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Bringing care to the community: expanding access to health care in rural Malawi through mobile health clinics

E. Geoffroy, A. D. Harries, K. Bissell, E. Schell, A. Bvumbwe, K. Tayler-Smith, W. Kizito

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Setting: Malawi has chronic shortages of health workers, high burdens of human immunodeficiency virus (HIV) infection and malaria and a predominately rural population. Mobile health clinics (MHCs) could provide primary health care for adults and children in hard-to-reach areas.

Objectives: To determine the feasibility, volume, and types of services provided by three MHCs from 2011 to 2013 in Mulanje District, Malawi.

Design: Cross-sectional retrospective study.

Results: The MHCs conducted 309,492 visits for primary health care, and in 2013 services operated on 99% of planned days. Despite an improvement in service provision, overall patient visits declined over the study period. Malaria and respiratory and gastro-intestinal conditions constituted 60% of visits. Females (n = 11,543) significantly outnumbered males (n = 2481) tested for HIV, yet males tested HIV-positive (27%) more often than females (14%). Malaria accounted for 26,421 (35%) visits for children aged <5 years, with a significant increase in the rainy season. Implementation of rapid diagnostic testing was associated with a decline in numbers treated for malaria. Antibiotic stockouts at government clinics were associated with increased MHC visits.

Conclusion: MHCs can routinely provide primary health care for adults and children living in rural Malawi and complement fixed clinics. Moving from a complementary role to integration within the government health system remains a challenge.

In most low-income countries, access to affordable basic primary health care is limited. In Malawi, 84% of the population lives in rural villages, located far from fixed government health facilities. The distance that villagers travel to access health care adversely affects health-seeking behaviors and health outcomes, particularly in a country where the prevalence of human immunodeficiency virus (HIV) infection is 10% and malaria incidence is 34,000 per 100,000 population annually. Only 46% of Malawians live within 5 km of a health facility. Deaths resulting from the acquired immune-deficiency syndrome (AIDS) are a major contributing factor to health care worker shortages and limit the capacity of the health system to deliver services. Government health facilities are chronically understaffed—51% of Ministry of Health (MOH) established health care worker positions were reported vacant in 2011. Moreover, a study by Oxfam in 2012 found that only 9% of local health facilities had the full essential health package of drugs, and that clinics were frequently out of basic antibiotics and HIV test kits.

Although mobile health clinics (MHCs) often provide targeted health care services to vulnerable populations in both high- and low-income countries, limited evidence exists of their use and effectiveness in improving delivery of health services. In an attempt to increase the visibility of MHC utilization and its impact on the health care system, one study from the United States reviewed data from 1500 MHCs and found them to be effective in targeting hard-to-reach populations, in improving the care of chronic conditions, and in controlling health system costs. In low- and middle-income countries, MHCs are effective in screening for specific diseases such as HIV in South Africa and cervical cancer in Thailand and in treating targeted chronic conditions such as epilepsy in rural Malawi. MHCs have improved vaccination coverage and reduced parasite prevalence in children living in remote areas of Namibia, and they offer a means of extending access to primary health care for seasonal migratory workers in Turkey.

From 2008 onwards, the Global AIDS Interfaith Alliance (GAIA) operated an MHC program to combat HIV, tuberculosis (TB), and malaria in Mulanje, Malawi, in conjunction with the Malawi MOH. Eighteen months after implementation, GAIA conducted an evaluation of implementation performance and challenges, and the program has since expanded the scope of services to include basic primary health care. A third MHC was launched in 2010. Beyond the preliminary evaluation of this program, there is no evidence to show that MHCs can continuously provide basic primary health care for both children and adults in Malawi. Such evidence has the potential to improve primary health care delivery in rural settings and inform deployment of additional MHCs, in both Malawi and other low-income countries in Africa.

The aim of this study was therefore to describe the feasibility of clinic operations and utilization of expanded services provided by the GAIA Elizabeth Taylor MHC program over a 3-year period from 2011 to 2013, with an in-depth review of HIV testing and malaria services. Specific objectives were to assess: 1) the feasibility of service provision; 2) the volume of services and utilization by type of service provided in relation to age and sex; 3) HIV testing and counseling, and administration of cotrimoxazole preventive therapy (CPT) for those who are HIV-positive; and 4) malaria screening and treatment.
Data variables
The preventive and curative health services offered at the MHCs include child growth monitoring, basic primary health care, and health education, detailed in Table 1. All staff, services, and supplies are funded directly by GAIA (with the exception of contraceptives, which are provided by the government). Data collected by clinic nurses are aggregated to summarize the services utilized at each clinic, by month, year, age group (under 5 years and over 5 years only), and sex (after 2011 for some services) for outcomes of interest. Data variables collected in this way include: clinic operating information, number of visits by type of service utilized, and conditions treated in relation to client age, sex, and month and year of the visit.

Analysis
Data were imported into Stata (Stata/SE11.2, StataCorp LP, College Station, TX, USA) from the Excel® database (Microsoft Corp, Redmond, WA, USA). Summary statistics and t-tests were generated in Stata to determine whether the variable of interest, service utilization, was associated with year of service provision, age group, and sex, with differences at the 5% level being regarded as significant. Excel was used for time-trend analysis and graphical representation.

RESULTS
Feasibility of service provision
Data on clinic operating days were available for 2012 and 2013. In 2012, MHCs operated for 675 (93%) of the expected 723 clinic days. Missed days were due to planning meetings (n = 24), vehicle servicing (n = 10), death of a clinical officer and a national day of mourning for the president’s death (n = 9), and countrywide fuel shortages (n = 5). In 2013, as a result of implementation changes, MHCs operated for 722 (99%) of 729 days, with missed days due to planning meetings (n = 6) and weather-related road conditions (n = 1).

Volume and types of service utilized
The overall total and annual utilization of the three types of MHC services are shown in Table 2. There was an average of over 100,000 client visits per year for primary health care, of which 75% were paired with health education. In children aged <5 years, primary health care visits often included child growth monitoring. For all types of service, there was a decline from 2011 to 2013; this was mirrored by client visits per day, which also decreased from a mean of 174 in 2011 to 162 in 2012 and 123 in 2013. Malaria and respiratory and gastro-intestinal diseases were the most com-
TABLE 1  Preventive and curative care provided at the GAIA Elizabeth Taylor Mobile Clinics, Mulanje, Malawi

1  Child growth monitoring: height and weight measurements*

2  Primary health care: case finding, diagnosis and treatment

   HIV counseling, testing and pre-ART care
   Cotrimoxazole preventive therapy
   Referrals for WHO staging/CD4 counts
   Malaria
   Assessment for clinical malaria
   Malaria rapid diagnostic tests
   Malaria treatment
   Respiratory disease
   Upper respiratory infections
   Pneumonia
   Asthma
   Bronchitis
   Presumptive tuberculosis
   Identification of presumptive tuberculosis
   Sputum specimens collected
   Reproductive health services
   Family planning
   ANC—1st, 2nd, 3rd trimester
   Skin conditions
   Gastro-intestinal disease
   Gastroenteritis
   Peptic ulcers
   Intestinal worms

3  Client health education: health talk topics

   Anemia
   Malaria
   Sanitation
   HIV/AIDS
   PMTCT

*Immunization services were originally offered, but the government took responsibility for providing these across the district in 2010. GAIA = Global AIDS Interfaith Alliance; HIV = human immunodeficiency virus; ART = antiretroviral therapy; WHO = World Health Organization; ANC = antenatal care; AIDS = acquired immune-deficiency syndrome; PMTCT = prevention of mother-to-child HIV transmission.

TABLE 2  Preventive and curative care services utilized at GAIA Elizabeth Taylor Mobile Clinics, Mulanje, Malawi, 2011–2013

<table>
<thead>
<tr>
<th>Services utilized*</th>
<th>Total</th>
<th>2011 n (%)</th>
<th>2012 n (%)</th>
<th>2013 n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Total child growth monitoring visits</td>
<td>71925</td>
<td>38720</td>
<td>16006</td>
<td>17199</td>
</tr>
<tr>
<td>2 Total primary care visits</td>
<td>309492</td>
<td>109270</td>
<td>108666</td>
<td>91556</td>
</tr>
<tr>
<td>Malaria</td>
<td>79499 (26)</td>
<td>38075 (35)</td>
<td>22909 (21)</td>
<td>18515 (20)</td>
</tr>
<tr>
<td>Respiratory conditions</td>
<td>69198 (22)</td>
<td>22040 (20)</td>
<td>24132 (22)</td>
<td>23026 (25)</td>
</tr>
<tr>
<td>HIV counseling, testing and pre-ART care</td>
<td>31232 (10)</td>
<td>10360 (10)</td>
<td>12996 (12)</td>
<td>7876 (9)</td>
</tr>
<tr>
<td>Gastro-intestinal conditions</td>
<td>27919 (9)</td>
<td>10621 (10)</td>
<td>9439 (9)</td>
<td>7859 (9)</td>
</tr>
<tr>
<td>Musculo-skeletal conditions</td>
<td>22885 (7)</td>
<td>4548 (4)</td>
<td>10378 (10)</td>
<td>7959 (9)</td>
</tr>
<tr>
<td>Skin conditions</td>
<td>21327 (7)</td>
<td>6568 (6)</td>
<td>8328 (8)</td>
<td>6431 (7)</td>
</tr>
<tr>
<td>Head, neck, eye, ear, mouth</td>
<td>18137 (6)</td>
<td>6511 (6)</td>
<td>6107 (6)</td>
<td>5519 (6)</td>
</tr>
<tr>
<td>Chronic conditions</td>
<td>14137 (5)</td>
<td>2423 (2)</td>
<td>5421 (5)</td>
<td>6293 (9)</td>
</tr>
<tr>
<td>Generalized infections and other conditions</td>
<td>7379 (2)</td>
<td>1408 (1)</td>
<td>3216 (3)</td>
<td>2755 (3)</td>
</tr>
<tr>
<td>Reproductive health services</td>
<td>7150 (2)</td>
<td>3700 (3)</td>
<td>1855 (2)</td>
<td>1595 (2)</td>
</tr>
<tr>
<td>Genito-urinary conditions</td>
<td>4813 (2)</td>
<td>971 (&lt;1)</td>
<td>1957 (&lt;1)</td>
<td>1885 (&lt;1)</td>
</tr>
<tr>
<td>Malnutrition and anemia</td>
<td>3070 (1)</td>
<td>882 (&lt;1)</td>
<td>1068 (1)</td>
<td>120 (1)</td>
</tr>
<tr>
<td>Sexually transmitted infections</td>
<td>2442 (1)</td>
<td>1021 (&lt;1)</td>
<td>764 (&lt;1)</td>
<td>657 (&lt;1)</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>304 (&lt;1)</td>
<td>142 (&lt;1)</td>
<td>96 (&lt;1)</td>
<td>66 (&lt;1)</td>
</tr>
</tbody>
</table>

3 Total client contacts for health education | 224390 | 96137 | 70973 | 57280 |

*Visits for these three types of service were not mutually exclusive: at a single visit, clients may have received primary health care services in addition to growth monitoring and/or health education.

GAIA = Global AIDS Interfaith Alliance; HIV = human immunodeficiency virus; ART = antiretroviral therapy.
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Mon conditions, accounting for nearly 60% of total primary health care visits. Monthly client visits by sex and age group from 2012 to 2013 are shown in Figure 1. Significantly more females utilized services every month ($P < 0.001$), accounting for 62% of all client visits. Children aged <5 years accounted for 39% of total client visits.

**HIV testing, counseling and cotrimoxazole preventive therapy**

In the 3-year period, 14,024 HIV tests were carried out, 11,543 (82%) of which were among females. Figure 2 shows quarterly trends in visits for HIV testing and counseling along with the results. Numbers tested for HIV were similar in the first two years but declined in the third year, although visits for HIV counseling, testing, and pre-ART care represented roughly the same proportion of annual visits, between 9% and 12%. In each quarter, significantly more females were tested for HIV ($P < 0.001$). In contrast, in each quarter significantly more males were found to be HIV-positive ($P < 0.001$): in total, 27% of males were HIV-positive compared with 14% of females. Figure 3 shows quarterly visits for CPT. The two periods when client visits for CPT were high coincided with stockouts of CPT in government clinics.

**Malaria screening and treatment**

Of the 76,294 MHC visits in the 3-year period for children aged <5 years, 26,421 (35%) were for malaria diagnosis and treatment. Monthly visits for these children are shown in Figure 4. There was an overall decline in the total number of visits during the 3 years. With the implementation of the RDT policy, there was a significant decline in the number of patients treated for clinical malaria and a significant increase in treatment of RDT-positive malaria in 2012 compared with 2011 ($P < 0.001$). Figure 5 illustrates the monthly visits to the clinics for both adults and children treated for malaria. In each year, there were significantly more visits for malaria treatment during the rainy season months of January to May (2011 and 2013 $P < 0.001; 2012 P < 0.003$).

**DISCUSSION**

This is the first study to report on the use of MHCs in providing routine primary health care for adults and children in a rural district of Malawi. The study had four main findings. First, the MHCs conducted an average of 153 client visits per clinic per day, the majority for the diagnosis and management of malaria and respiratory and gastrointestinal conditions, and for HIV testing. Females accessed these services more frequently than males, and children aged <5 years accounted for 39% of total client visits.

Second, significantly more females were tested for HIV compared with males. This parallels trends in national reports on HIV testing and counseling, and illustrates a general problem of low uptake of HIV testing by males.15 Males tested at MHCs had nearly double the HIV-positive rate of females, suggesting an urgent need to increase the male uptake of HIV testing and counseling.

Third, yearly quarters associated with high provision of CPT coincided with stockouts in government fixed clinics, showing that MHCs complement fixed facilities and fill a service provision gap.15,16 CPT is an important part of HIV/AIDS care, used for both pre-ART and as an adjunct for those on ART, and drug interruptions compromise quality of care and threaten survival.17

Fourth, visits for malaria diagnosis and treatment constituted over one third of under-five visits. Malaria is an important public health problem in Malawi, fluctuates seasonally, as shown by increased MHC visits in the rainy season, and is responsible for a large number of childhood deaths. Before 2012, malaria in Malawi was generally managed empirically, resulting in significant

![Figure 1](image_url)
over-treatment. For example, only 2% of rural fixed health centers used RDTs to diagnose malaria in 2011. Malawi subsequently recommended the use of RDT in all clients with suspected malaria, with treatment targeted to those shown to be RDT-positive. The findings from MHCs showed a marked decrease in numbers of all clients being treated for malaria after this policy change. This may indicate a more rational use of anti-malarial treatment and facilitates further investigation in febrile clients without confirmed malaria.

The strengths of this study were the large catchment area served by MHCs, the long period of observation, and the closely monitored and comprehensive record keeping. Furthermore, this observational study adhered to Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines. The main limitations, which were outside the scope of this study, were the lack of comparative data from fixed clinics in the district, the lack of qualitative data to explain the overall decline in client visits, and lower male partici-
participation, which limited analysis to trends in relation to season, age, and sex.

The study has several policy and practice implications. First, the continuity of the MHC services improved between 2012 and 2013 due to servicing of vehicles and organizing of planning meetings on weekends. Real-time accurate data on service continuity and feasibility can be used by management to inform and improve program implementation. Second, it is clear that MHCs complement the work of fixed government clinics through, for example, filling gaps in treatment when there are drug stockouts, rapidly implementing and monitoring changes in government health policy, and expanding access to health care for hard-to-reach communities. More, however, needs to be done to integrate complementary MHC services into the government health system and district health office budgets and to include MHC client data in district level databases. Distinct level data from the next Malawi Demographic and Health Survey could also be used to analyze trends in child mortality due to malaria and pneumonia, which are routinely treated at the MHCs. Third, qualitative research is needed to understand and possibly resolve low MHC service utilization by males. The cost-effectiveness of the MHC approach should also be formally investigated.

In conclusion, we have shown that primary health care for large numbers of adults and children can be provided by non-governmental organizations on a routine basis through MHCs in a rural district of Malawi with limited resources. The most important challenge ahead is how best to integrate MHCs with public health sector services to target the most underserved populations.

References
9 Bassett I, Regan S, Luthuli P, et al. Linkage to care following community-based mobile HIV testing compared with clinic-based testing in Umlazi
Cadre : Le Malawí souffre d’un manque chronique de personnel de santé, d’un lourd fardeau d’infection au virus de l’immunodéficience humaine (VIH) et de paludisme avec une population surtout rurale. Des unités de santé mobiles (MHCs) pourraient fournir des soins de santé primaires aux adultes et aux enfants dans les zones d’accès difficile.

Objectifs : Déterminer la faisabilité, le volume et les types de services fournis par trois MHCs de 2011 à 2013 dans le district de Mulanje, Malawi.

Schéma : Etude rétrospective transversale.

Résultats : Les MHCs ont effectué 309 492 consultations de soins de santé primaires et en 2013, les services ont fonctionné pendant 99% des jours prévus. En dépit d’une amélioration dans la fourniture des services, le total des consultations de patients a diminué au cours de la période d’étude. Le paludisme et les problèmes respiratoires et gastro-intestinaux constituaient 60% des consultations. Les femmes étaient significativement plus nombreuses (n = 11 543) que les hommes (n = 2481) à avoir un test VIH, mais les hommes étaient plus souvent VIH positifs (27%) que les femmes (14%). Le paludisme représentait 26 421 (35%) consultations pour les enfants de moins de 5 ans avec une augmentation significative en saison des pluies. La mise en œuvre des tests de diagnostic rapide a été associée à un déclin du nombre de patients traités pour paludisme. Les ruptures de stock d’antibiotiques dans les centres de santé du gouvernement étaient associées à une augmentation des consultations des MHC.


Marco de referencia: Malawi soporta una escasez crónica de personal sanitario, altas cargas de morbilidad por el virus de la inmunodeficiencia humana (VIH) y el paludismo con una población predominantemente rural. Los dispensarios ambulantes (MHC) podrían aportar atención primaria de salud a los adultos y los niños en las zonas de difícil acceso.

Objetivo: Examinar la factibilidad de la prestación de servicios ambulatorios y determinar el volumen y los tipos de atención suministrados durante una intervención privada en tres MHC del 2011 al 2013 en el distrito de Mulanje, en Malawi.

Método: Fue este un estudio transversal retrospectivo.

Resultados: En los dispensarios ambulantes se realizaron 309 492 consultas de atención primaria y en el 2013, los servicios funcionaron durante el 99% de los días planeados. Pese a un progreso en la prestación de servicios, el número global de consultas disminuyó durante el periodo del estudio. El paludismo, las enfermedades respiratorias y gastrointestinales constituyeron el motivo de consulta en el 60% de los casos. Las mujeres fueron significativamente más numerosas que los hombres a practicar la prueba diagnóstica del VIH (11 543 contra 2481), pero los hombres obtuvieron con mayor frecuencia un resultado positivo (27% contra 14%). El paludismo correspondió a 26 421 consultas en los niños menores de 5 años de edad (35%) y se observó un aumento considerable en la temporada de lluvias. La ejecución de las pruebas diagnósticas rápidas se asoció con una disminución del número de pacientes tratados por paludismo. Los desabastecimientos de antibióticos en los consultorios gubernamentales se asociaron con un aumento en el número de consultas a los consultorios ambulantes.

Conclusión: Los MHC pueden suministrar atención sanitaria sistemática a los adultos y los niños que viven en las zonas rurales de Malawi y completar así la atención prestada por los consultorios fijos. La evolución de este sistema, una función complementaria a su integración en los sistemas nacionales de salud, sigue siendo una tarea difícil.