vs. 40%, respectively; all $p < 0.001$ ). Mobile testers were less likely to undergo CD4+ testing (33% vs. 83%, respectively), but more likely to have higher CD4+ counts [median (interquartile range) 416 (287-587) cells/ $\mu$ l vs. 285 (136-482) cells/ $\mu$ l, respectively] than clinic testers (both $p < 0.001$ ). Of those who tested HIV-positive, 10% of mobile testers were linked to care vs. 72% of clinic testers ( $p < 0.001$ ).	1. Linkage to care may have been underestimated since the assessment of linkage to care was only conducted at IPHC, therefore clinic and mobile testers; however, could have been linked to care at other sites providing HIV services. 2. Use of programmatic data, which did not allow to assess patient-identified barriers to linkage to care.



Table 3. Cont.

No.	Author(s), year	Aim/ Objective	Design	Sampling	Setting	Major findings	Limitations
11	Wasantioo-papokakorn <i>et al.</i> , 2018	To evaluate the effectiveness of HIV prevention program for linkage to care, following HIV testing in MHC for MSM and transgender women.	Descriptive evaluation	Purposive	Thailand	1. HIV testing among MSM and transgender women increased during the PREV program. 2. Peer involvement expanded access to young high-risk MSM and transgender women.	No comparison group was available. Some HIV cases diagnosed in the program did not register at diagnosis, hindering knowledge whether ART was initiated or not and retained in care. CD4+ count test as proxy for linkage to care.
12	Bajunwe <i>et al.</i> , 2020	To measure waiting time, adherence and viral load before and at 12 months after the mobile antiretroviral therapy and HIV care (MAP-HC) implementation.	Descriptive evaluation	Consecutive	Uganda	The proportion of patients who missed ART dose in the last 30 days dropped from 20% to 8.5% at 12 months post-intervention ( $p = 0.009$ ), and those with detectable viral load dropped from 19.9% to 7.4% ( $p = 0.001$ ); however, mean waiting time increased from 4.48 to 4.76 hours ( $p = 0.13$ ).	Some of the patients involved in the pre-intervention assessment were not necessarily involved in the post-intervention VL and adherence measurement sample. Cost-effectiveness analysis was not conducted for the intervention program as well as distance to travel was not measured.
13	Hatcher <i>et al.</i> , 2012	To determine linkage to HIV care following community-based HIV diagnosis.	Cross-sectional cohort	Purposive	Kenya	Cumulative linkage to HIV care and treatment was high: 63.2% enrolled within 3 months of the campaign; 81.4% enrolled by the time of follow-up interview 10 months later (83.4% of women and 75.6% of men; Pearson $\chi^2 = 3.79$ for linkage by sex; $p = 0.052$ ). Median time to enrollment was one month, and interquartile range was 0-6 months. A total of 72 men (56.7%) and 217 women (61.0%) received PLWHA visits for 10 months. Neither proportion nor frequency of PLWHA visits differed significantly between men and women. The association between better health and enrolling in care strengthened over time to 5 months (AHR = 1.62; 95% CI: 1.55-1.69%) and 10 months (AHR = 1.71; 95% CI: 1.60-1.82%). There was also a positive association between travel time to a clinic of choice and enrollment (AHR = 1.26; 95% CI: 1.04-1.54%), meaning women who reported a further distance to the clinic were more likely to enroll over time.	The study followed HIV-positive persons prospectively from time of diagnosis, but had access to only a minimal amount of data collected by the HCT campaign at the time of testing. Lack of exact date of diagnoses and enrollment decreased the precision of measurement of time to enrollment.
14	Maughan-Brown <i>et al.</i> , 2019	To assess linkage to care and ART uptake following ART-referral by a mobile clinic in Cape Town.	Multi-method	Purposive	South Africa	Study results demonstrate low rates of rapid ART initiation (42% of participants started ART within 3 months) following ART referral from a mobile clinic.	It is possible that incomplete matching of study participants to clinic records could have resulted in an error in the measurement of linkage to care and ART initiation. Inconsistencies in the provision or data capture of names and dates of birth between study and clinic records.
15	Gorman <i>et al.</i> , 2015	To evaluate: 1. Retention in HIV treatment; 2. Change in CD4+ count; 3. Adherence to ARVs; 4. Number of deaths of patients attending the mobile health clinic compared to those at the district hospital.	Retrospective non-experimental, observational	Purposive	Kenya	Overall, the groups did not differ in initial CD4+ counts at baseline. However, patients not on ARVs in the mobile clinic group ( $n = 60$ ) had significantly lower CD4+ counts at baseline than patients not on ARVs in the hospital group ( $n = 23$ ; 339.3 vs. 469.4, $df = 81$ , $t = 2.05$ , $p = 0.043$ ). Retention did not differ significantly between the two groups (mean for hospital: 0.71, $n = 54$ ; mean for mobile clinic: 0.77, $n = 124$ ). Mortality was also not statistically significantly different between the two groups. Change in CD4+ count was also not statistically significantly different, with a mean change of 1.72 for the hospital ( $n = 30$ ) and 1.88 for the mobile clinic groups ( $n = 61$ ). The mean number of ARV medication pills remaining in the last seven days for the hospital group ( $n = 26$ ) was 4.5 and for the mobile group ( $n = 57$ ) was 4.7, a non-significant difference.	Study design restricted the use to make certain inferences.

Table 3. Cont.

No.	Author(s), year	Aim/ Objective	Design	Sampling	Setting	Major findings	Limitations
16	Govindasamy et al., 2011	To assess the proportion and characteristics of individuals, who accessed HIV care after testing HIV-positive in MHC.	Non-experimental retrospective observational cohort	Stratified random	South Africa	<ol style="list-style-type: none"> <li>1. A total of 6738 records of individuals accessing mobile service (51.2% females). The overall prevalence of those newly diagnosed with HIV was 6.9% (463/6,738). Only 376 (81.2%) of newly diagnosed HIV-positive individuals met study's inclusion criteria. A stratified random sample (<math>n = 192</math>) was then drawn from this cohort (<math>n = 376</math>): 36/36 individuals with CD4+ count <math>\leq 200</math> cells/<math>\mu</math>l, 80/ 80 cases with CD4+ counts between 201-350 cells/<math>\mu</math>l, and 30% of individuals with CD4+ counts <math>&gt; 350</math> cells/<math>\mu</math>l (76/260) were sampled.</li> <li>2. There was an inverse relationship between CD4+ count result and linkage to care: all patients with CD4+ counts <math>\leq 200</math> cells/<math>\mu</math>l were linked to care; however, 66.7% and 36.4% of those with CD4+ counts between 201-350 cells/<math>\mu</math>l and <math>&gt; 350</math> cells/<math>\mu</math>l, respectively, were linked to care. Among those who accessed care, the majority (71.0%) stated that the mobile unit's referral letter facilitated their linkage to care at a public health-care facility. The overall mean time from diagnosis to accessing HIV care was 2.2 months. Patients with CD4+ counts <math>\leq 200</math> cells/<math>\mu</math>l took on average less than a month (3 weeks) to access care, whereas those with CD4+ counts <math>&gt; 350</math> cells/<math>\mu</math>l took a mean time of 3 months. Of those with CD4+ counts <math>\leq 200</math> cells/<math>\mu</math>l, 69.2% started ART within 2 months of diagnosis, and the remaining 30.8% were within ART screening process.</li> <li>3. Among the 49 patients, who were linked to care, 43 (88%) provided additional consent to access their clinic folders at respective public healthcare facilities. Eight (19%) of these folders were untraceable. Validation of the 35 (81.4%) clinic folders, which were traced showed that sensitivity of self-reported linkage to care was excellent (100%). Those contactable patients with CD4+ counts <math>&gt; 350</math> cells/<math>\mu</math>l were 0.49 times less likely to link to care compared to individuals with CD4+ counts <math>\leq 350</math> cells/<math>\mu</math>l (95% CI: 0.27-0.87%). In a bivariate analysis, individuals who had TB symptoms and those who had disclosed their HIV status were more likely to link to care, whereas those employed were less likely.</li> <li>4. The most common stated barrier (41.4%) to linking to care was the inability to access public healthcare facilities during working hours, and many participants reported they could not get time off work. Other barriers included fear of toxicity and side effects of ART (12.6%) as well as stigma and fear of disclosure (8.8%).</li> </ol>	<p>The small sample size limited the power to detect associations, particularly in the group of individuals with CD4+ counts <math>\leq 200</math> cells/<math>\mu</math>l.</p> <p>Multivariate analysis for the assessment of predictors of linkage to care could not be conducted due to insufficient power. Notably, 42.4% of the eligible participants were not tracked despite multiple follow-ups attempts, which might have resulted in a biased estimate.</p> <p>The strata with <math>&lt; 200</math> and <math>&gt; 350</math> CD4+ cells/<math>\mu</math>l had the greatest proportion of uncontactable patients.</p>
17	Govindasamy et al., 2013	To assess the number of clients newly diagnosed with HIV, TB symptoms, diabetes and/or hypertension, and linkage to HIV and other chronic disease care in MHC.	An observational cohort study	Stratified sampling	South Africa	<ol style="list-style-type: none"> <li>1. Overall, 51.3% were linked to care within the prescribed timeframe for each CD4+ stratum: (<math>\leq 200</math> cells/<math>\mu</math>l: 37.5% <math>\leq 1</math> month; 201-350 cells/<math>\mu</math>l: 53.0% <math>\leq 3</math> months; <math>\geq 351</math> cells/<math>\mu</math>l: 53.1% <math>\leq 6</math> months). In sensitivity analysis, 60% of participants accessed care at some point. Of the 18 ART eligible patients that were linked to care within a month, 15 (83.3%) started ART.</li> <li>2. Controlling for CD4+ count, newly-diagnosed HIV-infected individuals who had disclosed their HIV-positive status to their family member or partner were 2.6 times more likely to link to HIV care than those who had not (95% CI: 1.04-6.3%).</li> <li>3. Participants reported the following as the main reasons for failing to link to HIV care: lost referral letter (18.8%), insufficient time during the day to attend a clinic (15.6%), and re-location (12.5%).</li> <li>4. The majority of TB suspects, diabetics, and hypertensives, who failed to link to care reported having insufficient time to attend a weekday clinic due to competing priorities during the day (TB suspects: 70.5%, diabetics: 50.0%, hypertensives: 68.9%).</li> </ol>	<p>A larger proportion of patients screened did not meet the strict eligibility criteria for the assessment of linkage to care due to several reasons, and thus, linkage was only assessed in 10% (<math>n = 777</math>) of those screened. Sampling bias might have been introduced as it was not feasible to sample all HIV-infected subjects in the CD4+ <math>\geq 201</math> cells/<math>\mu</math>l stratum in newly-diagnosed in 2011, since follow-up could only commence once the recommended timeframe for linkage had lapsed (i.e., after three to six months post-diagnosis). The small sample size in the CD4+ <math>\leq 200</math> cells/<math>\mu</math>l stratum and the diabetes group resulted in limited power to detect associations.</p>

Table 3. Cont.

No.	Author(s), year	Aim/ Objective	Design	Sampling	Setting	Major findings	Limitations
18	Kohli <i>et al.</i> , 2012	To examine the expansion of MHC services to gender-based violence survivors and their partners.	Descriptive study	Purposive	Congo	HIV test was offered to all 772 women who visited the MHC, 714 (93%) gave consent for an HIV test. 1.8% of 714 were HIV-positive, and health assessments and laboratory tests as appropriate were conducted; 84% had symptoms consistent with an STI. About 40% of the survivors were diagnosed and treated with other illnesses, including malaria, urinary tract infections, intestinal parasites, and chronic pain.	1. Services were limited to women over 20. 2. Cost-effectiveness of the service has not been done. 3. Challenge to reach their male partners for treatment of STI's.
19	Kojima <i>et al.</i> , 2017	To demonstrate that MHCs are feasible and acceptable models to deliver education and antenatal care with HIV/sexually-transmitted infection (STI) testing and management of pregnant women.	Descriptive	Purposive	India	A total of 1,675 (76%) from 2,211 pregnancies in 144 villages received antenatal care from the mobile clinic, with 1,639 (97.85%) women consenting to counsel and testing for HIV along with all other routine investigations. All women who were tested for HIV also received their post-test counselling and test results (100%). Of the tested women, 14 (0.9%) were found to have new HIV infections, and received management to prevent vertical transmission of HIV. Those women were also accompanied to the tertiary care facility to ensure they had access to antiretroviral therapy through the government-sponsored treatment programs. Of the newborns born to HIV-positive mothers, seven (50%) were HIV-negative, three (21%) were deceased, and four (29%) did not have data available. Six women (0.4%) tested positive for hepatitis B and two (0.1%) women tested positive for syphilis serology. Bacterial vaginosis was diagnosed in 97 (5.9%) women. Among the women, 306 (18.7%) were mildly anemic, 381 (23.2%) had moderate to severe anemia, and 94 (5.7%) had hypertension.	Initially, there was a lack of community participation and involvement. High staff turnover of physicians and nurses.
20	Kranzer <i>et al.</i> , 2012	To assess feasibility, uptake, yield, treatment outcomes, and costs of adding an active tuberculosis case-finding programme to an existing mobile HIV testing service.	Cross-sectional	Purposive	South Africa	1. A total of 1,385 individuals (21.7% of all adults accessing the service) were eligible for TB screening through sputum induction: 627 were HIV-negative, 370 were newly diagnosed HIV-positive, and 388 were known HIV-positive. 2. Median BMI was 24.4 (IQR: 21.4-29.4). A quarter of individuals had a history of previous TB. The median CD4+ count was 434 cells/ml (IQR: 316-617) in newly HIV-diagnosed, and 403 cells/ml (IQR: 288-570) in known HIV-infected individuals. 40% of the known HIV-infected individuals were on antiretroviral therapy (ART) at the time of screening, with a median time on ART of 3.1 years (IQR: 1.1-6.5). 3. A total of 160 (55.6%) of newly HIV-diagnosed and 162 (52.6%) of known HIV-infected individuals screened positive for TB symptoms. 4. Among newly diagnosed with HIV individuals, TB prevalence was 2.2% (95% CI: 0.9-4.2%) for smear-positive and 4.9% (95% CI: 2.9-7.6%) for the culture-positive disease. Prevalence was 0.3% (95% CI: 0-1.4%) for smear-positive and 3.1% (95% CI: 1.6-5.3%) for culture-positive TB in individuals with known HIV infection. 5. TB prevalence was highest in HIV-infected patients with CD4+ counts of 200 cells/ml (18.6%; 95% CI: 9.7-30.9%), followed by patients with missing CD4+ counts (7.7%; 95% CI: 0.9-25.1%). TB prevalence was 5.3% (95% CI: 2.0-11.1%), 4.3% (95% CI: 1.6-9.1%), and 2.8% (95% CI: 0.9-6.3%) in HIV-infected patients with CD4+ counts of 201-350, 351-500, and > 500 cells/ml, respectively.	Study conducted at a single study site; the findings can therefore only be generalized to similar settings with comparable levels of deprivation and TB prevalence.

Table 3. Cont.

No.	Author(s), year	Aim/ Objective	Design	Sampling	Setting	Major findings	Limitations
21	Larson <i>et al.</i> , 2012	To assess the proportion of patients, who completed their referral visit within 8 weeks of HIV testing in MHC, and to evaluate the impact of including POC CD4+ testing on the proportion of patients completing the referral visit within 8 weeks of HIV testing.	Retrospective pilot	Purposive	South Africa	A total of 508 adult patients were diagnosed with HIV in the MHC during the study period. Their median age was 33 years (IQR: 25-40), 59.6% were women, and 39.9% reported having tested previously for HIV. 311 patients (61%) were offered the opportunity to have a POC CD4+ test, while 197 (39%) were not. There were no large differences in age, gender, and previous HIV testing experience between those offered POC CD4+ test and those not. The mobile program successfully contacted by phone 197 out of the 311 patients offered POC CD4+ test (63.4%) and 122 out of 197 not offered the test (61.9%). No differences in successful contact between the testing groups or by age or previous HIV testing experience. Women were more likely to be contacted than men (RR: 1.21; 95% CI: 1.04-1.40%). For the 197 patients offered POC CD4+ test, who were successfully followed-up by phone, 117 (59.4%) reported completing their referral visit within 8 weeks of HIV testing. Among patients not offered the POC test, 57 out of 122 (46.7%) reported completing the referral visit within 8 weeks.	1. There was no explicit randomization of patients to the two testing groups (offered POC CD4+ test or not). 2. Follow-up was limited to phone calls placed 8 weeks after HIV testing. 3. The reliance of study on self-reported completion of the referral visit.
22	Nakigozi <i>et al.</i> , 2011	To assess the acceptance of HIV results and uptake of HIV care services by MHC, and to examine factors associated with non-use of services to have an improved understanding of factors affecting HIV-related health-seeking behavior at the population level to design more effective HIV prevention and care strategies.	Cohort survey	Purposive	Uganda	1. A total of 12,216 participants were enrolled, and 1,451 (11.9%) were found to be HIV-positive. Of the HIV-positive participants, 45 refused to learn their HIV results (3.1%), and 261 had not received their HIV results more than six months before data closure. Therefore, a total of 306 HIV-positive cases were excluded from further analysis. The remaining 1,145 (78.9%) HIV-positive persons had received their HIV results, and were referred for HIV care more than six months before the closure of the dataset. At the time of data closure, 361 of the 1,145 eligible persons (32%) had not yet enrolled in HIV care. 2. Non-enrollment into care was significantly higher among men compared to women (adj. PRR: 1.40; 95% CI: 1.10-1.78%; $p = 0.006$ ). Other factors significantly associated with non-enrollment into care included younger age (15-24 years, adj. PRR = 1.47; 95% CI: 1.15-1.89%) compared to persons 25 and 34 years (adj. PRR = 2.22, 95% CI: 1.64-3.00%) or age between 35 years or older; living alone (adj. PRR = 2.22; 95% CI: 1.57-3.15%), or in households with 12 co-residents (adj. PRR = 1.63; 95% CI: 1.31-2.03%) compared to three or more co-residents (CD4+ count > 250 cells/ml; adj. PRR = 1.81; 95% CI: 1.38-2.46%). Median (IQR) CD4+ count was lower among participants in care (388 cells/ml; IQR: 211-589) compared to those not enrolled (509 cells/ml; IQR: 321-754).	The use of secondary data resulted in inability to explore some factors, such as health beliefs, distance to health unit, etc., which have been identified as important factors for healthcare utilization.

Table 3. Cont.

No.	Author(s), year	Aim/ Objective	Design	Sampling	Setting	Major findings	Limitations
23	Nglazi <i>et al.</i> , 2012	To assess the effectiveness of incentivized mobile HCT in reaching unemployed men in Cape Town, South Africa.	Retrospective observational	Non-random	South Africa	<p>1. Men testing positive in the non-incentivized mobile services were compared with those testing positive in the incentivized services. Age was similar in newly diagnosed HIV-positive incentivized and non-incentivized testers. Laboratory CD4+ count data were available for 92.5% (571/227) of incentivized testers and 82.3% (227/276) of non-incentivized testers. Incentivized mobile testers had a higher prevalence of CD4+ counts <math>\leq 200</math> cells/<math>\mu</math>l compared to non-incentivized mobile testers (14.9% vs. 7.5%; <math>p = 0.027</math>). The proportion of individuals with WHO stage III and IV at diagnosis was higher among incentivized (21.4%) compared to non-incentivized testers (16.6%; <math>p = 0.101</math>). Similar results were observed in sub-analyses of self-reported first-time testers only and repeat testers only.</p> <p>2. Among those men testing at the mobile clinic, there was no difference in BMI, STI, and age between incentivized and non-incentivized testers.</p> <p>3. Whilst the employment status of men attending the incentivized service was known, that of those attending the mobile non-incentivized service and the stationary clinic was unknown, although the underserved communities where the mobile service operated presented high unemployment rates in general.</p>	<p>1. The associations observed in this study were potentially confounded by differences in the target population for each service, since the study was observational and non-randomized in nature.</p> <p>2. The mobile service under incentivized testing conditions reached men seeking employment and therefore, these men may have a compromised socio-economic status, whereas the mobile service under non-incentivized testing conditions attracted voluntary male patients, who may thus be described as the 'worried well'. Men accessing the primary healthcare clinic were presumably attending for specific health-related issues or specific perceptions of HIV risk.</p> <p>3. The study lacks data on linkage to care in newly diagnosed HIV-positive non-incentivized and incentivized testers.</p>
24	Schwartz <i>et al.</i> , 2017	To analyze ART uptake for female sex workers, following HIV-positive diagnosis in MHC.	Cross-sectional	Respondent-driven sampling	South Africa	<p>1. Overall, 435 women were screened for eligibility. Twenty-five women did not meet eligibility criteria, and 410 FSWs, including nine 'seeds,' were enrolled.</p> <p>2. HIV prevalence in the sample population was 63.7% (95% CI: 59.0-68.3%) and RDS-weighted estimate of 61.5% (95% CI: 54.1-68.0%). Syphilis was common among study participants, with 20.3% in the sample tested positive for syphilis (95% CI: 16.3-24.2%), yielding an RDS-weighted estimate of 17.1% (95% CI 12.1-22.1%).</p> <p>3. Among the 261 FSWs living with HIV, 99% reported having ever tested for HIV, and majority (82%, <math>n = 214/261</math>) reported a prior HIV diagnosis. ART ineligibility accounted for a 9% loss in the cascade, and the median CD4+ cell count was 407 (IQR: 250-589). Overall, 45% (<math>n = 117</math>) had ever been initiated on antiretrovirals (ARVs), and 39% of those living with HIV reported current ART use (<math>n = 102</math>), which was primarily accessed at government clinics (95%). Among those previously diagnosed with HIV, 48% (<math>n = 102/214</math>) were currently on ART. Considering the 102 FSWs on ART, self-reported adherence data (number of days of missed treatment in the past 30 days) were available for 100. Half (50%) of the FSWs reported <math>\geq 95\%</math> ART adherence during the past 30 days; 76% reported <math>\geq 80\%</math> adherence. Among the 10 HIV-positive pregnant women with available viral loads, none were virally suppressed at the lowest detection limit of <math>&lt; 50</math> copies/ml, and 2/10 had viral loads <math>&lt; 1,000</math> copies/ml. ART initiation was the biggest absolute loss in the treatment cascade, with a 37% overall loss in the cascade and a 28% loss among ART-eligible FSWs. Correlation of ART use was thus assessed among ART-eligible women with a prior HIV infection diagnosis.</p> <p>4. In a multivariate analysis, women who had engaged in mobile health services were nearly 30% less likely to be on ART (adjusted prevalence ratio [aPR] 0.71; 95% CI: 0.57-0.89%).</p>	<p>1. Lack of availability of viral load data for all women and reliance on self-report for prior HIV diagnosis and ART use.</p> <p>2. Another potential concern is whether the study oversampled those already engaged in care. RDS leverages peer networks to try and reach those currently not reached by services.</p> <p>3. Two-thirds of women reached had not engaged in mobile HIV testing or care services in the past 12 months.</p> <p>4. Interpretations of associations with ART use were limited by the cross-sectional nature of data and potentially missing measures of structural barriers to care.</p>



Table 3. Cont.

No.	Author(s), year	Aim/ Objective	Design	Sampling	Setting	Major findings	Limitations
25	Freeman-Romilly <i>et al.</i> , 2017	To investigate if patients diagnosed in mobile community clinics have higher baseline CD4+ cell counts than those diagnosed in genitourinary medicine (GUM)/HIV clinics.	Retrospective cohort	Purposive	UK and Wales	<p>1. Two-hundred and fourteen people received a reactive HIV diagnosis in the study period (2.0%). Seventy-four (36%) fit the inclusion criteria of being newly diagnosed and subsequently confirmed as accessing HIV treatment in England or Wales. Thirty-six patients were already aware they were HIV-positive at the time of their community clinic test, and 104 patients could not be linked to a subsequent baseline CD4+ cell count. The mean baseline CD4+ cell count of patients who tested positive in a TH1 community clinic was 84 cells/mm<sup>3</sup>, higher than that of patients diagnosed at the referral hospitals' GUM/HIV clinics (<math>p = 0.014</math>).</p> <p>2. Wilcoxon signed-rank tests showed that community-tested patients were significantly more likely to have higher CD4+ cell counts than the national population. Fifty-nine community-tested patients had CD4+ cell counts higher than the national median, while 20 patients diagnosed in community clinics were significantly more likely to be diagnosed at a baseline CD4+ &gt; 350 cells/mm<sup>3</sup> than patients diagnosed in clinical settings. This effect was not replicated for baseline CD4+ cell count &gt; 500 cells/mm<sup>3</sup>. T tests controlling for sexuality, ethnicity, and gender found that MSM diagnosed in community settings had significantly higher baseline CD4+ cell counts than patients tested in clinical settings, and were significantly more likely to be diagnosed at a baseline with CD4+ &gt; 350 cells/mm<sup>3</sup>.</p>	<p>1. The study was dependent on patients providing the community-testing site with the same information they used if they sought HIV care. If they provided different information, linking their baseline CD4+ cell count was not possible.</p> <p>2. This study did not investigate why patients appeared to be testing at community clinics at an earlier stage of HIV infection than those testing in clinical settings.</p>

attitudes. It also ensures that ethical, compassionate, and competent care is delivered [22, 33, 43, 44]. This capacitation of individuals would ensure continuity and retention of people in care for longer time. Training of non-health workers or lay-persons as peer educators have been an important issue, since most success stories of community HIV programs can be attributed to their existence [16, 20, 22], as patients find it easy to relate to them as opposed to healthcare workers who may be unknown to them. World Health Organization recommends that trained and supervised lay-providers offer HIV testing and ART [46], suggesting that peers can play a greater role in the provision of HIV services.

The commendable thing about the startup of HIV care and support services by MHCs has been the delivery of competent care, which has been achieved through training. Donors can fund staff development needs and as a result, the specialized care benefits both staff and patients. Furthermore, the general community also benefit through job training and employment opportunities to various positions not limited to caregivers, counsellors, tracers, etc. [27, 33, 34]. For instance, in India, a MHC clinic was mainly utilized for health promotion, education, and care, but through its' educational function, nearly 700 community workers and 100 healthcare providers were trained [34].

#### Theme 4: Excellent platform to reach otherwise marginalized populations and expanding healthcare access

MHC played a critical role in reaching out to hard-to-reach populations that sometimes have a low health-seeking behavior, including men, transgender women, men who have sex with men, transactional sex workers, bisexuals, psychiatrics, gender-based violence survivors, and substance drug users [14, 20, 22, 32, 33, 35, 45]. All these populations are at high-risk for HIV infection and require greatest HIV support and care, which is mostly possible through dedicated MHC service.

Mobile health clinics in HIV care delivery have been shown to be the most successful and instrumental in screening for early diagnosis and prevention of HIV. Up to 97% of HIV screening has been reported in MHCs [39, 40]. This is vital in ensuring that the ambitious 90-90-90 strategy is achieved. Moreover, in the literature, it was shown that MHCs tend to attain hard-to-reach populations, such as men [23, 31, 35, 43, 47-49] and those with early infections with relatively good immunological status [19, 35]. This is very important, since HIV counselling and testing (HCT) is a fundamental component of HIV care and prevention [49]. This means that MHCs can be rolled out fully in respect to HIV care and support, as they have a potential of reaching hard-to-reach populations through tradition hospital care models, in which most of the patients who present to a hospital have already advance disease that is usually costly to manage, as opposed to the ones generally found at MHCs. Furthermore, it would ensure more patients are put on treatment, as national guidelines have evolved towards initiating ART for all people living with HIV regardless of clinical and immunological

status [45]. Several studies have shown evidence that retention in care through MHCs was good [14-16, 33, 37, 41].

### **Theme 5: Possible multi-health program delivery**

HIV-infected individuals tend to have various health problems based on HIV pathogenesis. MHCs have demonstrated the ability to address such problems through various specific programs incorporated to HIV care and support services. This ensures that a meaningful specific, yet comprehensive and responsive healthcare is provided, which includes but is not limited to psychological counselling, malaria, long-lasting insecticidal nets [19,31], psychiatric illnesses, substance abusers, specific STI screenings, TB [14, 19, 25, 27, 28, 33, 34, 39], maternal and child services [11, 12, 34], voluntary male medical circumcision, transgender women, female sex workers and MSM [32, 35, 45], men [14, 23], point-of-use water purification [19], gender-based violence interventions [33], nutritional support [37], and basic disease chronic care [25, 28, 33, 39].

### **Theme 6: Implementation of critical viable point-of-care services**

Critical point-of-care (POC) services, such as viral load and CD4+ count monitoring tests, have been the backbone in the management of people living with HIV (PLWH) embedded in HIV clinical management guidelines. Therefore, ideal and effective HIV care services should put them in their place. MHCs in Kenya [19, 37], South Africa [21, 27, 28, 39], United Kingdom [32], and Uganda [15], amongst others, demonstrated the need and effectiveness of these POC services, where turnaround time for results ranged from 3 hours to a day. This significantly improves linkage to care following the diagnosis, since in the cascade from HIV testing to care, one area of attrition is the delivery of CD4+ count [25]. Ninety percent service acceptance by patients was reported [21], and with availability of ART in MHCs, it increases improvement in viral suppression and adherence, as structural barriers and distance were eliminated [15].

### **Theme 7: Follow-up care leads to successful health outcomes for patients attending MHCs**

Effective health outcomes for MHCs patients receiving HIV care are achievable, not only with clinic visits, but also by MHCs teams making conscious efforts to contact all the affected patients via telephone or home visits [25, 27]. This strengthens the relationship between patients and healthcare system, resulting in a trusted partnership. Such follow-ups were done by members employed in MHCs, and the care becomes more personal and individualized. Various studies have reported positive attributes regarding follow-up care matched against outcomes [19, 21, 27, 32, 38, 41].

## **Discussion**

Decentralization and expansion of HIV and care support to MHCs are essential, especially towards the attainment of universal healthcare coverage. With positive results reported on utilization of MHCs in HIV testing, enthusiasm can be maintained towards ensuring that universal HIV care and support services are provided fully, and can even be expanded to contextual HIV support service, which would ensure comprehensive contribution to the services needed by PLWH.

In the South African context, no studies reported on providing all four components of universal HIV care services by mobile health clinics. Meanwhile, advocacy for HIV care and support services provision is needed to curb barriers, such as long-distance travel, with no transport nor fees. Whereas it has been identified in literature that long wait time, work commitments, lack of money for transportation as well as food insecurity are barriers to uptake and avoidance of HIV service provision, while MHCs reduced majority of the barriers [50].

HIV care and support through MHCs can significantly lead to a decrease in HIV-related morbidity and mortality; therefore, deployments of NIMART services through decentralization is essential, especially in the South African and broader Africa context, where people needing HIV care and support services still are hard to reach, and often further located, if not isolated from a healthcare system and facility. Based on gaps identified in terms of providing universal HIV care and support within MHCs, it is understood that there is a need for such models of HIV delivery to be implemented, supported, and improved internationally as well as developing context-specific frameworks and models.

## **Strengths and limitations**

The strength of this review is that all the studies that met the inclusion criteria were diverse, from various source countries, and spread through different continents. The review selection process was undertaken by three different independent readers, who reached an agreement on the selection of studies to be included.

Limitations include the type of sampling methods used in the eligible studies. Most of the studies employed non-probability sampling methods, which are known to have a higher risk of sampling bias. Furthermore, the study exclusion criteria posed limitations, since only English-written articles were considered. Additionally, papers, which did not have open access and were not accessible to the reviewers, if such articles had been included, they would have made a difference in this study outcomes.

## **Recommendations**

The following are the recommendations based on this review:

- Adoption of universal HIV care and support by all MHCs should be considered as a basic minimum requirement

in HIV management to ensure every person living with HIV receives appropriate minimum care.

- HIV care provision through MHCs should be incorporated as a part of the district response to ensure the population coverage is achieved by the district, which would lead to better health outcomes.
- MHCs can address many barriers of HIV services and incorporation of regional endemic health response in their delivery, so that total healthcare needs of the local population are holistically met.
- Implementation of universal HIV care in rural areas is achievable through the involvement of community leaders, providers, traditional healers, and patients, since rural communities respect authority from their leaders; therefore, easy uptake of the programme would be achieved if leaderships are involved.

## Conclusions

In the current review, it was demonstrated that HIV care and support is successfully rendered through MHCs in a fragmented fashion; therefore, careful planning of HIV care and support services is of paramount importance to maximize care for the targeted population. It has been demonstrated that multiple focused HIV programs can be rendered at once for the community through multiple stakeholders' involvement.

## Conflict of interest

The authors declare no conflict of interest.

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