HIV treatment cascade in migrants and mobile populations

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Purpose of review
Health policy makers aspire to achieve an HIV treatment ‘cascade’ in which diagnostic and treatment services are accessed early and routinely by HIV-infected individuals. However, migrants and highly mobile individuals are likely to interact with HIV treatment programs and the healthcare system in ways that reflect their movement through time and place, affecting their successful progression through the HIV treatment cascade. We review recent research that has examined the challenges in effective and sustained HIV treatment for migrants and mobile populations.

Recent findings
Mobility is associated with increased risk of antiretroviral therapy (ART) nonadherence, lost to follow-up, deterioration in CD4 count, HIV-related death, development of drug resistance and general noncontinuity of HIV care. Migrants’ slow progression through the HIV treatment cascade can be attributed to feelings of confusion, helplessness; an inability to effectively communicate in the native language; poor knowledge about administrative or logistical requirements of the healthcare system; the possibility of deportation or expulsion based on the legal status of the undocumented migrant; fear of disclosure and social isolation from the exile or compatriot group. Travel or transition to the host country commonly makes it difficult for migrants to remain enrolled in ART programs and to maintain adherence to treatment.

Summary
Existing public health systems fail to properly account for migration, and actionable knowledge of the health requirements of migrants is still lacking. A large body of research has shown that migrants are more likely to enter into the healthcare system late and are less likely to be retained at successive stages of the HIV treatment cascade. HIV-infected migrants are especially vulnerable to a wide range of social, economic and political factors that include a lack of direct access to healthcare services; exposure to difficult or oppressive work environments; the separation from family, friends and a familiar sociocultural environment. Realizing the full treatment and preventive benefits of the UNAIDS 90–90–90 strategy will require reaching all marginalized subpopulations of which migrants are a particularly large and important group.

Keywords
antiretroviral therapy, HIV epidemiology, key populations, migration

INTRODUCTION
In recent years, several studies have convincingly demonstrated that combination antiretroviral therapy (ART) can improve the life expectancy of communities experiencing severe HIV epidemics and reduce the rate of onward HIV transmission [1–5]. Optimism generated by these findings has been coupled with the timely development of standardized and affordable ART regimens that have reached more than 15 million people worldwide by 2015 [6]. Given these developments, the United Nations Programme on HIV/AIDS (UNAIDS) has recently proposed a set of ‘ambitious but achievable’ targets to have 90% of all HIV-infected people...
The HIV treatment cascade is a conceptual framework that can be used to evaluate the implementation and success of systems to diagnose and treat HIV-infected individuals. Migrants are more likely to experience disparities and inequalities in health access due to their legal (undocumented) status, unfamiliarity with the host environment, poor communication skills, and experience of culturally insensitive healthcare services and practices. Feelings of confusion, helplessness, vulnerability, fear of disclosure and suspicion of the healthcare system may further contribute to poorer diagnostic and treatment uptake by migrants. Migrants are therefore less likely to be diagnosed at an early stage of HIV infection and are more likely to be LTFU at successive stages of the HIV treatment cascade.

Timely progress and long-term retention in the HIV treatment cascade can be facilitated by improvements in migrant health monitoring systems, an emphasis on the human right to health regardless of citizenship or legal status and the integration of migrant-specific health services into the broader public health framework of the host country.

HIV is diagnosed, to ensure that 90% of those who know their status are on ART and to maintain virologic suppression for 90% of all treated individuals by the year 2020 [6]. Attention has now turned to the question of how HIV diagnostic and treatment strategies, in the context of the 90–90–90 benchmarks, can be optimized through existing public healthcare programs. Introduced in 2009, the HIV treatment cascade has since regained traction as an important concept and a useful metric with which to evaluate the implementation and success of these strategies [7,8].

The HIV treatment cascade envisages an ideal pathway for the infected individual through a discrete set of diagnostic and treatment stages. In the best-case scenario, an individual is diagnosed early after HIV infection in stage 1 (testing); in stages 2 and 3 (linkage and retention), the individual links to clinical care and is routinely monitored until meeting ART eligibility criteria; in stage 4 (treatment), the individual is initiated on ART soon after eligibility; in stage 5 (re-engagement), virologic suppression is maintained through long-term treatment adherence and care [7]. In reality, however, individuals are more likely to enter into the healthcare system late and are at a greater risk of lost-to-follow-up at successive stages of the treatment cascade [8–15,16*]. Furthermore, existing ‘leaks’ in the treatment cascade are being multiplied by a range of factors related to migration, mobility and frequent travel [17,18,19*,20,21].

Migrants are a large group of individuals (approximately 1 billion worldwide) who reside outside their country of birth [22]. This group includes labor migrants, refugees, asylum seekers, returnees and undocumented migrants who have chosen to either settle in the host country (settlers), relocate or move to another country (transit migrants), or move back and forth between their home and host countries (circular migrants). Because of their levels of high mobility, as documented elsewhere, migrants are at a higher risk of HIV acquisition and will be less likely to benefit from the survival and preventive impact of ART [23,24]. Furthermore, an accumulating body of research has described the vulnerability of HIV-infected migrants to a wide range of social, economic and political factors that include a lack of direct access to healthcare services; exposure to difficult or oppressive work environments; the separation from family, friends and a familiar sociocultural environment [25,26]. Migrants will require very specific health systems infrastructure and interventions to rapidly and successfully progress through the HIV treatment cascade [27]. In this article, we review recent research that has examined the challenges in effective and sustained HIV treatment for migrants and mobile populations. We then review findings related to strategies that hold promise for increasing HIV testing and HIV treatment retention and adherence in this highly vulnerable population.

CHALLENGES IN EFFECTIVE HIV TREATMENT FOR MIGRANTS

Migrants commonly have distinct health profiles that are closely linked to their social values, cultural norms and geographic backgrounds. A health profile is likely to inform the behavior of a migrant when confronted with an unfamiliar context. The health needs and expectations of the migrant are also likely to be at odds with those of the host country, which will have important implications for the timely entry into, and retention within, the HIV cascade of care. A summary of recent key qualitative and quantitative studies linking population mobility with the HIV treatment cascade is given in Table 1 [15,16*,28–39].

Entry into HIV care

Over the last decade, a large body of research has shown that migrants and other highly mobile
<table>
<thead>
<tr>
<th>Authors</th>
<th>Aims</th>
<th>Results</th>
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<tbody>
<tr>
<td>Lima et al. [28]</td>
<td>Determines the association between adherence to ART and migration in HIV-infected individuals in British Columbia, Canada</td>
<td>Individuals who migrate at least 3 times were 1.79 (95% CI 1.44–2.21) times more likely to nonadhere to ART than individuals who never migrate</td>
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<td>Bygrave et al. [29]</td>
<td>Determines the rates of loss to follow-up for migrant vs. nonmigrant workers in Lesotho</td>
<td>After 1 year, migrants had a 6.69-fold (95% CI 3.18–14.09) increased rate of LTFU compared with nonmigrants</td>
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<td>Kogee et al. [30]</td>
<td>Examines the key structural barriers to ART adherence that are classified as poverty-related, institutional, and political and cultural</td>
<td>Voluntary and forced migration are among the political and cultural barriers, together with political controversies and traditional beliefs about AIDS care, low levels of health literacy, and stigma and discrimination</td>
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<td>Krentz et al. [31]</td>
<td>Examines the impact of planned transfers between care centers for HIV-positive individuals in southern Alberta, Canada</td>
<td>Compared with patients who received care at the same center whose CD4&lt;sup&gt;+&lt;/sup&gt; cell count increased, patients who transferred care showed deterioration of CD4&lt;sup&gt;+&lt;/sup&gt; cell count and higher incident AIDS (9%, P &lt; 0.01) similar to LTFU patients</td>
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<td>Andrews et al. [32]</td>
<td>Assesses the impact of migration and linkage to care on the benefits of ART for HIV prevention</td>
<td>After accounting for population mobility, the projected decreases in HIV incidence induced by ART are significantly reduced</td>
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<td>Abgrall et al. [33]</td>
<td>Assesses the effects of short- and long-term travel to their native countries of HIV-positive sub-Saharan immigrants living in France on ART adherence</td>
<td>An increased probability of ART adherence (13%) failure was associated with longer stays in native countries (adjusted OR 5.2, 95% CI 1.4–20.4), with unexpected traumatic events during travel (adjusted OR 7.8, 95% CI:2.3–26.1) and with negative perceptions on ART effectiveness (adjusted OR 4.3, 95% CI 1.3–13.7)</td>
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<td>Ware et al. [34]</td>
<td>Qualitative study of disengagement from HIV treatment and care programs in Nigeria, Tanzania and Uganda</td>
<td>After the absences of 3 months or more, individuals were either reluctant to return to care, or provided unintentional or intentional reasons for missed visits</td>
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<td>Mann et al. [35]</td>
<td>Examines the effects of HIV treatment interruptions caused by political conflicts which are recognized to frequently result in patient displacement</td>
<td>Effective strategies to ensure the continuity of care for patients who are forced to relocate must be implemented to alleviate the risks of the development of HIV drug resistance</td>
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<td>Mutevedzi et al. [36]</td>
<td>Determines factors associated with disengagement from HIV treatment and care in Hlabisa, South Africa</td>
<td>Migration was among the factors identified: in migrants in the surveillance area at ART initiation were significantly (hazard ratio 1.53, P = 0.03) more likely to disengage than nonmigrants</td>
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<td>Buskin et al. [37]</td>
<td>Investigates how migration affects the estimates of the number of HIV-positive individuals, and of the individuals out of HIV care in King County, WA, USA</td>
<td>This study shows that migration is common among people living with HIV/AIDS. If migration is not taken into account, the proportion of individuals who are out of HIV care will be overestimated as some find treatment providers in the areas where they move</td>
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<td>Levira et al. [38]</td>
<td>Examines the AIDS-related mortality rates between migrants and nonmigrants of Rufiji district, Tanzania</td>
<td>Prior to ART, in-migrants were 70% (adjusted OR 1.70, 95% CI 10.6–2.73) more likely to die from AIDS than nonmigrants. However, after ART scale-up, the likelihood of dying from AIDS was comparable with migrant and nonmigrants</td>
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<td>Mendelsohn et al. [39]</td>
<td>Investigates adherence to ART use among refugees and host community clients of a public clinic in Kuala Lumpur, Malaysia</td>
<td>Although refugees were younger, more likely to be female and to have been on HAART for less time, their adherence to care was similar to host community clients</td>
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<td>Taylor et al. [16*]</td>
<td>Investigates the influence of mobility patterns on HIV care and adherence to ART in migration-linked communities of Santo Domingo, Dominican Republic, and New York City, NY, USA</td>
<td>Two major obstacles to successful continued HIV care were identified: fear of HIV-related stigma at destination leads to delays in seeking care, and trips that last &gt;30 days which may interrupt treatment due to limited medication supply</td>
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individuals typically learn about their HIV status a particularly long time after infection [40,41]. Migrants from low-income countries have often attributed delays in HIV testing to feelings of vulnerability, loneliness, confusion, helplessness and other social acculturation experiences related to their new environment [42–45]. In some cases, timely entry into the healthcare system was complicated by a lack of knowledge about the necessary administrative procedures and an inability to communicate effectively in the native language experiences that were further compounded by a significant amount of effort and skill required to access relevant HIV care services in the first place [16,38,46,47,48,49]. Access to HIV testing was not always facilitated by service providers in the healthcare system itself. In a recent study, only one-half of 31 European countries surveyed offered voluntary HIV testing to migrants despite acknowledging the merits of this service [50]. In turn, circulatory migrants and frequent travelers could not be easily reached by service providers seeking to undertake HIV testing and counseling [51].

Given the dramatic change in their life course, newly arriving migrants often felt the need to connect with compatriot groups, and described a strong pressure to conform to the social norms and beliefs of the group [48,52]. For this reason, a reluctance to know one’s HIV status was strongly linked with the fear of disclosure and exclusion from the compatriot group as a result [48,52,53]. The decision to delay testing was also linked to the legal implications of an HIV-positive test, which some migrants believed would lead to deportation or the revoking of a visa or residence application [53–56]. Further factors associated with low testing uptake and late HIV diagnosis for migrants were high levels of unemployment, low social status, violence and socioeconomic inequalities [43,45,49]. These factors represent missed opportunities to increase the levels of HIV testing and show the need for policies that offer voluntary HIV testing and counseling to migrants.

### Retention in HIV care

Migrants also face challenges in linking to and remaining in HIV treatment. Barriers which reduced linkage to, and retention within, the healthcare system were associated with unfamiliarity with the new host environment, miscommunication with HIV service providers and a lack of knowledge about patient rights and obligations [48]. Differences in the health-seeking behaviors of migrants were also reported; for example, individuals tended to seek care only once they felt sick or showed severe symptoms [18,55,57]. Further, the health seeking behaviors of immigrants or migrants were not always fully understood by the host service-providers, who at times were described as displaying a lack of cultural sensitivity [52,57–60]. Often, these experiences led to feelings of distrust or a lack of control, which sometimes resulted in migrants seeking treatment and care advice from sources outside the healthcare system [43,48].

Several barriers have also been associated with poor virologic suppression, many of which are further exacerbated by the high mobility of individuals, typically in the form of frequent travel, travel for care, work-related travel, transnational travel, and circular migration [16,41,61]. Continual engagement with the healthcare system at this stage of the treatment cascade is necessitated by the need to collect and refill medication supplies on a routine basis. Circulatory migrants are especially vulnerable to treatment interruption. Such individuals report not taking their pills consistently because of fear of side-effects while traveling, difficulties in finding clean water or food to aid the ingestion of pills, and a preference to delay taking pills until the destination is reached [16]. HIV-positive individuals who traveled frequently to family events described a reluctance to take their medications around family members and in some cases resorted to hiding their pills in bottles with different labels so as to not disclose their status [62,63]. One important barrier to treatment adherence was related to the site where an individual registered and initiated...
ART. In these cases, individuals would have to overcome the difficulties in identifying new sites to access medication, which often involved additional administrative procedures, navigating public transport schedules and routes, overcoming public transport services that do not take individuals all the way to the clinic, the rising costs of travel to the clinic and a number of other transport-related barriers [16*,49,64,65]. In the USA, migrants typically reported exhausting their supply of pills while traveling for periods greater than 1 month [16*,66]. An extensive review of the literature on transnational migrants in low-income and middle-income countries described barriers and facilitators to HIV services and raised concerns about the manner in which the healthcare systems of developing countries struggled keep up with the increasing range of migration flows [67].

**STRATEGIES TO IMPROVE MIGRANTS’ PROGRESSION THROUGH THE HIV TREATMENT CASCADE**

An effective strategy to begin to address the problems discussed above is to more accurately monitor migrant health. The development of standardized and reproducible data categories to describe migrants is useful and could assist in the measurement of the impact of migration on the healthcare system. To collect migrant-relevant information, novel approaches will need to be added to existing routine data collection infrastructures both in health systems and in population-based health research.

**Monitoring of migrant health**

To facilitate uninterrupted access to treatment and to be able to provide realistic estimates at each step of the cascade, it is important that mobile populations are able to easily receive their HIV treatment at different facilities both within and between countries. Seamless record linkage via a centralized database can contribute to ensuring that HIV treatment is not interrupted by migration. Such record linkage across space and time is increasingly being done even in African settings [68–71]. One area that improvements in monitoring migrant systems could be useful is the loss to follow-up of infected individuals in the healthcare system. Research has shown that migrants and mobile individuals are at a significantly higher risk of being lost to follow-up (LTFU) within ART programs [28,29,33,36]. However, research has begun to show that only a proportion of those declared to be LTFU actually disengage from care [37]. For instance, a study in the USA showed people who migrated to another county within the USA often reengaged in HIV care at other clinics. Therefore, adjusting for out-migration in addition to mortality was shown to be crucial for the valid estimation of LTFU rates [37]. A study focusing on the effect of out-migration on the estimates of retention in care over 5 years following HIV diagnosis in the USA concluded that the retention in care rates would be underestimated unless out-migration and death were taken into account [72*]. A meta-analysis of 28 studies of patients of 258 ART clinics in sub-Saharan Africa found that 20% of the ART patients reported as LTFU had, in fact, self-transferred to a different clinic and have remained engaged in ART care [15]. Therefore, assessments of the HIV treatment cascade must involve linking health records of individuals across healthcare locations, otherwise LTFU rates would likely be overestimated, and ART retention rates underestimated. It would be important for the employment of data collection to consider the challenges of data collection on migrants, and potential concerns migrants may have about their data being used for deportation purposes of fear of discrimination or other negative interaction with authorities.

One important avenue to pursue is the ability to use mobile technology to improve monitoring systems. The ability to track migrants as they move from one area to another area is essential to assure their continued HIV care, as well as for HIV surveillance. Based on the figures released by the International Communication Union, the worldwide penetration rate of cellular phones will be 97% with more than 7 billion subscriptions [73]. As migrants are likely to retain their cellular phone service when changing residences, the mobile phone technology hold an immense potential to facilitate the interaction between healthcare providers and HIV-infected patients in need of lifelong care. Mobile health (mHealth) focuses on the use of mobile phone technology to improve health outcomes and deliver healthcare. A key application supported by the WHO involves using text messaging to improve adherence to ART. Table 2 [60,74–82] summarizes some of the current evidence about the efficacy of mHealth in HIV care.

Despite the unquestionable widespread adoption of cellular technology, some studies have shown uncertain evidence that text messages improve ART adherence even in high-risk populations [76,77]. Scaling up mHealth applications involve major challenges related to their dependency on funding sources, unreliable infrastructure, fast-evolving technology and their harmonization with existing healthcare systems [71]. Positive outcomes of the use of mHealth, however, have started...
new evidence suggests that the delivery of support by cellular phones is accepted by youth ages 15–24 years nonadherent to ART [82]. This is an important finding as adolescents (especially girls) are a key high-risk population, which deals with major challenges in reducing their risk of HIV acquisition and linking to healthcare [83]. The efficacy of mHealth solutions can be improved by utilizing fewer text messages whose content and timing are customized for each individual, and inquire about their well-being instead of conveying plain reminders about medications [78,81]. Solutions that encourage individuals to respond to the text messages sent to them also seem to be more effective [79].

### Access to healthcare for migrants

At the present time, existing public health systems fail to properly account for migration, and...
actionable knowledge of migration is still lacking [61]. This observation has enormous implications in terms of defining new policies for improving the HIV care continuum in which assuring treatment continuity for migrants is of utmost importance. UNAIDS has recently formulated key recommendations for national and international policies that facilitate continued access of migrants to the HIV treatment cascade [27]. The organization called for the implementation of customized HIV care programs with increased effectiveness in addressing the needs of specific groups of migrants (e.g., circular labor migrants, international migrants, people who visit their country of origin and internal migrants who move from one administrative area to another). Cultural, language and stigma-related barriers to care must be properly taken into consideration when designing care programs. UNAIDS argued for the need to end any discrimination for access to care between migrants and nonmigrants. Appropriate treatment and counseling should be offered to migrants who should be free to refuse in case if they so desire. Mandatory HIV testing should be eliminated, together with any restrictions related to the entry, stay and residence of people known to be HIV positive. UNAIDS also called for cross-country efforts to create HIV care programs that reduce treatment interruptions for international migrants. The families of migrants must be included in the care programs, as they are at an increased vulnerability to acquisition of HIV.

CONCLUSION

Migrants and mobile individuals represent a large and diverse group who have changing healthcare needs. At the present time, public health systems fail to properly account for migration, and actionable knowledge of the health requirements of migrants is still lacking [53]. A significant body of research has been devoted to the HIV treatment cascade, but our understanding of the challenges experienced by migrants is incomplete. There are a number of areas in which future research on HIV treatment and care services for migrants should be developed. One of these is the establishment of a centralized health information system that could be used to more accurately determine the state of health of HIV-infected migrants and their interaction with the healthcare system. In this regard, research initiatives should focus on the challenges associated with the implementation and management of such systems. Attention could be devoted to whether the information generated from these data systems can improve linkage to care and retention within the HIV treatment cascade. Such information could in turn be disseminated to other sectors of the healthcare systems, or shared with other government planning departments and public health agencies to address existing gaps in service delivery. Improvements in data collection could also provide an opportunity for researchers to identify hidden disparities or inequalities in migrant healthcare access and quantify the determinants associated with loss to follow-up at successive stages of the treatment cascade. In this regard, research should focus on identifying the largest ‘leaks’ in the treatment cascade area and proposing how these may be addressed. One particular and necessary area of focus is the linkage to HIV care. One systematic review of approaches to link to HIV care identified 24 relevant studies (21 from sub-Saharan Africa) prior to 2014, none of which focused on the target population of migrants [84]. Another systematic review of Latino migrants in the USA could not find any articles reporting linkage or retention to care by birth country or region [85].

An important and recurrent theme that we encountered in our review was that of the sensitivity of the healthcare system to the migrants’ needs. Here, research should be orientated toward efforts or interventions designed to minimize the negative impact of migration, as well as the disparities that affect access to health services. One area of focus could be the evaluation of programs to tailor HIV care services to fit the cultural needs or expectations of migrants. Such initiatives could include improvements to language and interpretation resources, including the delivery of health services to migrants in a culturally and linguistically appropriate manner. One aspect of migrant-sensitive care could be related to staff training, as well as diversification of staff labor; for example, existence of multicultural staff has been perceived as a strength by migrant patients.[86] In addition, research initiatives can continue to expand on the barriers to care associated with the legal and undocumented status of HIV-positive migrants. Improved outreach efforts to inform individuals of the human right to health may or may not alleviate the concerns of migrants, which may improve equal access to health services. Ultimately, opportunities for research would link to a broader question of whether migrant HIV services can be integrated into existing structures and services, rather than existing as parallel services. The movement of individuals through the treatment cascade provides a demonstrable context for which to evaluate the success of health services in host countries to achieve this level of integration.

The actual and perceived legal status of the HIV-infected migrants has been identified as an important theme throughout this review. High levels of
human mobility and international migration are likely to continue into the foreseeable future. Member states of the WHO have endorsed resolutions to respect the rights of migrants to health services regardless of legal status [87]. In the past, a large number of European countries have restricted access to nonemergency services as a way to discourage the entry of new migrants [88]. To this extent, health services for migrants are often informed by the broader immigration policy regimes of the host country [89]. In response to binding resolutions, many nation states will have to consider adapting their existing structures and institutions to accommodate the healthcare needs of migrants in an increasingly globalized world. Research initiatives to document the transition of healthcare systems from an exclusive to an inclusive and multidimensional approach will be important.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES AND RECOMMENDED READING

Papers of particular interest, published within the annual period of review, have been highlighted as: of special interest; of outstanding interest

20. A study specifically investigating the factors that affect a migrant’s passage through the HIV care cascade, and showing delayed diagnosis of HIV and a higher rate of loss to follow-up.
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