## District overview of travel time to ART facilities: Dedza

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### **Objectives**

- Map the estimated prevalence and number of people living with HIV (PLHIV) by approximately 1 km grid cells.
- Estimate the travel time to the nearest ART facility for PLHIV in Malawi.
- Identify optimal locations for additional facilities with ART service to reach PLHIV with long travel times to existing ART facilities (>60, 90, or 120 minutes).

Interactive results are available at: https://mrc-ide.github.io/mwi-hiv/ART\_facilities/index.html.

#### **HIV prevalence and PLHIV estimates**

Figure 2 illustrates estimates for spatial HIV prevalence for adults aged 15-49 years. Figure 3 shows the estimated number of PLHIV (all ages), and the locations of health facilities with ART services (labelled with  $\mathbf{A}$ ) and without current ART services (labelled with  $\mathbf{F}$ ).

Total PLHIV (all ages)	21,957 (19,127–25,197)
HIV prevalence, age 15-49 years	3.8% (3.3%–4.3%)
Total patients receiving ART	37,342
Average walking time to nearest ART (minutes)	47 (45–48)
Number PLHIV > 60 minutes walking time	6,515 (5,645–7,437)
Percentage PLHIV > 60 minutes walking time	29.7% (27.8%–31.4%)

Table 1: Summary estimates for Dedza, September 2020.

Table 2: Traditional authorities with the lowest and highest estimated number of PLHIV, 15-49 Prevalence, and average walking time, respectively.

	Lowest TA		
PLHIV	TA Chauma: 535 (378–734)	TA Kachindamoto: 4,861 (3,749–6,070)	
15-49 Prevalence	TA Chilikumwendo: 2.9% (2.2%–3.9%)	TA Kachindamoto: 5.5% (4.2%–6.9%)	
Average Walking Time	Dedza Boma: 8 min (8–8 min)	TA Chilikumwendo: 66 min (64–69 min)	

#### Travel time to existing ART facilities

In Dedza, there are 29 ART facilities that had at least 1 patient in September 2020. The median number of ART patients per facility was 371. The list of *active ART facilities* is in Table 4. Private not-for-profit facilities have been excluded from the analysis. Figure 4 shows the modelled travel times to the nearest active ART facility. The average walking time to the nearest facility for residents in each traditional authority are in (Figure 5).

- The estimated average walking time for PLHIV to the closest ART facility across Dedza is 47 minutes (45-48 min).
- The shortest estimated average walking time to the closest ART facility is in Dedza Boma (8 minutes (8-8 min)).
- The longest estimated average walking time to the closest ART facility is in TA Chilikumwendo (66 minutes (64-69 min)).

An estimated 29.7% (27.8%–31.4%) of PLHIV reside more than 60 minutes walking time to their nearest ART facility, compared to 30.5% of the total population. This decreases to 7.1% (6.3%–7.8%) of PLHIV and 7.3% of the total population residing more than 90 minutes walking time to their nearest ART facility. More details are provided in Table 3.

Threshold (minutes)	Population not reached	As % of total population	PLHIV not reached	As % of total estimated PLHIV
45	437,178	50.3%	10,678 (9,307–12,145)	48.7% (46.8%–50.6%)
60	264,923	30.5%	6,515 (5,645–7,437)	29.7% (27.8%–31.4%)
90	63,311	7.3%	1,546 (1,315–1,802)	7.1% (6.3%–7.8%)
120	11,156	1.3%	314 (250–387)	1.4% (1.2%–1.7%)

### Proposed facilities for new ART services

A list of 13 *non-ART facilities* were considered to identify existing health facility locations for expanding ART services, listed in Table 5. Figure 6 shows the number of PLHIV in grid cells where the estimated travel time is longer than 60 minutes and candidate new ART facilities.

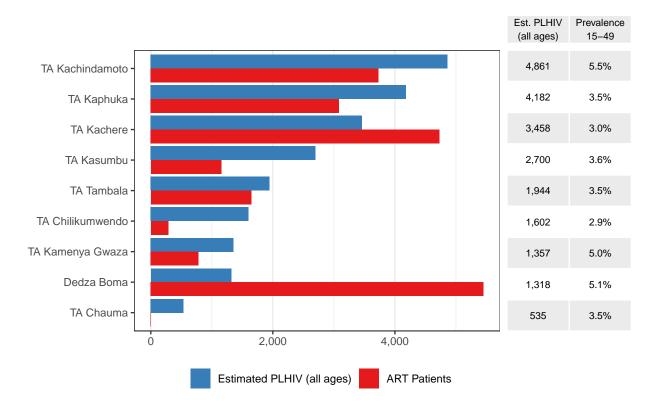
- The TA with the largest number of PLHIV residing more than 60 minutes from their closest ART facility is TA Kachindamoto (1577 PLHIV (1213-2001) with walking time > 60 minutes).
- The facility that can reach the most PLHIV residing outside 60 minutes travel time is **Mdeza Disp.**, with 575 PLHIV (388-827) reached.

### Limitations

There are several important limitations to this analysis:

- Travel time surfaces and catchments may not optimally reflect typical routine travel or movement patterns, for example for work or other activities.
- Results do not represent uncertainty in the 1km gridded maps of PLHIV arising from uncertainty about the gridded populations.
- There are discrepancies in the gridded HIV prevalence estimates from the Bayesian geostatistical model and the Naomi estimates for some districts which should be further reviewed, especially neighbouring urban and rural districts.
- Geographic locations of some health facilities are discrepant between multiple data sources and need to be confirmed.
- The physical infrastructure and suitability of candidate health facilities for supporting an ART service is unknown.
- Optimisation analysis for locations for new facilities has not considered overcrowding, wait times, or other barriers to access at existing facilities. It could be more optimal to expand services in some geographically dense locations to address barriers to access.

Dedza



### Summary figures and maps

Figure 1: Number registered ART clients within each TA and estimated number of PLHIV within the TA. The right table indicates the estimated 15-49 HIV prevalence.

## HIV prevalence in ages 15-49

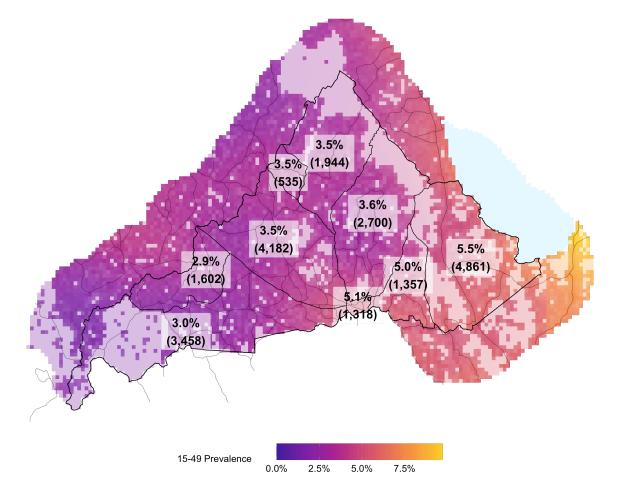


Figure 2: Estimated spatial HIV prevalence. Percentages correspond to TA level 15-49 HIV prevalence and numbers in brackets indicate the estimated number of PLHIV overall.

## Estimated number of PLHIV at 1km square

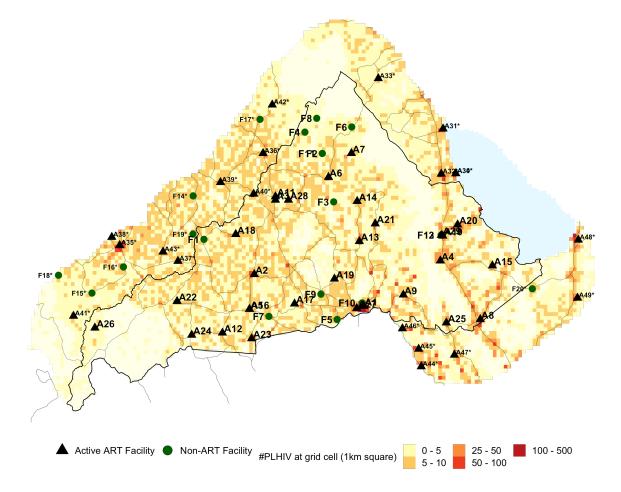


Figure 3: Estimated number of PLHIV on a 1km square.

Table 4: List of active ART facilities that had at least 1 registered ART patient in September 2020. The column "ART" indicates how many ART patients are registered at the ART facility. Facilities outside the district boundaries that may be accessible to residents within the district are marked with "\*".

V2   Dedza   TA Kaphuka   Kasinje HC   Health centre   CHAM   94.08   -4.31   81     V3   Dedza   TA Kaphuka   Kasinje HC   Health centre   Government   34.13   -14.15   85     V5   Dedza   TA Kachindamoto   Lobi Rural Hosp,   Health centre   Government   34.07   14.91   10.8     V5   Dedza   TA Tambala   Kaphuka HC   Health centre   Government   34.21   -14.00   87     V1   Dedza   TA Kachindamoto   Golomoti HC   Health centre   Government   34.21   -14.40   77     Quaza   TA Kachindamoto   Mtakataka HC   Health centre   CHAM   34.13   -14.41   76     Quaza   TA Kachindamoto   Kasina HC   Health centre   Government   34.31   -14.43   42   -14.33   14.14   66     V11   Dedza   TA Kachindamoto   Kasina HC   Health centre   Government   34.32   -14.24   43   43   -14.23 <t< th=""><th>ID</th><th>District</th><th>ТА</th><th>Name</th><th>Туре</th><th>Authority</th><th>Long.</th><th>Lat.</th><th>AR</th></t<>	ID	District	ТА	Name	Туре	Authority	Long.	Lat.	AR
33   Dedza   TA Kaphuka   Kasinje HC   Health centre   Government   41.4 5   64.4 5     44   Dedza   TA Kachindamoto   Mus Mission Hosp.   District hospital   Government   34.6 7   -14.3 8   10     65   Dedza   TA Kachindamoto   Golowernment   34.6 7   -14.3 8   10     70   Dedza   TA Kachindamoto   Golomoti HC   Health centre   Government   34.6 1   -14.1 8   8     80   Dedza   TA Kachindamoto   Golomoti HC   Health centre   Government   34.6 1   -14.2 3   70     101   Dedza   TA Kachindamoto   Mtakataka HC   Health centre   Government   34.3 1   -14.14 4   44     112   Dedza   TA Kachindamoto   Kasana HC   Health centre   Government   34.3 1   -14.14 4   44     112   Dedza   TA Kachindamoto   Kasana HC   Health centre   Government   34.3 1   -14.44   44     112   Dedza   TA Kachere   Kasana HC<	A1	Dedza	Dedza Boma	Dedza District Hosp.	District hospital	Government	34.33	-14.38	5282
V4   Dedza   TA Kachindamoto   Mua Mission Hosp.   District hospital   CHAM   94.51   -14.28   12.33     V5   Dedza   TA Kachere   Lobi Rural Hosp.   Health centre   Government   34.07   -14.38   12.0     V5   Dedza   TA Tambala   Kaphuka HC   Health centre   Government   34.61   -14.14   77.     V6   Dedza   TA Kachindamoto   Golomoti HC   Health centre   Government   34.61   -14.43   77.     Obdza   TA Kachindamoto   Mtakataka HC   Health centre   Government   34.11   -14.23   77.     V11   Dedza   TA Kachere   Chimoto HC   Health centre   Government   34.51   -14.24   44.44     V13   Dedza   TA Kachere   Chimoto HC   Health centre   Government   34.31   -14.14   45.     V13   Dedza   TA Kachere   Chimoto HC   Health centre   Government   34.32   -14.24   32.     V14   Dedza   TA	42	Dedza	TA Kachere	Mtendere HC	Health centre	CHAM	34.08	-14.31	185
S5   Dedza   TA Kachere   Lobi Rural Hosp.   Health centre   Government   34.07   -14.39   100     66   Dedza   TA Tambala   Mayani HC   Health centre   Government   34.31   -14.40   74     70   Dedza   TA Kachindamoto   Golomoli HC   Health centre   Government   34.63   -14.41   77     70   Dedza   TA Kachindamoto   Makataka HC   Health centre   Government   34.61   -14.23   77     710   Dedza   TA Kachindamoto   Mtakataka HC   Health centre   CHAM   34.13   -14.44   44     714   Dedza   TA Kachere   Chinob HC   Health centre   Government   34.61   -14.29   37     714   Dedza   TA Kachere   Kanyana HC   Health centre   Government   34.63   -14.29   37     714   Dedza   TA Kachere   Kanyani HC   Health centre   Government   34.61   -14.39   32     714   Dedza   TA Ka	43	Dedza	TA Kaphuka	Kasinje HC	Health centre	Government	34.13	-14.15	164
Abs   Dedza   TA Tambala   Mayani HC   Health centre   Government   34.25   14.10   87     VT   Dedza   TA Tambala   Kaphuka HC   Health centre   Government   34.25   14.10   74     VT   Dedza   TA Kachindamoto   Boronti HC   Health centre   Government   34.25   14.10   74     VID   Dedza   TA Kachindamoto   Mtakataka HC   Health centre   Government   34.51   14.23   74     VID   Dedza   TA Kachindamoto   Kasima HC   Health centre   Government   34.51   14.23   74     VID   Dedza   TA Kachindamoto   Kavuzi HC   Health centre   Government   34.52   14.24   44     VIA   Dedza   TA Kachindamoto   Kavuzi HC   Health centre   Government   34.07   14.39   34     VIA   Dedza   TA Kachindamoto   Navuzi HC   Health centre   Government   34.07   14.39   34   14.22   33     VIA	\4	Dedza	TA Kachindamoto	Mua Mission Hosp.	District hospital	CHAM	34.51	-14.28	128
V7   Dedza   TA Tambala   Kaphuka HC   Health centre   Government   34.31   -14.04   77     88   Dedza   TA Kachindamoto   Golomoli HC   Health centre   Government   34.31   -14.04   77     90   Dedza   TA Kachindamoto   Makataka HC   Health centre   Government   34.51   -14.23   77     110   Dedza   TA Kachindamoto   Makataka HC   Health centre   Government   34.51   -14.23   77     120   Dedza   TA Kachindamoto   Makataka HC   Health centre   Government   34.51   -14.24   42     131   Dedza   TA Kachindamoto   Kavina HC   Health centre   Government   34.32   -14.15   43     141   Dedza   TA Kachindamoto   Kavina HC   Health centre   Government   34.32   -14.15   43     1430   Dedza   TA Kachindamoto   Nakalazi HC   Health centre   Government   34.91   -14.22   33     1430   Dedza	۹5	Dedza	TA Kachere	Lobi Rural Hosp.	Health centre	Government	34.07	-14.39	104
B   Dedza   TA Kachindamoto   Golomoti HC   Health centre   Government   34.60   -14.41   77     10   Dedza   TA Kachindamoto   Mtakataka HC   Health centre   Government   34.51   -14.23   77     11   Dedza   TA Kachindamoto   Mtakataka HC   Health centre   Government   34.51   -14.23   77     12   Dedza   TA Kachindamoto   Kasima HC   Health centre   Government   34.51   -14.23   71     13   Dedza   TA Kashmbu   Kiniske HC   Health centre   Government   34.02   -14.24   44     14   Dedza   TA Kachindamoto   Kavuzi HC   Health centre   Government   34.03   -14.29   33     16   Dedza   TA Kachindamoto   Nakuizi HC   Health centre   Government   34.07   -14.39   33     17   Dedza   TA Kachindamoto   Nakaizi HC   Health centre   Government   34.07   -14.20   32     18   Dedza	6	Dedza	TA Tambala	Mayani HC	Health centre	Government	34.25	-14.10	85
9.9   Dedza   TA Kachindamoto   Matataka HC   Health centre   CHAM   34.42   -14.36   74     V10   Dedza   TA Kachindamoto   Mtakataka HC   Health centre   Government   34.51   -14.23   77     V11   Dedza   TA Kachindamoto   Mtakataka HC   Health centre   Government   34.51   -14.23   71     V11   Dedza   TA Kaschindamoto   Kasina HC   Health centre   Government   34.23   -14.24   44     V13   Dedza   TA Kaschindamoto   Kasuryama HC   Health centre   Government   34.02   -14.15   44     V14   Dedza   TA Kachindamoto   Kavuzi HC   Health centre   Government   34.07   -14.39   33     V15   Dedza   TA Kachindamoto   Nakalzai HC   Health centre   Government   34.08   -14.20   33     V13   Dedza   TA Kachindamoto   Nakatazi HC   Health centre   Government   34.08   -14.42   33   14.37   24	٨7	Dedza	TA Tambala	Kaphuka HC	Health centre	Government	34.31	-14.04	79
N3   Dedza   TA Kachindamoto   Matataka HC   Health centre   CHAM   34.42   -14.36   74     M10   Dedza   TA Kachindamoto   Mtakataka HC   Health centre   Government   34.51   -14.23   77     M11   Dedza   TA Kachindamoto   Mtakataka HC   Health centre   Government   34.51   -14.23   71     M12   Dedza   TA Kasumbu   Kasina HC   Health centre   Government   34.22   -14.14   44     M14   Dedza   TA Kasumbu   Chikuse HC   Health centre   Government   34.02   -14.39   34     M14   Dedza   TA Kachere   Kanyezi HC   Health centre   Government   34.07   -14.39   34     M16   Dedza   TA Kachrida   Chinowi HC   Health centre   Government   34.08   -14.20   32     M17   Dedza   TA Kachindamoto   Natatazi HC   Health centre   Government   34.08   -14.20   32     M13   Dedza	48	Dedza	TA Kachindamoto		Health centre	Government	34.60	-14.41	78
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N19DedzaTA KaphukaChongoni HCHealth centreOther34.27-14.3233V20DedzaTA KachindamotoNakalazi HCHealth centreCHAM34.55-14.2034V21DedzaTA KasumbuDzindevu HCHealth centreGovernment33.91-14.3724V22DedzaTA KachereMyhati HCHealth centreGovernment33.91-14.4524V22DedzaTA KachereMyhati HCHealth centreGovernment34.52-14.4224V24DedzaTA KachereMyhati HCHealth centreGovernment34.52-14.4214V25DedzaTA KachereKafele HCHealth centreGovernment34.52-14.4317V26DedzaDedza BomaFPAM Clinic DedzaHealth centreNGO34.32-14.3917V27DedzaDedza BomaFPAM Clinic DedzaHealth centreOther34.51-14.2316V27DedzaTA KaphukaTsoyo Disp.SpecialGovernment34.51-14.2316V29DedzaTA KambalameLife Line Salima HCHealth centreNGO34.54-14.09133V30*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0910V33*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0910V33*Salima <td< td=""><td>17</td><td>Dedza</td><td>TA Kachere</td><td>Mphunzi HC</td><td>Health centre</td><td>Government</td><td>34.18</td><td>-14.38</td><td>33</td></td<>	17	Dedza	TA Kachere	Mphunzi HC	Health centre	Government	34.18	-14.38	33
V20DedzaTA KachindamotoNakalazi HCHealth centreCHAM34.55-14.2030V21DedzaTA KasumbuDzindevu HCHealth centreGovernment33.91-14.3722V23DedzaTA KachereMphati HCHealth centreGovernment34.08-14.4622V24DedzaTA KachereMikondo Disp.DispensaryCHAM33.94-14.4522V25DedzaTA KachereMikondo Disp.DispensaryCHAM33.94-14.4522V26DedzaTA KachereKatele HCHealth centreGovernment34.32-14.4313V26DedzaTA KachereKafele HCHealth centreGovernment34.52-14.4314V27DedzaTA KachulaTsoyo Disp.SpecialGovernment34.51-14.239V28DedzaTA KachulamotoPolice College HCHealth centreNGO34.54-14.0913V30*SalimaTA KambalameLife Line Salima HCHealth centreGovernment34.51-14.239V33*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0910V33*SalimaTA ChisekaMitundu CommunityRural/CommunityGovernment34.51-14.0910V33*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0910V33*Sa	18	Dedza	TA Kaphuka	Chitowo HC	Health centre	Government	34.04	-14.22	32
A21DedzaTA KasumbuDzindevu HCHealth centreGovernment34.36-14.2022A22DedzaTA ChilikumwendoMatumba HCHealth centreGovernment33.91-14.3722A23DedzaTA KachereMphati HCHealth centreGovernment33.91-14.4522A24DedzaTA KachereMikondo Disp.DispensaryCHAM33.94-14.4522A25DedzaTA KachereMikondo Disp.DispensaryCHAM33.72-14.4312A25DedzaTA KachereKafele HCHealth centreGovernment34.52-14.4216A26DedzaTA KachereKafele HCHealth centreNGO34.32-14.4317A27DedzaDedza BomaFPAM Clinic DedzaHealth centreNGO34.52-14.2317A28DedzaTA KachindamotoPolice College HCHealth centreOther34.51-14.2302A30*SalimaTA KambalameLife Line Salima HCHealth centreGovernment34.52-13.9981A31*SalimaTA KambalameNipoka HCHealth centreGovernment34.51-14.0910A33*SalimaTA KambalameNipoka HCHealth centreGovernment34.51-14.0910A34*SalimaTA KambalameNipoka HCHealth centreGovernment34.51-14.0910A35*L	<b>\19</b>	Dedza	TA Kaphuka	Chongoni HC	Health centre	Other	34.27	-14.32	30
X22DedzaTA ChilikumwendoMatumba HCHealth centreGovernment33.91-14.3724V23DedzaTA KachereMiphati HCHealth centreGovernment34.08-14.4622V24DedzaTA KachereMikondo Disp.DispensaryCHAM33.94-14.4524V25DedzaTA KachindamotoMganja HCHealth centreGovernment33.72-14.4311V25DedzaTA KachindamotoMganja HCHealth centreGovernment34.52-14.4311V27DedzaDedza BomaFPAM Clinic DedzaHealth centreNGO34.32-14.3911V28DedzaTA KachindamotoPolice College HCHealth centreNGO34.51-14.2302V28DedzaTA KambalameLife Line Salima HCHealth centreNGO34.54-14.0913V30*SalimaTA KambalameChipoka HCHealth centreGovernment34.51-14.0913V33*SalimaTA KambalameNgodzi HCHealth centreGovernment34.54-14.0910V33*SalimaTA KambalameNgodzi HCHealth centreGovernment34.54-14.0910V33*SalimaTA KambalameParchute BattalionDispensaryOther34.54-14.0910V33*SalimaTA KambalameParchute BattalionDispensaryOther34.54-14.0910<	420	Dedza	TA Kachindamoto	Nakalazi HC	Health centre	CHAM	34.55	-14.20	30
223DedzaTA KachereMphati HCHealth centreGovernment34.08-14.4624244DedzaTA KachereMikondo Disp.DispensaryCHAM33.94-14.4524245DedzaTA KachindamotoMganja HCHealth centreGovernment34.52-14.4216246DedzaTA KachereKafele HCHealth centreRovernment37.22-14.4317247DedzaDedza BomaFPAM Clinic DedzaHealth centreNGO34.32-14.3917248DedzaTA KachindamotoPolice College HCHealth centreOther34.16-14.1517249DedzaTA KanbalameLife Line Salima HCHealth centreOther34.51-14.09136330*SalimaTA KambalameChipoka HCHealth centreGovernment34.52-13.9923337*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.09106337*SalimaTA KambalameParachute BattalionDispensaryOther34.54-14.09106336*LilongweTA ChisekaMikundu CommunityRural/CommunityGovernment33.77-14.25254336*LilongweTA ChisekaMikundu CommunityRural/CommunityGovernment34.51-14.09106337*LilongweTA ChisekaMikundu CommunityRural/CommunityGovernment34.76 <t< td=""><td>21</td><td>Dedza</td><td>TA Kasumbu</td><td>Dzindevu HC</td><td>Health centre</td><td>Government</td><td>34.36</td><td>-14.20</td><td>28</td></t<>	21	Dedza	TA Kasumbu	Dzindevu HC	Health centre	Government	34.36	-14.20	28
224DedzaTA KachereMikondo Disp. Mganja HCDispensary Health centreCHAM33.94 Government-14.4524 24225DedzaTA KachindamotoMganja HCHealth centreGovernment34.52-14.4216 16226DedzaTA KachereKafele HCHealth centreGovernment33.72-14.4317 17227DedzaDedza BormaFPAM Clinic DedzaHealth centreNGO34.32-14.3917 17228DedzaTA KachindamotoPolice College HC MuaHealth centreOther34.51-14.239230*SalimaTA KanbalameLife Line Salima HCHealth centreNGO34.54-14.0913 13331*SalimaChipoka UrbanChipoka HC MuaHealth centreGovernment34.52-13.9985 13332*SalimaTA KambalameNgodzi HC Muganda HCHealth centreGovernment34.54-14.0912 14.23334*SalimaTA KambalameNgodzi HC Muganda HCHealth centreGovernment34.54-14.0912 16335*LilongweTA ChisekaMitundu Community Hosp.Rural/CommunityGovernment34.54-14.0912 16336*LilongweTA ChadzaKatema HCHealth centreGovernment34.51-14.2312 17337*LilongweTA ChadzaKatema HCHealth centreGovernment34.61-14	22	Dedza	TA Chilikumwendo	Matumba HC	Health centre	Government	33.91	-14.37	28
N25DedzaTA KachindamotoMganja HCHealth centreGovernment34.52-14.42142N26DedzaTA KachereKafele HCHealth centreGovernment33.72-14.4317N27DedzaDedza BomaFPAM Clinic DedzaHealth centreNGO34.32-14.3917N28DedzaTA KaphukaTsoyo Disp.SpecialGovernment34.16-14.1517N29DedzaTA KachindamotoPolice College HCHealth centreOther34.51-14.239N30*SalimaTA KambalameLife Line Salima HCHealth centreGovernment34.52-13.9983N31*SalimaChipoka UrbanChipoka HCHealth centreGovernment34.51-14.09136N32*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.09106N33*SalimaTA KambalameNgodzi HCHealth centreGovernment34.54-14.09106N33*SalimaTA KambalameParachute BattalionDispensaryOther34.54-14.09106N35*LilongweTA ChadzaMitundu CommunityRural/CommunityGovernment33.77-14.25254N36*LilongweTA ChadzaKatema HCHealth centreGovernment34.01-14.04227N37*LilongweTA ChadzaMiatema HCHealth centreGovernment34.01-14.28	<b>\</b> 23	Dedza	TA Kachere	Mphati HC	Health centre	Government	34.08	-14.46	28
V26DedzaTA Kachere DedzaKafele HC FPAM Clinic DedzaHealth centre Health centreGovernment NGO33.72 34.32-14.43 1111 11V27DedzaTA Kachere DedzaTA KaphukaTsoyo Disp. Police College HC MuaSpecialGovernment34.16 34.16-14.1511 11V29DedzaTA KachindamotoPolice College HC MuaHealth centreOther34.51 34.51-14.2335V30*SalimaTA KambalameLife Line Salima HCHealth centreNGO34.54-14.09135V31*SalimaTA KambalameNgodzi HC Chagunda HCHealth centreGovernment34.51-14.0926V33*SalimaTA KambalameNgodzi HC ClinicHealth centreGovernment34.51-14.0926V33*SalimaTA KambalameNgodzi HC ClinicHealth centreGovernment34.51-14.0926V33*SalimaTA KambalameParachute Battalion ClinicDispensaryOther34.54-14.0910V34*SalimaTA ChisekaMitundu Community Hosp.Rural/CommunityGovernment33.77-14.25254V34*LilongweTA ChadzaKatema HC Hosp.Health centreCHAM33.91-14.28117V38*LilongweTA ChadzaMlale Mission Hosp. Hosp.Rural/CommunityCHAM33.67-14.23116V34*LilongweTA Chadza </td <td>424</td> <td>Dedza</td> <td>TA Kachere</td> <td>Mikondo Disp.</td> <td>Dispensary</td> <td>CHAM</td> <td>33.94</td> <td>-14.45</td> <td>24</td>	424	Dedza	TA Kachere	Mikondo Disp.	Dispensary	CHAM	33.94	-14.45	24
X27DedzaDedza BomaFPAM Clinic DedzaHealth centreNGO34.32-14.3917X28DedzaTA KaphukaTsoyo Disp.SpecialGovernment34.16-14.1517X29DedzaTA KachindamotoPolice College HCHealth centreOther34.51-14.2352X30*SalimaTA KambalameLife Line Salima HCHealth centreNGO34.54-14.09133X31*SalimaChipoka UrbanChipoka HCHealth centreGovernment34.51-14.0922X32*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0922X33*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0922X34*SalimaTA KambalameParachute BattalionDispensaryOther34.54-14.0922X34*SalimaTA ChisekaMitundu CommunityRural/CommunityGovernment33.77-14.2525X37*LilongweTA ChadzaKatema HCHealth centreCHAM33.91-14.28117X38*LilongweTA ChadzaKatema HCHealth centreGovernment34.10-14.0422X37*LilongweTA ChadzaKatema HCHealth centreGovernment34.01-14.23116X38*LilongweTA ChadzaMlale Mission Hosp.Rural/CommunityCHAM33.67-14.2311	425	Dedza	TA Kachindamoto	Mganja HC	Health centre	Government	34.52	-14.42	18
X28DedzaTA Kaphuka TA KachindamotoTsoyo Disp. Police College HC MuaSpecial Health centreGovernment Other34.16-14.1511X30*SalimaTA KachindamotoLife Line Salima HCHealth centreNGO34.54-14.09136X31*SalimaChipoka UrbanChipoka HCHealth centreGovernment34.51-14.0926X32*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0926X34*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0926X34*SalimaTA KambalameParachute Battalion ClinicDispensaryOther34.54-14.0910X35*LilongweTA ChisekaMitundu Community Hosp.Rural/CommunityGovernment33.77-14.25254X36*LilongweTA ChadzaKatema HCHealth centreCHAM33.91-14.28111X38*LilongweTA ChadzaKatema HCHealth centreGovernment34.00-14.28111X38*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.00-14.28111X38*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.00-14.28111X38*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.00-14.28111X39*Lilongwe<	426	Dedza	TA Kachere	Kafele HC	Health centre	Government	33.72	-14.43	17
A29DedzaTA KachindamotoPolice College HC MuaHealth centreOther34.51-14.23.52A30*SalimaTA KambalameLife Line Salima HCHealth centreNGO34.54-14.09133A31*SalimaChipoka UrbanChipoka HCHealth centreGovernment34.51-14.0922A32*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0922A33*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0922A34*SalimaTA KambalameParachute BattalionDispensaryOther34.54-14.0910A35*LilongweTA ChisekaMitundu Community Hosp.Rural/CommunityGovernment33.77-14.25254A36*LilongweTA ChadzaKatema HCHealth centreCHAM33.91-14.2811A38*LilongweTA ChadzaKatema HCHealth centreCHAM33.76-14.2311A38*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.08-14.1352A34*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.10-14.2811A38*LilongweTA ChadzaKatema HCHealth centreGovernment34.08-14.1352A39*LilongweTA KalumbuMtenthera HCHealth centreGovernment34	427	Dedza	Dedza Boma	FPAM Clinic Dedza	Health centre	NGO	34.32	-14.39	17
MuaA30*SalimaTA KambalameLife Line Salima HCHealth centreNGO34.54-14.09138A31*SalimaChipoka UrbanChipoka HCHealth centreGovernment34.52-13.9983A32*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0926A33*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0926A34*SalimaTA KambalameParachute BattalionDispensaryOther34.54-14.0910A35*LilongweTA ChisekaMitundu Community Hosp.Rural/CommunityGovernment33.77-14.25254A36*LilongweTA ChadzaKatema HCHealth centreCHAM34.10-14.0422*A37*LilongweTA ChadzaKatema HCHealth centreCHAM33.91-14.2811*A38*LilongweTA ChadzaKatema HCHealth centreGovernment34.01-14.1211*A38*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.01-14.1211*A39*LilongweTA MazengeraDiamphwi HCHealth centreGovernment34.67-14.4125*A41*LilongweTA MasulaChiunjiza HCHealth centreGovernment34.01-14.1426*A42*LilongweTA ChadzaMaluwa HCHealth centreGovernme	428	Dedza	TA Kaphuka	Tsoyo Disp.	Special	Government	34.16	-14.15	11
X30*SalimaTA KambalameLife Line Salima HCHealth centreNGO34.54-14.09136X31*SalimaChipoka UrbanChipoka HCHealth centreGovernment34.52-13.9987X32*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0926X33*SalimaTA KambalameNgodzi HCHealth centreGovernment34.37-13.8825X34*SalimaTA KambalameParachute BattalionDispensaryOther34.54-14.0910ClinicClinicDispensaryOther34.54-14.0910X35*LilongweTA ChisekaMitundu Community Hosp.Rural/CommunityGovernment33.77-14.25254X36*LilongweTA ChadzaKatema HCHealth centreCHAM34.10-14.0422*X37*LilongweTA ChadzaKatema HCHealth centreCHAM33.76-14.2311*X38*LilongweTA ChadzaKatema HCHealth centreGovernment34.01-14.1211*X39*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.01-14.1211*X39*LilongweTA MazengeraDiamphwi HCHealth centreGovernment34.01-14.1355X41*LilongweTA MasulaChiunjiza HCHealth centreGovernment34.01-14.1425X41* <td><b>\</b>29</td> <td>Dedza</td> <td>TA Kachindamoto</td> <td>Police College HC</td> <td>Health centre</td> <td>Other</td> <td>34.51</td> <td>-14.23</td> <td>ç</td>	<b>\</b> 29	Dedza	TA Kachindamoto	Police College HC	Health centre	Other	34.51	-14.23	ç
X31*SalimaChipoka UrbanChipoka HCHealth centreGovernment34.52-13.9983X32*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0926X33*SalimaTA KambwiriChagunda HCHealth centreGovernment34.57-13.8826X34*SalimaTA KambalameParachute BattalionDispensaryOther34.54-14.0910X35*LilongweTA ChisekaMitundu Community Hosp.Rural/CommunityGovernment33.77-14.25254X36*LilongweTA MazengeraNkhoma Mission Hosp.District hospitalCHAM34.10-14.0422*X37*LilongweTA ChadzaKatema HCHealth centreCHAM33.76-14.2811*X38*LilongweTA ChadzaKatema HCHealth centreGovernment34.01-14.2811*X38*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.01-14.1186X40*LilongweTA MazengeraDiamphwi HCHealth centreGovernment34.08-14.1352X41*LilongweTA MasulaChiunjiza HCHealth centreGovernment34.10-14.4127X42*LilongweTA ChadzaMaluwa HCHealth centreGovernment34.77-14.4127X44*LilongweTA ChadzaMaluwa HCHealth centreGovernment <td></td> <td></td> <td></td> <td>Mua</td> <td></td> <td></td> <td></td> <td></td> <td></td>				Mua					
X32*SalimaTA KambalameNgodzi HCHealth centreGovernment34.51-14.0922X33*SalimaTA KambwiriChagunda HCHealth centreGovernment34.37-13.8825X34*SalimaTA KambalameParachute BattalionDispensaryOther34.54-14.0910X35*LilongweTA ChisekaMitundu Community Hosp.Rural/CommunityGovernment33.77-14.25254X36*LilongweTA MazengeraNkhoma Mission Hosp.District hospitalCHAM34.10-14.04227X37*LilongweTA ChadzaKatema HCHealth centreCHAM33.91-14.28117X38*LilongweTA ChisekaMlale Mission Hosp.Rural/CommunityCHAM33.76-14.23110X39*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.01-14.1421X40*LilongweTA MazengeraDiamphwi HCHealth centreGovernment34.01-14.1166X41*LilongweTA MasulaChiunjiza HCHealth centreGovernment34.12-13.9416X41*LilongweTA ChadzaMaluwa HCHealth centreGovernment33.87-14.25126X44*NtcheuTA ChasaaMaluwa HCHealth centreGovernment33.87-14.2666X44*NtcheuTA MasaaMlanda HCHealth centreGovernment <td>\30*</td> <td>Salima</td> <td>TA Kambalame</td> <td>Life Line Salima HC</td> <td>Health centre</td> <td>NGO</td> <td>34.54</td> <td>-14.09</td> <td>139</td>	\30*	Salima	TA Kambalame	Life Line Salima HC	Health centre	NGO	34.54	-14.09	139
X33*SalimaTA KambwiriChagunda HC Parachute Battalion ClinicHealth centreGovernment34.37-13.8824X34*SalimaTA KambalameParachute Battalion ClinicDispensaryOther34.54-14.0910X35*LilongweTA ChisekaMitundu Community Hosp.Rural/Community BoynGovernment33.77-14.25254X36*LilongweTA MazengeraNkhoma Mission Hosp.District hospitalCHAM34.10-14.0422*X37*LilongweTA ChadzaKatema HCHealth centreCHAM33.91-14.2811*X38*LilongweTA ChisekaMlale Mission Hosp.Rural/Community Rural/CommunityCHAM33.67-14.21110X39*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.01-14.1166X40*LilongweTA MazengeraDiamphwi HCHealth centreGovernment33.67-14.4127X41*LilongweTA ChitekweleChiunjiza HCHealth centreGovernment33.67-14.4127X42*LilongweTA ChadzaMaluwa HCHealth centreGovernment33.67-14.2666X44*NtcheuTA ChashumbiraLizulu HCHealth centreGovernment34.47-14.52128X45*NtcheuTA MasasaMlanda HCHealth centreCHAM34.46-14.4833X46*Ntcheu	\31*	Salima	Chipoka Urban	Chipoka HC	Health centre	Government	34.52	-13.99	87
A34*SalimaTA KambalameParachute Battalion ClinicDispensaryOther34.54-14.0910 10A35*LilongweTA ChisekaMitundu Community Hosp.Rural/CommunityGovernment33.77-14.25254A36*LilongweTA MazengeraNkhoma Mission Hosp.District hospitalCHAM34.10-14.04224A37*LilongweTA ChadzaKatema HCHealth centreCHAM33.91-14.28117A38*LilongweTA ChisekaMlale Mission Hosp.Rural/CommunityCHAM33.76-14.23110A38*LilongweTA ChisekaMlale Mission Hosp.Rural/CommunityCHAM33.76-14.23110A39*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.01-14.1186A40*LilongweTA MazengeraDiamphwi HCHealth centreGovernment34.02-14.4127A41*LilongweTA ChitekweleChiunjiza HCHealth centreGovernment33.67-14.4127A42*LilongweSTA ChitekweleChimbalanga HCHealth centreGovernment33.67-14.2660A44*NtcheuTA ChadzaMaluwa HCHealth centreGovernment34.47-14.2660A44*NtcheuTA MasasaMlanda HCHealth centreGovernment34.47-14.4833A46*NtcheuTA MasasaMlanda HCH	\32*	Salima	TA Kambalame	Ngodzi HC	Health centre	Government	34.51	-14.09	28
A35*LilongweTA ChisekaClinic Mitundu Community Hosp.Rural/CommunityGovernment33.77-14.25254A36*LilongweTA MazengeraNkhoma Mission Hosp.District hospitalCHAM34.10-14.04221A37*LilongweTA ChadzaKatema HCHealth centreCHAM33.91-14.28111A38*LilongweTA ChisekaMlale Mission Hosp.Rural/CommunityCHAM33.76-14.23110A39*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.01-14.1186A40*LilongweTA MazengeraDiamphwi HCHealth centreGovernment34.01-14.1352A41*LilongweTA MasulaChiunjiza HCHealth centreGovernment33.67-14.4121A42*LilongweTA ChitekweleChimbalanga HCHealth centreGovernment33.87-14.2660A44*NtcheuTA ChadzaMaluwa HCHealth centreGovernment33.87-14.2660A44*NtcheuTA MasasaMlanda HCHealth centreGovernment34.47-14.4332A46*NtcheuTA MasasaMasasa HCHealth centreGovernment34.42-14.4332	433*	Salima	TA Kambwiri	Chagunda HC	Health centre	Government	34.37	-13.88	25
A35*LilongweTA ChisekaMitundu Community Hosp.Rural/CommunityGovernment33.77-14.25254A36*LilongweTA MazengeraNkhoma Mission Hosp.District hospitalCHAM34.10-14.04221A37*LilongweTA ChisekaKatema HCHealth centreCHAM33.91-14.28111A38*LilongweTA ChisekaMlale Mission Hosp.Rural/CommunityCHAM33.76-14.23110A39*LilongweTA KalumbuMtenthera HCHealth centreGovernment34.01-14.1186A40*LilongweTA MazengeraDiamphwi HCHealth centreGovernment34.02-14.4152A41*LilongweTA MasulaChiunjiza HCHealth centreGovernment33.67-14.4127A42*LilongweTA ChitekweleChimbalanga HCHealth centreGovernment33.67-14.4127A44*NtcheuTA ChadzaMaluwa HCHealth centreGovernment33.67-14.4127A44*NtcheuTA ChadsaMlauda HCHealth centreGovernment34.12-13.9410A44*NtcheuTA MasasaMlanda HCHealth centreGovernment34.47-14.4332A46*NtcheuTA MasasaMasasa HCHealth centreGovernment34.42-14.4332	\34*	Salima	TA Kambalame		Dispensary	Other	34.54	-14.09	10
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	40	Nicheu	IA Masasa		meanin centre		34.40	-14.40	33
47* Ntcheu TA Chakhumbira Chigodi HC Health centre CHAM 34.54 -14.49 2 <sup>.</sup>		Ntcheu	TA Masasa	Masasa HC	Health centre	Government		-14.43	32
	47*	Ntcheu	TA Chakhumbira	Chigodi HC	Health centre	CHAM	34.54	-14.49	2

Dedza

A48*	Mangochi	TA Nankumba	Malembo HC Mangochi	Health centre	Government	34.83	-14.24	1459
A49*	Mangochi	TA Nankumba	Nankumba HC	Health centre	Government	34.82	-14.37	1097

Table 5: List of non-ART facilities considered in the analysis. The column "PLHIV" indicates the number of PLHIV that currently need more than 60 minutes to walk to the closest ART facility but less than 60 minutes to the listed health facility in the table. Facilities outside the district boundaries that may be accessible to residents within the district are marked with "\*".

ID	District	ТА	Name	Туре	Authority	Long.	Lat.	PLHIV	95% CI
F1	Dedza	TA Chilikumwendo	Mdeza Disp.	Dispensary	Government	33.97	-14.24	575	(388-827)
F2	Dedza	TA Tambala	Mjini Disp.	Dispensary	Government	34.24	-14.04	166	(109-246)
F3	Dedza	TA Tambala	MTEMWENDE	Health Post	Government	34.26	-14.15	140	(97-194)
F4	Dedza	TA Tambala	Kalulu HC	Health Centre	Government	34.20	-14.00	136	(87-200)
F5	Dedza	TA Kachere	Mlangali Disp.	Dispensary	Government	34.27	-14.41	118	(75-175)
F6	Dedza	TA Tambala	MPOMBE	Health Post	Government	34.31	-13.99	126	(83-184)
F7	Dedza	TA Kachere	Maonde HC	Health Centre	Government	34.12	-14.41	72	(48-106)
F8	Dedza	TA Tambala	KANYERERE	Health Post	Government	34.23	-13.97	91	(55-137)
F9	Dedza	TA Kaphuka	CHILAMBA	Health Post	Government	34.24	-14.36	75	(52-107)
F10	Dedza	Dedza Boma	BLM Dedza	Special	NGO	34.33	-14.38	2	(1-3)
F11	Dedza	TA Tambala	MJINI	Dispensary	Government	34.24	-14.04	166	(109-246)
F12	Dedza	TA Kachindamoto	Mtakataka Police College HC	Health Centre	Other	34.51	-14.23	0	(0-0)
F13	Dedza	TA Kachindamoto	Ntakataka Police Disp.	Health Centre	Government	34.51	-14.23	0	(0-0)
F14*	Lilongwe	TA Kalumbu	NYANJA	Health Post	Government	33.94	-14.14	429	(294-619)
F15*	Lilongwe	TA Masula	KAMBANIZITHE	Health Post	Government	33.71	-14.35	316	(205-459)
F16*	Lilongwe	TA Chiseka	KAMPINI	Health Post	Government	33.78	-14.30	311	(206-437)
F17*	Lilongwe	STA Chitekwele	CHITEKWELE	Health Post	Government	34.10	-13.97	249	(162-368)
F18*	Lilongwe	TA Masula	KAMPHONI	Health Post	Government	33.63	-14.31	210	(128-318)
F19*	Lilongwe	TA Kalumbu	BWESE	Health Post	Government	33.94	-14.22	456	(298-673)
F20*	Ntcheu	TA Masasa	Phanga Disp.	Dispensary	Government	34.72	-14.34	211	(139-316)

### Travel Times to Closest ART Facilities

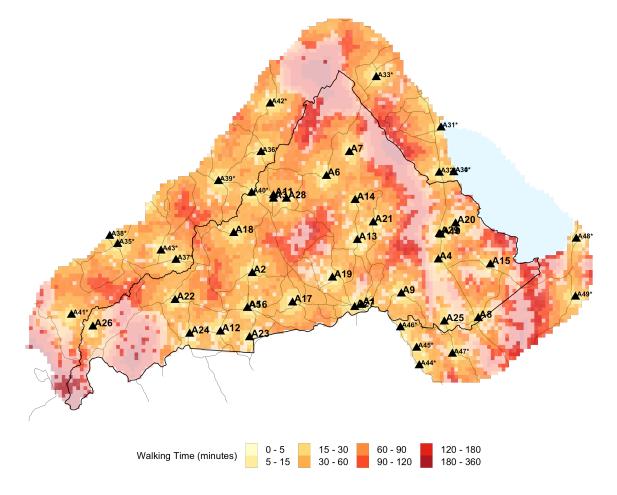


Figure 4: Estimated travel times to the closest ART facility. Travel times were calculated using data on road infrastructure, types of terrain and land elevation.

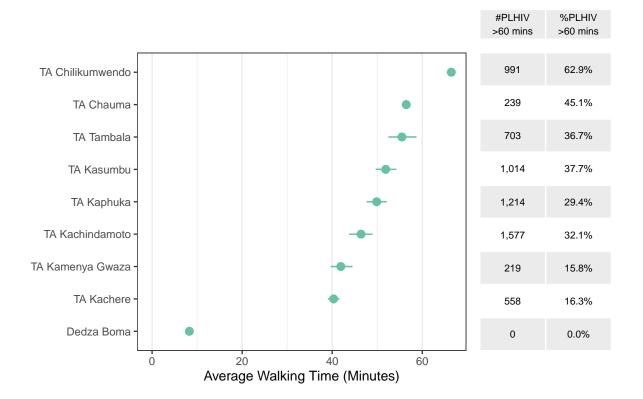


Figure 5: Estimated average walking time to the closest ART facility, weighted by the estimated number of PLHIV within the traditional authority. The right table indicates estimated number and proportion of PLHIV that need more than 60 minutes to travel to the closest ART facility, respectively.

# Areas outside 60 minutes travel

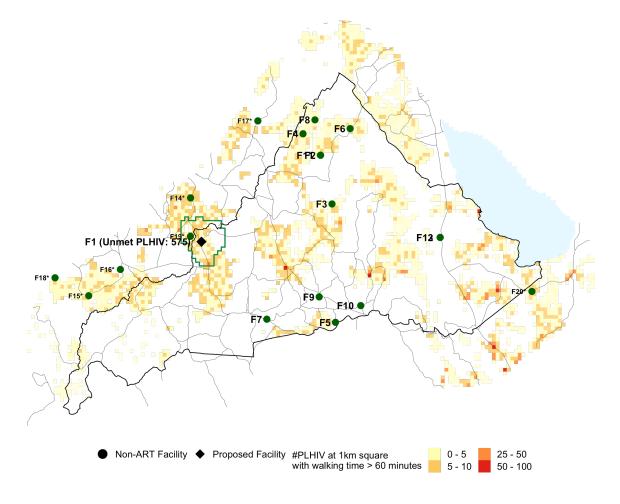


Figure 6: Proposed facility locations. Areas where the walking time to the closest ART facility is <60 minutes have been removed. Green lines indicate the 60-minutes catchment area of the proposed facility.

## Appendix (Methods Summary)

The analysis involved several steps:

- Creating a map of spatial prevalence by approximately 1km grid cells. We used cluster-level survey data from the 2015/16 MDHS and MPHIA household surveys and HIV prevalence amongst ANC clients from routine health facility data to obtain a gridded PLHIV prevalence map (1km grid cells).
- 2. Calculate the estimated number of PLHIV in each 1km grid cell.
- Modelled estimates of total population by 1km grid cell were sourced from the WorldPop project (https://www.worldpop.org/geodata/summary?id=49698). Gridded populations are constrained to only grid cells containing built settlements based on satellite imagery.
- Gridded populations were adjusted to match traditional authority (TA) population data from the 2018 household census, projected forward to 2020 based on district population projections.
- Gridded HIV prevalence (step 1) was multiplied by population for estimates of the distribution of PLHIV by 1km grid cell.
- The gridded PLHIV in each district were scaled to align to total PLHIV in each district from the from 2020 Naomi model estimates.
- 3. Calculate walking travel time for PLHIV to existing ART services. We used data on land cover terrain type (Global Land Cover 2000), roads (OpenStreetMap), elevation (GMTED2010), and water bodies (NASA Shuttle Radar Topography Mission) to model walking time from each grid cell to 757 public or not-for-profit health facilities providing ART services using the AccessMod software. Walking speed was assumed to be 6-7km/h on roads and 2-3 km/h on non-road surfaces.
- 4. Analyse the number and locations of PLHIV residing greater than 60, 90, or 120 minutes walking time from existing ART facilities. Grid cells were classified by the travel time to the nearest public or not-for-profit ART facility using the travel time model. Maps were filtered for PLHIV residing greater than 60, 90, or 120 minutes, thresholds of interest defined based on discussions with the Department of HIV and AIDS (DHA).
- 5. Identify optimal locations to reach the most PLHIV who currently reside greater than 60 or 90 minutes from ART services. An optimisation algorithm was implemented to systematically select the best facilities and locations where ART service delivery can be introduced to reach the most PLHIV residing outside travel time thresholds.

The list of 757 active facilities currently providing ART services was sourced from DHA-MIS database. Facilities that were private-for-profit were excluded from the analysis of travel time catchments. Health facilities which do not currently provide an ART service, which are candidate locations for expanding ART services, were sourced from facilities visited during the 2018/19 Service Availability and Readiness Assessment (SARA). Candidate facilities included existing health posts which are not staffed full time.