

UCLA

UCLA Previously Published Works

Title

Mobility and HIV care engagement: a research agenda

Permalink

<https://escholarship.org/uc/item/2pw1f8ff>

Journal

JIAS, 26(3)

Authors

Thorp, Marguerite
Ayieko, James
Hoffman, Risa M
[et al.](#)

Publication Date

2023-03-21

DOI

<https://doi.org/10.1002/jia2.26058>

Peer reviewed

COMMENTARY

Mobility and HIV care engagement: a research agenda

Marguerite Thorp^{1,§} , James Ayieko² , Risa M. Hoffman¹ , Kelvin Balakasi³,
Carol S. Camlin^{4,5}  and Kathryn Dovel^{1,3} 

[§]**Corresponding author:** Marguerite Thorp, Division of Infectious Diseases, David Geffen School of Medicine, University of California Los Angeles, 10833 Le Conte Ave, Los Angeles, CA 90095, USA. Tel: (310) 825-7225. (mthorp@mednet.ucla.edu)

Abstract

Introduction: Mobility is common and an essential livelihood strategy in sub-Saharan Africa (SSA). Mobile people suffer worse outcomes at every stage of the HIV care cascade compared to non-mobile populations. Definitions of mobility vary widely, and research on the role of temporary mobility (as opposed to permanent migration) in HIV treatment outcomes is often lacking. In this article, we review the current landscape of mobility and HIV care research to identify what is already known, gaps in the literature, and recommendations for future research.

Discussion: Mobility in SSA is closely linked to income generation, though caregiving, climate change and violence also contribute to the need to move. Mobility is likely to increase in the coming decades, both due to permanent migration and increased temporary mobility, which is likely much more common. We outline three central questions regarding mobility and HIV treatment outcomes in SSA. First, it is unclear what aspects of mobility matter most for HIV care outcomes and if high-risk mobility can be identified or predicted, which is necessary to facilitate targeted interventions for mobile populations. Second, it is unclear what groups are most vulnerable to mobility-associated treatment interruption and other adverse outcomes. And third, it is unclear what interventions can improve HIV treatment outcomes for mobile populations.

Conclusions: Mobility is essential for people living with HIV in SSA. HIV treatment programmes and broader health systems must understand and adapt to human mobility, both to promote the rights and welfare of mobile people and to end the HIV pandemic.

Keywords: HIV; mobility; migration; sub-Saharan Africa; antiretroviral therapy; outcomes

Received 3 August 2022; Accepted 10 January 2023

Copyright © 2023 The Authors. *Journal of the International AIDS Society* published by John Wiley & Sons Ltd on behalf of the International AIDS Society.

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

1 | INTRODUCTION

In the fight to end the HIV pandemic, it has become more important than ever to focus on marginalized groups that struggle to remain in care. The world is nearing UNAIDS' 95-95-95 targets—ensuring 95% of people with HIV know their status, 95% of those who know their status are engaged in treatment and 95% of those in care have achieved viral suppression [1]—but progress has been slower for certain groups, including mobile people. Mobility threatens each stage of the care cascade, especially in sub-Saharan Africa (SSA): mobile people are less likely to access preventative services, less likely to remain on antiretroviral therapy (ART), and less likely to achieve viral suppression as compared to non-mobile people [2–6]. These disparities are a problem both for mobile people who experience worse HIV-related outcomes, and for larger goals of epidemic control since mobility is simultaneously associated with viremia, higher rates of multiple and concurrent partners [7], and increased risk of HIV transmission [3, 8]. Ending the HIV pandemic requires understanding the challenges faced by

mobile populations and designing effective systems to address them.

Mobility is an essential livelihood tactic for those in SSA. People in SSA use mobility to find employment, to stay connected with family and to avoid conflict or disasters [9–12]. People face similar pressures regardless of HIV status, and in some cases, people with HIV may experience higher levels of mobility due to HIV-related factors, such as marital dissolution or stigma [13–15]. Yet, most HIV treatment programmes do not accommodate mobile clients [16].

Defining “mobility” is contentious, and researchers use widely varying measures and definitions [16], ranging from one night away in the past 6 months to 30 nights away in the past year. It may be appropriate to use different definitions of mobility in different settings, since the impact of mobility on the use of health services is likely context-dependent [2]. However, widely varying definitions make it difficult to achieve a cohesive understanding of the relationship between mobility and HIV care [17].

We review the current landscape of mobility and HIV care research to identify what is already known, gaps in the

literature, and recommendations for future research. Of note, many mobility-related challenges apply not only to HIV, but also to any chronic disease, such as hypertension, diabetes, and other conditions that require repeated, regular engagement with the health system. HIV provides a useful lens to examine chronic disease care and access issues for mobile people due to available data and well-established delivery systems. HIV also presents unique issues of stigma and disclosure, which may further affect adherence for mobile people.

2 | DISCUSSION

2.1 | Sources of mobility

Mobility is common in SSA and is expected to increase in the coming decade [9]. Most movements within the region are temporary and recurrent. Informal employment is the norm [18], and jobs are often short-term and insecure—however, because cash-earning opportunities are inconsistently available in rural areas, such “piece work” remains highly desirable even if it requires movement. Within countries, modern cities offer greater earning opportunities, which may induce permanent or temporary movement; however, a variety of factors (including the high costs of urban living, familial ties and social norms) may pressure low-wage workers to maintain rural residences [19–21]. Rural–rural migration is increasingly recognized in mobility research as well: seasonal patterns present economic opportunities in different parts of the country depending on the time of the year, and geographically dispersed social networks result in travel for caregiving, funerals and celebrations [10]. Between countries, the demand for labour and workers’ desire for higher wages attract workers from lower-income countries to more industrialized neighbours, though immigration laws and social pressures may cause them to eventually return [22].

Increasing civil conflict, violent extremism, and rising authoritarianism have led to record numbers of displaced people in the 21st century [11, 23], and a changing climate has caused disasters and made some environments uninhabitable [12, 24]. Extreme climate or conflict events can result in a mix of permanent and temporary mobility. Individuals may flee and later return home as climate challenges wane or as levels of violence fluctuate. Workers may move seasonally to newly productive regions and away from barren ones [25, 26]. These patterns will continue, and with regard to climate change, movements are likely to increase over time [12, 27].

Studies on mobility tend to focus on *migration* (a permanent or semi-permanent change of residence) because census data describe who relocates where and when [7, 15, 28]. Temporary mobility is more difficult to study—including circular movements between multiple residences, temporary relocation for better earning opportunities, or frequent travel for trading goods. Estimates of the prevalence of temporary mobility are highly variable, and traditional models for estimating mobility that rely only on distance and population density may not be applicable in SSA [29]. Several studies using cell phone data demonstrate how frequent mobility may be: in Rwanda, 32% of cell phone owners spent 3–12 months outside their home district in the 4 years between 2005 and 2008 [30]; in Kenya and Namibia, 5% and 13% of cell

phone users travelled across district borders on any given day, respectively [31]. Temporary mobility may have similar or greater impacts on HIV care outcomes as compared to permanent migration. For example, a single permanent move may transiently interrupt access to HIV care, but with time individuals may be able to integrate and re-start treatment [32]. Temporary mobility, on the other hand, presents a frequent risk for missed appointments and treatment interruptions that can negatively impact long-term outcomes [33, 34].

2.2 | What is known about mobility and HIV care engagement

Early epidemiologic research on HIV showed associations between mobility and HIV acquisition, suggesting that highly mobile individuals have a higher risk of HIV infection [7, 35–37]. More recent data explore the role of mobility in HIV treatment outcomes. Though quantitative data on rates of HIV testing among mobile people are scant [38], multiple studies show that mobility is negatively associated with retention in HIV care. In high-mobility settings like the Kenya–Uganda border, rural Lesotho, and peri-urban areas of South Africa, mobility is clearly associated with poor HIV treatment outcomes [2]: mobile people are less likely to be retained in treatment [4, 39, 40] and less likely to be virally suppressed [4–6]. The magnitude of mobility’s effects ranges widely—in part because definitions of mobility are so varied—from a 47% reduction in viral suppression to a six-fold reduction in 1-year retention. Mobile people are also less likely to be retained in pre-exposure prophylaxis (PrEP) programmes [41, 42]. Several qualitative studies from diverse settings, including West, East and Southern Africa, demonstrate how mobility can trigger a chain of events leading to treatment interruption [13, 43–47]. A single missed appointment can have significant consequences: it may result in long periods of treatment interruption due to the logistical challenges of re-establishing care and fear of negative patient–provider interactions (i.e. being punished for being a “defaulter”) [48, 49]. Additionally, treatment interruption can diminish the internal connection patients feel towards HIV care [43]. Those who experience treatment interruption are more likely to have repeat interruptions over time and stop ART completely [50–52].

2.3 | Closing the gaps in understanding

While poorer outcomes for mobile people are clearly documented, there is much less known about the mechanisms through which mobility affects HIV outcomes and what to do about it. Pressing questions include: What aspects of mobility cause the greatest threat to ART retention (i.e. what is “high-risk” mobility)? What populations experience high-risk mobility? And what interventions can improve ART outcomes for mobile people?

2.3.1 | What aspects of mobility matter?

We must better understand which aspects of mobility—including destinations, temporality (including duration, frequency, or seasonality), purpose and level of an individual’s control over travel—impede ART engagement and if there are high-risk mobility characteristics that interventions should

target [17, 34]. Not all mobility is the same, and various forms of mobility will affect HIV care differently. Specific patterns of mobility vary by region and individual, and an individual's experience may vary over time [53].

Members of our team have found that duration and individual agency over trip departure and duration matter. We recently assessed the impact of mobility on ART adherence (measured by levels of ART in hair samples) in communities in the Lake Victoria region and found that longer trips (>1 month) were associated with lower ART adherence as compared to shorter trips [54]. We also conducted qualitative research with mobile men in Malawi and found that men's control (or agency) over travel departure and duration greatly impacted how mobility interacted with HIV care [55]. Men emphasized that unplanned travel was unavoidable due to limited cash-earning opportunities at home; they had no choice but to travel wherever employment was available and for whatever duration an employer demanded. This meant that men often could not return to their assigned ART clinic before or during travel, resulting in treatment interruption. There may be other key aspects that characterize higher- versus lower-risk mobility for ART retention, although there is very little research on the topic.

Future research must explore what aspects of mobility matter for HIV care, rather than treating mobility as a singular phenomenon leading to a uniform risk of treatment interruption. Definitions of "high-risk mobility" may be context- and population-dependent. Research may require detailed qualitative studies or novel techniques for analyzing survey data (such as the visual analysis used in a study of mobility among female sex workers in Zimbabwe [56]) before locally specific definitions of high-risk can be operationalized. Whether there are universal aspects of mobility that matter for ART outcomes in all settings is not yet clear, but may emerge from a synthesis of more localized studies.

2.3.2 | Who is at risk?

Just as mobility patterns vary, so too do mobile clients and their ability to navigate mobility and remain in care [17]. Key questions to explore include whether certain populations are at increased risk of treatment interruption due to mobility—or, alternatively, whether there are specific populations that can overcome mobility-related barriers to care more easily. Answering these questions will help tailor interventions to those who need it most. For example, should interventions target people in extreme poverty who have limited employment opportunities, or those with more education who seek better job prospects in cities [57, 58]? Many men in SSA depend on mobility, but men who experience relative and absolute poverty often participate in more chaotic, less predictable mobility in pursuit of work [55], and disaggregating this broad group of "mobile men" could help target future interventions.

We know that women in SSA are also highly mobile, though their forms of mobility tend to differ from men's—women's movements have been shorter-term and more localized, with more frequent returns to households of origin [45, 59]. How do these different patterns of mobility intersect with gendered patterns of HIV care outcomes? Relatedly, many studies

find high rates of mobility among female sex workers, especially in West and Central Africa, but whether mobility is a risk factor or survival strategy for this vulnerable population is less clear [56, 60–63]. Children and adolescents may move with their caregivers, and they may face additional mobility-related challenges if attending boarding school [64, 65]; this vulnerable population faces many treatment adherence challenges already, which may be compounded by mobility [66, 67]. Finally, men who have sex with men (MSM) may experience high rates of mobility and unique challenges for engaging in care, and the few studies available suggest that mobility is associated with worse PrEP and ART outcomes among MSM. This population is generally understudied in SSA [68, 69].

Research should also examine if there are other key factors that amplify the negative impacts of mobility, such as disclosure, social support (at the destination and at home), literacy, and economic status [28]. It might be possible to use events like the COVID-19 pandemic or climate disasters to understand how mobility interacts with other sources of vulnerability. For example, the COVID-19 pandemic—which impeded mobility for some populations but created a new need for mobility among others [70, 71]—may provide interesting research opportunities to understand whether mobility itself causes poor ART outcomes, or if it is a marker for other types of vulnerability that are associated with poor outcomes. Finally, how do climate change, seasonal trends [72, 73], and fluctuating levels of violent conflict affect mobility decisions [74]? The ability to predict individuals' mobility and its impact on HIV outcomes, rather than just respond to it reactively, will be essential to target health system interventions.

2.3.3 | Exploring solutions

Further research is needed on interventions to improve ART outcomes for mobile populations. Client-centred, differentiated service delivery (DSD) models [75] should work for mobile populations. To date, DSD options have been largely available only to stable clients retained in care for more than 6 months, but there is increasing momentum towards expanding DSD to new or high-risk clients [75, 76]. Given the barriers mobile people face related to frequent facility visits for ART refills, they may benefit substantially from DSD models that reduce the burden of care.

Several DSD models could be considered for mobile populations. First, multi-month dispensing (MMD) for up to 6 months of ART is now common practice for stable clients and is highly acceptable, feasible, and effective from client and health system perspectives [77–79]. The shift to MMD was accelerated by the COVID-19 pandemic to reduce the need for people to make frequent return visits to health facilities and may partly explain the unexpectedly good ART outcomes seen widely in 2020 and 2021. MMD for mobile clients would allow clients to travel for longer periods of time without running out of medications, and it would reduce the opportunities for missed appointments. Second, community-based ART distribution has improved initiation, retention and viral suppression [80–83] and may be a useful solution for highly mobile people if refills were made available in common destinations or transit hubs.

Peer mentors provide tangible, real-life solutions to HIV care challenges, and can improve ART engagement among pregnant and breastfeeding women [84, 85], adolescents [86–88], men [89], and general populations [90, 91]. Deploying peer mentors who have experience with mobility may improve outcomes for mobile clients since this population often does not know how to navigate mobility and HIV care and the topic is rarely discussed in routine counselling sessions. In Kenya, social networks are being used to distribute HIV self-test kits and provide ART and PrEP linkage support: highly socially connected men are trained and supported to encourage other men in their network to use HIV services, with results pending [92]. A similar approach could be used for highly mobile populations.

Long-acting injectable therapies could help mobile clients avoid unwanted disclosure, a fear that is often magnified while travelling. While current regimens require injections every 2 months [93], the promise of injectable regimens delivered every 6 months or the use of an ART implant could substantially benefit many care recipients [94, 95].

National electronic health records would allow clients to easily access care from any facility in a given country [2, 40, 46]. Even if clients have reduced facility visits due to MMD or long-acting ART, unplanned trips may still interfere with scheduled appointment times, and accessing care outside of one's home facility is often difficult. In Malawi, we found that mobile men often tried to access HIV care at another facility while travelling, but facility staff sometimes refused services, asking for an official transfer letter from the home facility. National electronic records would promote continuity of care, regardless of client location. If national electronic health records are not feasible, national programmes could consider communication systems that allow health workers across facilities to communicate about clients who move between facilities.

Finally, mobile phone interventions may help mobile clients find nearby facilities or leverage telemedicine to connect with their home facility [96, 97].

3 | CONCLUSIONS

Mobility has a profound impact on HIV engagement and will likely increase in upcoming years due to climate change, conflict and unequal economic development. HIV programmes must understand what type of mobility has the greatest impact on HIV treatment outcomes, which clients experience high-risk mobility, and how to provide high-quality care for these clients. Temporary mobility may be much more common than originally assumed and deserves particular attention. As countries near UNAIDS' 95/95/95 goals, finding innovative strategies to serve mobile populations is critical, both to promote the rights and welfare of mobile people themselves and to end the HIV pandemic.

AUTHORS' AFFILIATIONS

¹Division of Infectious Diseases, David Geffen School of Medicine, University of California Los Angeles, Los Angeles, California, USA; ²Center for Microbiology Research, Kenya Medical Research Institute, Kisumu, Kenya; ³Partners in Hope, Lilongwe, Malawi; ⁴Department of Obstetrics, Gynecology & Reproductive

Sciences, University of California San Francisco, San Francisco, California, USA; ⁵Center for AIDS Prevention Studies, Department of Medicine, University of California San Francisco, San Francisco, California, USA

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHORS' CONTRIBUTIONS

MT and KD developed the concept and outline for this commentary. The first draft of the manuscript was written by MT, RMH and KD. All authors (MT, JA, RMH, KB, CSC and KD) participated in framing discussions, provided comments and edits on the initial draft and approved the final manuscript.

ACKNOWLEDGEMENTS

The authors would like to thank the many trial participants and researchers whose work informed this piece, as well as the anonymous reviewers whose comments greatly improved it.

FUNDING

Individual support during the preparation of this commentary included funding from the Fogarty International Center (K01-TW011484-01; UCLA CFAR grant AI028697; the University of California Global Health Institute D43TW009343), the Bill & Melinda Gates Foundation (grant #001423) and the National Institutes of Mental Health (T32MH080634).

DISCLAIMER

The funders of the study had no role in study design, data collection, data analysis, data interpretation or writing of the report.

DATA AVAILABILITY STATEMENT

This manuscript does not use original data.

REFERENCES

1. UNAIDS. Fast-Track—ending the AIDS epidemic by 2030. Geneva: 2014.
2. Tanser F, Barnighausen T, Vandormael A, Dobra A. HIV treatment cascade in migrants and mobile populations. *Curr Opin HIV AIDS*. 2015;10(6):430–8.
3. Akullian A, Bershteyn A, Jewell B, Camlin CS. The missing 27. *AIDS*. 2017;31(17):2427–9.
4. Larmarange J, Diallo MH, McGrath N, Iwuji C, Plazy M, Thiébaud R, et al. The impact of population dynamics on the population HIV care cascade: results from the ANRS 12249 Treatment as Prevention trial in rural KwaZulu-Natal (South Africa). *J Int AIDS Soc*. 2018;21(Suppl 4):e25128.
5. Edwards JK, Arimi P, Ssegooba F, Mulholland G, Markiewicz M, Bukusi EA, et al. The HIV care continuum among resident and non-resident populations found in venues in East Africa cross-border areas. *J Int AIDS Soc*. 2019;22(1):e25226.
6. Grabowski MK, Patel EU, Nakigozi G, Ssempijja V, Ssekubugu R, Ssekasanvu J, et al. Prevalence and predictors of persistent human immunodeficiency virus viremia and viral rebound after universal test and treat: a population-based study. *J Infect Dis*. 2021;223(7):1150–60.
7. Weine SM, Kashuba AB. Labor migration and HIV risk: a systematic review of the literature. *AIDS Behav*. 2012;16(6):1605–21.
8. Okano JT, Busang L, Seipone K, Valdano E, Blower S. The potential impact of country-level migration networks on HIV epidemics in sub-Saharan Africa: the case of Botswana. *Lancet HIV*. 2021;8(12):e787–92.
9. Africa migration report: challenging the narrative. Addis Ababa: International Organization for Migration; 2020.
10. Collinson M, Tollman SM, Kahn K, Clark S, Garenne M. Highly prevalent circular migration: households, mobility and economic status in rural South Africa. Africa on the move: African migration and urbanisation in comparative perspective. 2003:194–216.
11. UNHCR Global Report 2020. Geneva: United Nations High Commissioner for Refugees; 2021.
12. Rigaud KK, de Sherbinin A, Jones B, Bergmann J, Clement V, Ober K, et al. Groundswell: preparing for internal climate migration. Washington, DC: World Bank; 2018.

13. Chamberlin S, Mphande M, Phiri K, Kalande P, Dovel K. How HIV clients find their way back to the ART clinic: a qualitative study of disengagement and re-engagement with HIV care in Malawi. *AIDS Behav.* **2022**;26(3):674–685.
14. Anglewicz P. Migration, marital change, and HIV infection in Malawi. *Demography.* **2012**;49(1):239–65.
15. Anglewicz P, VanLandingham M, Manda-Taylor L, Kohler HP. Migration and HIV infection in Malawi. *AIDS.* **2016**;30(13):2099–105.
16. Camlin CS, Charlebois ED. Mobility and its effects on HIV acquisition and treatment engagement: recent theoretical and empirical advances. *Curr HIV/AIDS Rep.* **2019**;16(4):314–23.
17. Deane KD, Parkhurst JO, Johnston D. Linking migration, mobility and HIV. *Trop Med Int Health.* **2010**;15(12):1458–63.
18. Medina L, Jonelis A, Cangul M. The informal economy in sub-Saharan Africa: size and determinants. *Int Monet Fund Work Papers.* **2017**;2017(156):31.
19. Collinson MA, Tollman SM, Kahn K. Migration, settlement change and health in post-apartheid South Africa: triangulating health and demographic surveillance with national census data. *Scand J Public Health.* **2007**;35(Suppl 69):77–84.
20. Potts DH. Circular migration in Zimbabwe & contemporary sub-Saharan Africa. *Jama Currey;* **2010**.
21. Beguy D, Bocquier P, Zulu EM. Circular migration patterns and determinants in Nairobi slum settlements. *Demographic Res.* **2010**;23:549–86.
22. Agadjanian V. Research on international migration within sub-Saharan Africa: foci, approaches, and challenges. *Sociol Quart.* **2008**;49(3):407–21.
23. Cazabat C, O'Connor A. Internal Displacement Index Report. Internal Displacement Monitoring Center; **2021**.
24. Warner K, Hamza M, Oliver-Smith A, Renaud F, Julca A. Climate change environmental degradation & migration. *Nat Hazards.* **2010**;55:689–715.
25. Lieber M, Chin-Hong P, Whittle HJ, Hogg R, Weiser SD. The synergistic relationship between climate change and the HIV/AIDS epidemic: a conceptual framework. *AIDS Behav.* **2021**;25(7):2266–77.
26. Loevinsohn M. The 2001–03 Famine and the dynamics of HIV in Malawi: a natural experiment. *PLoS One.* **2015**;10(9):e0135108.
27. Schooley RT. Our warming planet: is the HIV-1-infected population in the crosshairs. *Top Antivir Med.* **2016**;26(2):67–70.
28. Pega F, Govindaraj S, Tran NT. Health service use and health outcomes among international migrant workers compared with non-migrant workers: a systematic review and meta-analysis. *PLoS One.* **2021**;16(6):e0252651.
29. Meredith HR, Giles JR, Perez-Saez J, Mande T, Rinaldo A, Mutembo S, et al. Characterizing human mobility patterns in rural settings of sub-Saharan Africa. *eLife.* **2021**;10:e68441.
30. Blumenstock JE. Inferring patterns of internal migration from mobile phone call records: evidence from Rwanda. *Inform Technol Dev.* **2012**;18(2):107–25.
31. Wesolowski A, zu Erbach-Schoenberg E, Tatem AJ, Lourenço C, Viboud C, Charu V, et al. Multinational patterns of seasonal asymmetry in human movement influence infectious disease dynamics. *Nat Commun.* **2017**;8(1):2069.
32. Taylor BS, Reyes E, Levine EA, Khan SZ, Garduño LS, Donastorg Y, et al. Patterns of geographic mobility predict barriers to engagement in HIV care and antiretroviral treatment adherence. *AIDS Patient Care STDs.* **2014**;28(6):284–95.
33. Taylor BS, Garduño LS, Reyes EV, Valiño R, Rojas R, Donastorg Y, et al. HIV care for geographically mobile populations. *Mt Sinai J Med.* **2011**;78(3):342–51.
34. Camlin CS, Cassels S, Seeley J. Bringing population mobility into focus to achieve HIV prevention goals. *J Int AIDS Soc.* **2018**;21(Suppl 4):e25136.
35. Chirwa WC. Migrant labour, sexual networking and multi-partnered sex in Malawi. *Health Transit Rev.* **1997**;7:5–15.
36. Kayukwa A, Butts SA, Barylski NA, Alcaide ML, Rodriguez VJ, Chitalu N, et al. HIV prevention among Zambian itinerant workers: challenges and solutions. *J Health Care Poor Underserved.* **2019**;30(1):358–77.
37. Cassels S, Jenness SM, Biney AAE, Ampofo WK, Dodo FN-A. Migration, sexual networks, and HIV in Agbogbloshie, Ghana. *Demographic Res.* **2014**;31(28):861–88.
38. Camlin CS, Ssemmondo E, Chamie G, El Ayadi AM, Kwarisiima D, Sang N, et al. Men “missing” from population-based HIV testing: insights from qualitative research. *AIDS Care.* **2016**;28(Suppl 3):67–73.
39. Bygrave H, Kranzer K, Hilderbrand K, Whittall J, Jouquet G, Goemaere E, et al. Trends in loss to follow-up among migrant workers on antiretroviral therapy in a community cohort in Lesotho. *PLoS One.* **2010**;5(10):e13198.
40. Clouse K, Vermund SH, Maskew M, Lurie MN, MacLeod W, Malet G, et al. Mobility and clinic switching among postpartum women considered lost to HIV care in South Africa. *J Acquir Immune Defic Syndr.* **2017**;74(4):383–9.
41. Ddaaki W, Strömdahl S, Yeh PT, Rosen JG, Jackson J, Nakyanjo N, et al. Qualitative assessment of barriers and facilitators of PrEP use before and after rollout of a PrEP program for priority populations in South-Central Uganda. *AIDS Behav.* **2021**;25(11):3547–62.
42. Kayesu I, Mayanja Y, Nakirijja C, Machira YW, Price M, Seeley J, et al. Uptake of and adherence to oral pre-exposure prophylaxis among adolescent girls and young women at high risk of HIV-infection in Kampala, Uganda: a qualitative study of experiences, facilitators and barriers. *BMC Womens Health.* **2022**;22(1):440.
43. Ware NC, Wyatt MA, Geng EH, Kaaya SF, Agbaji OO, Muyindike WR, et al. Toward an understanding of disengagement from HIV treatment and care in sub-Saharan Africa: a qualitative study. *PLoS Med.* **2013**;10(1):e1001369.
44. Bond V, Ngwenya F, Thomas A, Simuyaba M, Hoddinott G, Fidler S, et al. Spinning plates: livelihood mobility, household responsibility and anti-retroviral treatment in an urban Zambian community during the HPTN 071 (PopART) study. *J Int AIDS Soc.* **2018**;21(Suppl 4):e25117.
45. Camlin CS, Akullian A, Neilands TB, Getahun M, Bershteyn A, Ssali S, et al. Gendered dimensions of population mobility associated with HIV across three epidemics in rural Eastern Africa. *Health Place.* **2019**;57:339–51.
46. Hoddinott G, Myburgh H, de Villiers L, Nduvani R, Mantantana J, Thomas A, et al. Households, fluidity, and HIV service delivery in Zambia and South Africa - an exploratory analysis of longitudinal qualitative data from the HPTN 071 (PopART) trial. *J Int AIDS Soc.* **2018**;21(Suppl 4):e25135.
47. Nordentoft PB, Engell-Sørensen T, Jespersen S, Correia FG, Medina C, da Silva Té D, et al. Assessing factors for loss to follow-up of HIV infected patients in Guinea-Bissau. *Infection.* **2017**;45(2):187–97.
48. Camara BS, Belaid L, Manet H, Kolie D, Guillard E, Bigirimana T, et al. What do we know about patient-provider interactions in sub-Saharan Africa? A scoping review. *Pan Afr Med J.* **2020**;37:88.
49. Kwame A, Petrucka PM. Communication in nurse-patient interaction in healthcare settings in sub-Saharan Africa: a scoping review. *Int J Afr Nurs Sci.* **2020**;12:100198.
50. Beres LK, Schwartz S, Simbeza S, McGready J, Eshun-Wilson I, Mwamba C, et al. Patterns and predictors of incident return to HIV care among traced, disengaged patients in Zambia: analysis of a prospective cohort. *J Acquir Immune Defic Syndr.* **2021**;86(3):313–22.
51. Teklu AM, Yirdaw KD. Patients who restart antiretroviral medication after interruption remain at high risk of unfavorable outcomes in Ethiopia. *BMC Health Serv Res.* **2017**;17(1):247.
52. Nakiwogga-Muwanga A, Musaazi J, Katabira E, Worodria W, Talisuna SA, Colebunders R. Patients who return to care after tracking remain at high risk of attrition: experience from a large HIV clinic, Uganda. *Int J STD AIDS.* **2015**;26(1):42–7.
53. Cassels S, Camlin CS, Seeley J. One step ahead: timing and sexual networks in population mobility and HIV prevention and care. *J Int AIDS Soc.* **2018**;21(Suppl 4):e25140.
54. Murnane PM, Gandhi M, Bacchetti P, Getahun M, Gutin SA, Okochi H, et al. Distinct forms of migration and mobility are differentially associated with HIV treatment adherence. *AIDS.* **2022**;36(7):1021–30.
55. Thorp M, Bellos M, Temelkowska T, Mphande M, Robson I, Choko A, et al. Mobility is associated with ART interruptions among men in Malawi: a mixed-methods study. *International AIDS Society Conference; 29 July–2 August; Montreal; 2022*.
56. Davey C, Dirawo J, Hargreaves JR, Cowan FM. Exploring the association between mobility and access to HIV services among female sex workers in Zimbabwe. *AIDS Behav.* **2020**;24(3):746–61.
57. Herrera Almanza C, Sahn DE. Childhood determinants of internal youth migration in Senegal. *Demographic Res.* **2020**;43(45):1335–66.
58. Ginsburg PC, Bocquier P, Beguy D, Afolabi S, Augusto O, Derra K, et al. Human capital on the move: education as a determinant of internal migration in selected INDEPTH surveillance populations in Africa. *Demographic Res.* **2016**;34(30):845–84.
59. Camlin CS, Snow RC, Hosegood V. Gendered patterns of migration in rural South Africa. *Popul Space Place.* **2014**;20(6):528–51.
60. Platt L, Grenfell P, Fletcher A, Sorhaindo A, Jolley E, Rhodes T, et al. Systematic review examining differences in HIV, sexually transmitted infections and health-related harms between migrant and non-migrant female sex workers. *Sex Transm Infect.* **2013**;89(4):311–9.
61. Scorgie F, Chersich MF, Ntaganira I, Gerbase A, Lule F, Lo Y-R. Socio-demographic characteristics and behavioral risk factors of female sex workers in sub-Saharan Africa: a systematic review. *AIDS Behav.* **2012**;16(4):920–33.
62. Trout CH, Dembélé O, Diakitè D, Bougoudogo F, Doumbia B, Mathieu J, et al. West African female sex workers in Mali: reduction in HIV prevalence and differences in risk profiles of sex workers of differing nationalities of origin. *J Acquir Immune Defic Syndr.* **2015**;68(Suppl 2):S221–31.
63. Davey C, Cowan F, Hargreaves J. The effect of mobility on HIV-related health-care access and use for female sex workers: a systematic review. *Soc Sci Med.* **2018**;211:261–73.

64. Kose J, Lenz C, Akuno J, Kiiru F, Jelagat Odionyi J, Otieno-Masaba R, et al. Supporting adolescents living with HIV within boarding schools in Kenya. *PLoS One*. 2021;16(12):e0260278.
65. Ammon N, Mason S, Corkery JM. Factors impacting antiretroviral therapy adherence among human immunodeficiency virus-positive adolescents in sub-Saharan Africa: a systematic review. *Public Health*. 2018;157:20–31.
66. Ferrand RA, Briggs D, Ferguson J, Penazzato M, Armstrong A, MacPherson P, et al. Viral suppression in adolescents on antiretroviral treatment: review of the literature and critical appraisal of methodological challenges. *Trop Med Int Health*. 2016;21(3):325–33.
67. Idele P, Gillespie A, Porth T, Suzuki C, Mahy M, Kasedde S, et al. Epidemiology of HIV and AIDS among adolescents: current status, inequities, and data gaps. *J Acquir Immune Defic Syndr*. 2014;66:S144–53.
68. Mugo PM, Sanders EJ, Mutua G, van der Elst E, Anzala O, Barin B, et al. Understanding adherence to daily and intermittent regimens of oral HIV pre-exposure prophylaxis among men who have sex with men in Kenya. *AIDS Behav*. 2015;19(5):794–801.
69. Wanyenze RK, Musinguzi G, Matovu JK, Kiguli J, Nuwaha F, Mujisha G, et al. "If you tell people that you had sex with a fellow man, it is hard to be helped and treated": barriers and opportunities for increasing access to HIV services among men who have sex with men in Uganda. *PLoS One*. 2016;11(1):e0147714.
70. Loiate S, Mutembo S, Arambepola R, Makungo K, Kabalo EN, Sinyange NB, et al. Changes in mobility patterns during the COVID-19 pandemic in Zambia: implications for the effectiveness of NPIs in sub-Saharan Africa. *medRxiv*. 2022:2022.07.20.22277849.
71. Global Migration Data Portal [Internet]. IOM GMDAC. 2022 [cited 23 June 2022]. Available from: https://www.migrationdataportal.org/international-data?i=stock_abs_&t=2015&cm49=710
72. Serdeczny O, Adams S, Baarsch F, Coumou D, Robinson A, Hare W, et al. Climate change impacts in sub-Saharan Africa. *Reg Environ Change*. 2017;17:1585–1600.
73. Kniveton DR, Smith CD, Black R. Emerging migration flows in a changing climate in dryland Africa. *Nat Clim Change*. 2012;2(6):444–7.
74. Dercon S, Gutiérrez-Romero R. Triggers and characteristics of the 2007 Kenyan electoral violence. *World Dev*. 2012;40(4):731–44.
75. Ehrenkranz P, Grimsrud A, Rabkin M. Differentiated service delivery: navigating the path to scale. *Curr Opin HIV AIDS*. 2019;14(1):60–5.
76. Grimsrud A, Wilkinson L. Acceleration of differentiated service delivery for HIV treatment in sub-Saharan Africa during COVID-19. *J Int AIDS Soc*. 2021;24(6):e25704.
77. Hoffman RM, Moyo C, Balakasi KT, Siwale Z, Hubbard J, Bardon A, et al. Multi-month dispensing of up to 6 months of antiretroviral therapy in Malawi and Zambia (INTERVAL): a cluster-randomised, non-blinded, non-inferiority trial. *Lancet Glob Health*. 2021;9(5):e628–38.
78. Hubbard J, Phiri K, Moucheraud C, McBride K, Bardon A, Balakasi K, et al. A qualitative assessment of provider and client experiences with 3- and 6-month dispensing intervals of antiretroviral therapy in Malawi. *Glob Health Sci Pract*. 2020;8(1):18–27.
79. Tukei BB, Fatti G, Tiam A, Ngorima-Mabhena N, Tukei VJ, Tshabalala I, et al. Twelve-month outcomes of community-based differentiated models of multi-month dispensing of ART among stable HIV-infected adults in Lesotho: a cluster-randomized noninferiority trial. *J Acquir Immune Defic Syndr*. 2020;85(3):280–91.
80. Barnabas RV, Szpiro AA, van Rooyen H, Asiiimwe S, Pillay D, Ware NC, et al. Community-based antiretroviral therapy versus standard clinic-based services for HIV in South Africa and Uganda (DO ART): a randomised trial. *Lancet Glob Health*. 2020;8(10):e1305–15.
81. Eshun-Wilson I, Awotiwon AA, Germann A, Amankwa SA, Ford N, Schwartz S, et al. Effects of community-based antiretroviral therapy initiation models on HIV treatment outcomes: a systematic review and meta-analysis. *PLoS Med*. 2021;18(5):e1003646.
82. Vogt F, Kalenga L, Lukela J, Salumu F, Diallo I, Nico E, et al. Brief Report: decentralizing ART supply for stable HIV patients to community-based distribution centers: program outcomes from an urban context in Kinshasa, DRC. *J Acquir Immune Defic Syndr*. 2017;74(3):326–31.
83. Gilbert HN, Wyatt MA, Pisarski EE, Asiiimwe S, van Rooyen H, Seeley J, et al. How community ART delivery may improve HIV treatment outcomes: qualitative inquiry into mechanisms of effect in a randomized trial of community-based ART initiation, monitoring and re-supply (DO ART) in South Africa and Uganda. *J Int AIDS Soc*. 2021;24(10):e25821.
84. Hunduma F, Gebrehanna E, Aduana Debela F. Determinants of mother-to-child transmission of HIV in public hospitals of West Shewa Zone, Central Ethiopia: case-control study. *HIV AIDS*. 2021;13:435–43.
85. Shroufi A, Mafara E, Saint-Sauveur JF, Taziwa F, Viñoles MC. Mother to Mother (M2M) peer support for women in Prevention of Mother to Child Transmission (PMTCT) programmes: a qualitative study. *PLoS One*. 2013;8(6):e64717.
86. MacKenzie RK, van Lettow M, Gondwe C, Nyirongo J, Singano V, Banda V, et al. Greater retention in care among adolescents on antiretroviral treatment accessing "Teen Club" an adolescent-centred differentiated care model compared with standard of care: a nested case-control study at a tertiary referral hospital in Malawi. *J Int AIDS Soc*. 2017;20(3):e25028.
87. Funck-Brentano I, Dalban C, Veber F, Quartier P, Hefez S, Costagliola D, et al. Evaluation of a peer support group therapy for HIV-infected adolescents. *AIDS*. 2005;19(14):1501–8.
88. Mark D, Hrapcak S, Ameyan W, Lovich R, Ronan A, Schmitz K, et al. Peer support for adolescents and young people living with HIV in sub-Saharan Africa: emerging insights and a methodological agenda. *Curr HIV/AIDS Rep*. 2019;16(6):467–74.
89. Hlongwa M, Cornell M, Malone S, Pitsillides P, Little K, Hasen N. Uptake and short-term retention in HIV treatment among men in South Africa: the Coach Mpilo Pilot Project. *Glob Health Sci Pract*. 2022;10(1):e2100498.
90. Dave S, Peter T, Fogarty C, Karatzas N, Belinsky N, Pant Pai N. Which community-based HIV initiatives are effective in achieving UNAIDS 90-90-90 targets? A systematic review and meta-analysis of evidence (2007–2018). *PLoS One*. 2019;14(7):e0219826.
91. Asiiimwe SAA A, Tumusiime O, Turyamureeba B. Effectiveness of community health extension workers (CHEWs) in contributing to the overall UNAIDS goal of 90-90-90: a pilot project in south-western Uganda. *International AIDS Society; Durban, South Africa*; 2016.
92. Sheira LA, Kwena ZA, Charlebois ED, Agot K, Ayieko B, Gandhi M, et al. Testing a social network approach to promote HIV self-testing and linkage to care among fishermen at Lake Victoria: study protocol for the Owete Cluster Randomized Controlled Trial. *Trials*. 2022;23(1):463.
93. Overton ET, Richmond G, Rizzardini G, Thalme A, Girard P-M, Wong A, et al. Long-acting cabotegravir + rilpivirine every 2 months: ATLAS-2M week 152 results. *CROI; (virtual)* 2022.
94. Ogbuagu O, Segal-Maurer S, Brinson C, Chetchotiskad P, Lichtenstein K, McGowan J, et al. Long-acting lenacapavir in people with multidrug resistant HIV-1: week 52 results. *CROI; February 12–16; (virtual)* 2022.
95. Thornhill J, Orkin C. Long-acting injectable HIV therapies: the next frontier. *Curr Opin Infect Dis*. 2021;34(1):8–15.
96. IntraHealth. mHealth tool is keeping Central American clients connected to HIV care amid COVID-19 shutdowns [cited 1 April 2020]. Available from: <https://www.intrahealth.org/news/mhealth-tool-keeping-central-american-clients-connected-hiv-care-amid-covid-19-shutdowns>
97. Clouse K, Phillips TK, Mogoba P, Ndlou L, Bassett J, Myer L. Attitudes toward a proposed GPS-based location tracking smartphone app for improving engagement in HIV care among pregnant and postpartum women in South Africa: focus group and interview study. *JMIR Form Res*. 2021;5(2):e19243.