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Telehealth Interventions for HIV in Low- and Middle-Income Countries

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Abstract

Purpose of review This review summarizes technology-based interventions for HIV in low- and middle-income countries (LMICs). We highlight potential benefits and challenges to using telehealth in LMICs and propose areas for future study.

Recent findings We identified several models for using telehealth to expand HIV health care access in LMICs, including telemedicine visits for pre-exposure prophylaxis (PrEP) and antiretroviral therapy (ART) services, telementoring programs for providers, and virtual peer-support groups. Emerging data support the acceptability and feasibility of these strategies. However, further investigations are needed to determine whether these models are scalable and sustainable in the face of barriers related to cost, infrastructure, and regulatory approval.

Summary HIV telehealth interventions may be a valuable approach to addressing gaps along the HIV care cascade in LMICs. Future studies should focus on strategies for expanding existing programs to scale and for assessing long-term clinical outcomes.

Keywords Telehealth · HIV · Low- and middle-income countries · Technology · Telemedicine · Pre-exposure prophylaxis

Introduction

Despite substantial progress in controlling the human immunodeficiency virus (HIV) epidemic worldwide, several low- and middle-income countries (LMICs) fell behind the

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Joint United Nations Programme on HIV/AIDS (UNAIDS) "90–90-90" targets to diagnose 90% of all HIV-positive individuals, provide antiretroviral therapy (ART) to 90% of those diagnosed, and achieve viral suppression for 90% of those treated by 2020 [1, 2]. New HIV infections have continued to rise in eastern Europe and central Asia, in part due to policy barriers and inadequate attention paid to the needs of historically marginalized populations, including people who inject drugs, transgender people, sex workers, and men who have sex with men [1, 3••]. Access to pre-exposure prophylaxis (PrEP) remains insufficient in much of western and central Africa and in the Asia and Pacific region. In 2020, the total number of people using PrEP in LMICs reached only 28% of the target of 3 million people, 8% of the new global 2025 target [1].

Telehealth, defined as "the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, health administration, and public health" is a promising tool to overcome persistent obstacles to HIV-related health care in LMICs, including a lack of trained health care professionals, limited infrastructure, and in-person care costs [1, 4]. Telehealth encompasses several domains, including

provider-to-patient clinical care, provider-to-provider interactions, electronic consults, and mobile health applications [5•].

In 2020, an estimated 87% of people living in LMICs had access to a mobile phone, and over half of those in LMICs used the Internet [6, 7]. Although telehealth has long been technologically feasible, it was not widely adopted until the coronavirus disease 2019 (COVID-19) pandemic necessitated remote health care delivery options that supported physical-distancing precautions [8]. After widespread uptake during the pandemic, telehealth has the potential to address existing and growing inequities in the global HIV response by improving both provider-patient and provider-provider communication [9].

In this review, we summarize the use of telehealth for HIV-related care in LMICs, with a focus on (1) provider-to-provider interventions for clinical training and support, (2) provider-to-patient HIV-related health care delivery via telemedicine, and (3) considerations for overcoming implementation challenges and health system integration in LMICs (Fig. 1). A number of recent reviews have focused on HIV-related telehealth in high-income settings [5•, 10, 11], but experience in LMICs is less well described. We drew from peer-reviewed articles with a focus on data published from 2017 to 2022 to highlight key advances and knowledge gaps in translating telehealth to LMICs for HIV treatment and prevention. In addition, given the limited published experience from LMICs and the rapid pace of implementation during the COVID-19 pandemic, we included models presented at international conferences as well as through direct correspondence with telehealth implementers.
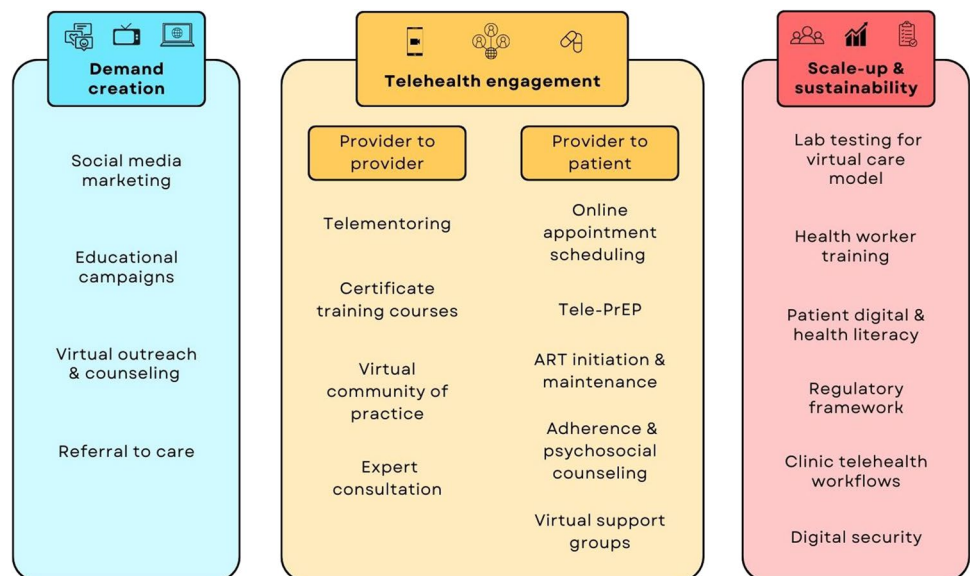
Provider-to-Provider Telehealth for Health Worker Training and Mentoring

The ability to train and retain sufficient human resources for health is a significant barrier to achieving HIV epidemic control in LMICs [12]. HIV is a rapidly evolving field that requires continuing professional development to keep pace with frequently updated local and global recommendations [13••]. Traditional in-person education strategies struggle to overcome challenges related to access, resource limitations, and scalability. Besides the delivery of ART, well-trained health providers are needed to rapidly scale-up PrEP services as well as to manage the rising prevalence of noncommunicable diseases in the aging HIV population in LMICs [14, 15].

Telehealth interventions are increasingly being utilized to provide training, mentoring, and expert consultation on HIV and other diseases in both high-income and LMIC settings. The Extension for Community Healthcare Outcomes (Project ECHO), pioneered by the University of New Mexico, catalyzed the scale-up of telehealth training for professional development and improving patient outcomes in the USA [16–18]. The model uses telehealth technology to connect community-based physicians with specialists from academic medical centers for training and patient co-management [16]. ECHO-like models have been developed for training health professionals on a variety of chronic diseases including HIV [5•, 18–20].

Adaptations of ECHO and other tele-training and mentoring programs for HIV health worker capacity building have been implemented in many LMICs including Vietnam [13••], Philippines [personal communication, Leyritana], Namibia [21••], and others across Asia, Africa, and Latin

Fig. 1 Considerations for HIV telehealth implementation in low- and middle-income countries. The first two panels summarize applications of telehealth for creating demand and for HIV service delivery. The third panel summarizes important considerations related to the scale-up and sustainability of telehealth interventions in low- and middle-income countries

Demand creation
- Social media marketing
- Educational campaigns
- Virtual outreach & counseling
- Referral to care

Telehealth engagement

Provider to provider
- Telementoring
- Certificate training courses
- Virtual community of practice
- Expert consultation

Provider to patient
- Online appointment scheduling
- Tele-PrEP
- ART initiation & maintenance
- Adherence & psychosocial counseling
- Virtual support groups

Scale-up & sustainability
- Lab testing for virtual care model
- Health worker training
- Patient digital & health literacy
- Regulatory framework
- Clinic telehealth workflows
- Digital security

America [22, 23]. In Vietnam, an HIV telehealth capacity-building program was developed and scaled to more than 15 public health institutions over a 4-year period. The program included virtual certificate training courses, webinars for continuing education, and telementoring including case-based discussions, patient co-management and expert consultation, and communication to support public health program implementation [13••]. In Namibia, the Ministry of Health and Social Services piloted an HIV clinical educational curriculum consisting of didactic and case-based discussions delivered via weekly 90-min sessions over Zoom™ videoconferencing technology. Regional clinical mentors served as on-site facilitators to encourage participation and information sharing across sites. Following the pilot, the program was expanded to serve doctors, nurses, and pharmacists at over 50 hospitals and health care centers across Namibia [21••].

In addition to videoconferencing-based training and mentoring, a variety of mobile health (mHealth) and learning (mLearning) programs have been developed to support health care workers providing HIV prevention and care in LMICs. While discussion of these applications is beyond the scope of this review, a recent review of mHealth interventions in LMIC settings found that most data are limited to small pilot programs [24]. One notable innovation has been the use of WhatsApp or other messaging applications to facilitate a community of practice among HIV providers [22, 24, 25].

Evaluations of HIV telementoring programs have reported increased provider knowledge, self-efficacy, motivation, satisfaction, and reduced perception of isolation [13••, 21••]. Most participants reported appreciating the accessibility of the telementoring platforms and expressed their desire to continue participating in future sessions. However, with a few exceptions in high-income countries [18, 26], limited data exists on the impact of telementoring programs on patient outcomes [27].

Telemedicine for Pre-exposure Prophylaxis (Tele-PrEP)

Differentiated models of PrEP service delivery such as key population (KP)-led PrEP services, mobile health clinics and pharmacy-led PrEP aim to ensure that PrEP is accessible to all who could benefit including KPs and other vulnerable groups [28, 29]. Telehealth and mHealth approaches to generating demand and delivering PrEP are increasingly being implemented and tested to support these efforts and show promise in overcoming barriers to PrEP uptake [5•]. A recent systematic review concluded that virtual service delivery models for PrEP were effective and feasible to implement [30•].

While much of the published experience to date comes from high-resource settings, Tele-PrEP programs in LMICs are accelerating [31]. A review of PrEP service delivery in 21 PEPFAR countries identified multiple adaptations made by country programs to maintain PrEP services during the COVID-19 pandemic. In addition to multi-month dispensing of PrEP and decentralization of PrEP delivery, identified best practices included the use of social media to engage communities and create demand, and telehealth service delivery such as organizing PrEP initiation and adherence counseling over the phone or sending prescriptions via WhatsApp [32•, 33]. We highlight several notable examples of Tele-PrEP implementation in LMICs.

In Brazil, telehealth strategies were developed and implemented to maintain HIV PrEP services among adults and adolescents during COVID-19-related health system disruptions [34••, 35]. At one large PrEP clinic in Rio de Janeiro, telemedicine procedures included initial HIV rapid testing and telephone consultation followed by the provision of a digital prescription for a 120-day PrEP supply plus two HIV self-test kits. Follow-up teleconsultations were performed remotely by telephone call, with results of HIV self-tests sent using a digital picture. A cross-sectional web-based survey of PrEP users demonstrated high acceptability with PrEP teleconsultation and home delivery [36].

In Vietnam, the Ministry of Health recently launched a national Tele-PrEP pilot program with the participation of 20 clinical sites in seven provinces [37]. According to the Vietnam Tele-PrEP guidelines, an initial in-person consultation is required for clinical examination, baseline laboratory test, and PrEP prescription. If the client is enrolled in Tele-PrEP, follow-up visits are conducted via telephone or video-conferencing consultation with a remote prescription for PrEP medications which can be purchased at the pharmacy or, if part of a free PrEP program, can be picked up at the clinic or delivered to the client's home. HIV testing is recommended before each PrEP follow-up visit and must be conducted at a certified laboratory or via a home-based laboratory service.

In Thailand, the COVID-19 pandemic accelerated the roll-out of tele-PrEP within existing KP-led PrEP health services (KPLHS) [31]. The KPLHS provides health services identified and designed by KPs and delivered by trained and qualified lay providers [38]. PrEP is prescribed remotely by doctors and dispensed by KP lay providers. In the Thai model, the PrEP initiation and initial follow-up visits remained in-person. For those on PrEP for more than 3 months, virtual visits were offered along with self-sampling and self-testing for HIV and other sexually transmitted infections. A second fully online PrEP delivery model in Thailand provided comprehensive HIV services through telehealth including ART and PrEP services. For PrEP, if an individual had a negative HIV test within 7 days of the

appointment, a creatinine within 6 months and an HBsAg test within 1 year, they could see a physician via videoconferencing, make an on-line payment, and receive PrEP medications shipped to their home [31].

In Kenya, telehealth services were integrated into the HIV prevention and PrEP programs for adolescent girls and young women to ensure continuity of services during the pandemic. Outreach and counseling through "virtual safe spaces" (via telephone, text messages, WhatsApp) combined with home delivery of PrEP medications, HIV self-test kits, sanitary packs, and condoms enabled continuity of prevention services [39]. Of note, PrEP home delivery was an option only for those who did not need HIV testing (required every 3 months) since HIV testing was provided at health facilities.

Telemedicine for HIV Care and Treatment

For people living with HIV (PLHIV) in resource-limited settings, the high frequency of clinic appointments required in traditional HIV service delivery models presents a barrier to ART scale-up and maintenance [28, 40]. Person-centered differentiated service delivery (DSD) models including multi-month dispensing of ART, community-based medication pickup points, out-of-facility care, and task shifting to KP lay providers [41–43], aim to improve treatment access and reduce unnecessary burdens on the health system [44].

Consistent with WHO recommendations beginning in 2016 [45], HIV programs around the world have reduced the standard visit frequency from monthly to every 3 or 6 months. The implementation of extended appointment intervals increased during the COVID-19 pandemic, as it became a practical necessity to promote physical distancing, particularly within health facilities to avoid bringing together patients with co-morbidities who were at increased risk of severe illness. Many clinics in higher income countries have adopted telehealth interventions as part of their DSD models to reach and screen patients, provide counseling, offer follow-up services, and promote retention in care via both telephone and video-conference consultations [42, 46].

However, implementation of telehealth-assisted ART interventions to date has been limited in LMICs. In 2017, Thailand's Institute of HIV Research and Innovation (IHRI) piloted the same-day antiretroviral therapy (SDART) initiation program at the Thai Red Cross Anonymous Clinic (TRCAC) [47••]. With the onset of the COVID-19 pandemic in 2020, the SDART program became the first known ART initiation model to integrate telehealth into its services.

SDART was divided into three parts: ART preparation, ART initiation, and post-initiation follow-up. After receiving a positive HIV test result, clients received post-test counseling, were assessed for willingness to start SDART, and

were started on therapy if eligible. After SDART initiation, clients were scheduled for a 2-week follow-up visit either virtually or in-person, during which they received baseline laboratory results, physical examination, and ART side effect assessment and management. Telehealth follow-up visits were conducted via LINE, a popular mobile application in Thailand with free audio and video calls. Individuals who had limited access to high-speed Internet used audio-only calls and sent photographs of laboratory test reports or visible symptoms via LINE chat. ART refill was provided via mail delivery. In 2021, an estimated 35% of the clinic's patients utilized telehealth services for SDART follow-up visits. Providers and patients who engaged in virtual visits reported increased service access, saved time and cost, improved confidentiality, and reduced stigma.

In April 2020, the Helios Salud clinic in Buenos Aires, Argentina, similarly became one of the first health institutions in a LMIC to implement telemedicine for ART-related services to minimize the impact of the COVID-19 pandemic on HIV care [48••]. Health-insured patients could meet virtually with their physicians via WhatsApp, which was linked to their electronic medical records. Pharmacies offered home delivery services for ART prescriptions bimonthly. In 2020, 32% of the clinic's medical visits were conducted virtually with a median patient satisfaction of 5/5 on post-visit surveys. Additionally, ART coverage, pharmacy withdrawals, and virologic suppression all remained over 90% and were comparable to the clinic's outcomes in the years before the pandemic.

While these examples are encouraging, longer term data are needed to evaluate the impact of telemedicine programs on access, adherence, and retention to care for PLHIV in resource-limited settings [42, 49, 50].

Telehealth Interventions for Psychosocial Support

Globally, PLHIV experience higher rates of mental health disorders than the general population [51, 52]. In turn, impairment in mental health leads to negative health outcomes at each step in the HIV care continuum, from the initial diagnosis to viral suppression [53–56]. Evidence from LMICs demonstrates that interventions integrating peer support are among the most effective in improving individuals' ability to engage with HIV care [57, 58]. However, the limited availability of mental health resources and providers in LMICs presents a barrier to their scale-up.

Technology-based approaches such as videoconferencing, voice-calling, text messaging, social media support groups, and Internet-based programs show promise in improving access to psychosocial interventions for PLHIV. To date, most research on digital mental health interventions among

PLHIV remains focused on high-income country settings [59]. However, a number of programs were established in LMICs during the COVID-19 pandemic.

In Kenya, a mobile counseling and peer support intervention for mental health and ART adherence was established for adolescents living with HIV (ALHIV) [60••]. Thirty ALHIV receiving care at the Academic Model Providing Access to Healthcare (AMPATH)-Turbo clinic in western Kenya were provided with a smartphone and assigned to a WhatsApp group facilitated by a trained counselor. Participants were encouraged to talk informally with other peers in the WhatsApp groups, who could also communicate one-on-one via direct messaging, voice messaging, and video calls. The counselor contacted participants via direct messaging every other week for individual check-ins, and participants were allowed to contact the counselor individually as needed. Following the 6-month intervention, participants reported that the intervention helped them improve their ART adherence by establishing a peer support network. Additionally, participants developed their ability to identify and articulate their experiences with stigma, non-adherence, and mental health challenges.

In Zambia, adolescent pregnant women living with HIV were recruited from Antenatal Clinics to participate in Project Insaka, a mobile phone-based intervention to address the mental health impact of social isolation and stigma [61••]. Sixty-one participants received a smartphone on which they used the Rocket.Chat application to anonymously communicate via text message in small groups led by a trained peer facilitator. Health professionals including a gynecologist, nutritionist, and primary care physician were invited to run virtual workshops throughout the program to increase health literacy. After the 4-month intervention participants self-reported an increase in social support and a reduction in internalized stigma.

In Nigeria, Social Media to promote Adherence and Retention in Treatment (SMART) Connections was established as a social media-based support group for ALHIV [62••]. Participants on ART for less than 12 months were recruited from 14 health facilities in south-central Nigeria and randomly assigned to either the SMART Connection intervention or a control group in which they continued to receive standard clinical care for HIV treatment. Study participants received a smartphone, and those in the intervention group ($n = 177$) were placed in private Facebook groups led by trained facilitators living with HIV. Participants engaged in daily activities, including interactive polls, live discussions, social chats, and educational activities. After 22 weeks, participants reported high levels of satisfaction and that they preferred online support groups, either alone or in combination with an in-person group, rather than in-person groups only. While the probability of retention in care and ART adherence was similar between the intervention and control groups, participants who completed the intervention had significantly higher HIV-related knowledge and reported feeling a greater sense of unity and belonging.

Challenges to Telehealth in LMICs

While telehealth holds promise for the prevention and management of HIV and other chronic diseases in LMICs, there are several challenges to consider before widespread implementation can be realized [63, 64]. At the national level, countries may lack sufficient legal and regulatory frameworks to guide telemedicine implementation [65]. Regulations such as those governing licensure, online prescribing, and financial reimbursement mechanisms may need to be developed or modified [66]. A 2015 WHO evaluation found that only 22% of the 125 countries surveyed had a national policy for telehealth [67]. A lack of national strategy for telehealth can lead to gaps in coordination among stakeholders, particularly between the private and public sectors. Many pilot programs in LMICs have been funded by private donors and run without the involvement of local governments [24, 68].

At the implementation level, issues of privacy, confidentiality, and data security are of paramount importance for patients, particularly for PLHIV and KPs seeking HIV-related care [3••, 69]. Telemedicine can pose greater privacy risks than in-person visits. Housemates or family members may be nearby or may interrupt telehealth conversations, cell phones or computers could inadvertently reveal patient information to others, and home-based lab kits or medication delivery could inadvertently disclose patient health information. Health care providers should select telemedicine technology platforms with appropriate safeguards and data security. Workflows may need to be restructured to facilitate virtual delivery of health services and health care providers need training on how to best deliver patient care and HIV services via telehealth [65].

While telehealth interventions may improve access to care in some populations, there is a risk of exacerbating disparities for already vulnerable groups, including those without access to digital devices, inexperienced technology users, individuals with limited literacy, and people with disabilities [3••]. A study in rural Uganda identified gender disparity in electronic possessions as one of the biggest challenges in adapting mHealth technology [70]. Therefore, HIV telemedicine programs should be designed with an understanding of the needs and characteristics of the target population, including their access to technology and their health and digital literacy [11, 71].

Laboratory services pose another important challenge to telemedicine in LMICs. Small-scale HIV self-testing interventions increased linkage to HIV care in the Philippines

[72], Thailand [73], and Vietnam [74]. However, few programs had the capacity to also prescribe treatment, resulting in low rates of PrEP and ART initiation. Community-led programs with integrated testing and treatment services, such as that in Vietnam and in one Philippines-based health center, saw higher ART initiation rates [72, 74]. Creating a fully virtual telemedicine experience requires the integration of all required laboratory testing, including screening for sexually transmitted infections, into the virtual care model. Approaches include accessing testing services at laboratory sites near patients' homes, phlebotomy home visits for specimen collection, and home specimen self-collection with shipping to central laboratories for analysis [75••]. Of those approaches, the use of self-collection kits holds the most promise for advancing HIV telemedicine models [76]. Small studies, conducted in the USA, have demonstrated the feasibility and acceptability of home specimen self-collection kits for laboratory testing as part of Tele-PrEP programs [75••, 77]. However, similar studies in LMICs are lacking and recognized challenges, including cost, regulatory approval, quality assurance, and the potential for exacerbating disparities in health care access, may be magnified in LMIC settings [76].

Additionally, many health systems in LMICs lack centralized electronic health record systems for efficient health information management and sharing across telehealth programs and platforms (e.g., from clinics to pharmacies) [78]. In Mexico, health professionals from four Tele-PrEP implementation sites reported that some patients had trouble acquiring medicines using prescriptions received electronically [79]. Furthermore, the human resource constraints in many LMICs may limit programs' ability to effectively train health workers to use new technologies without being an additional burden on health care systems and personnel [13••, 63, 80, 81].

Implementation of telehealth training and mentoring programs is less complex compared to telemedicine. However, the expansion and sustainability of such programs also face barriers related to cost, human resources, infrastructure, and Internet connectivity [13••, 82].

Conclusion

Worldwide, the need to reduce face-to-face consultations while maintaining the quality and accessibility of health care services has fueled the expansion of telehealth, particularly in the era of COVID-19. While there has been considerable attention to the advantages of telehealth in high-income countries, the implementation of technology-assisted services for HIV-related care may have an even greater benefit in circumventing infrastructure limitations, a scarcity of health care providers, and high in-person care costs in LMICs. However, much of the available evidence on the effects of telehealth in LMICs are still anecdotal and/or are derived from pilot studies and small-scale implementation. Nonetheless, many examples demonstrate significant potential in expanding health care access to vulnerable populations and promoting progress towards the UNAIDS 90–90-90 targets.

Interventions currently being implemented and evaluated in the context of HIV include health care delivery via videoconferencing, voice, and texting modalities; telementoring platforms (e.g., Project ECHO); and smartphone-application-based peer-support groups. The studies identified in this review provide evidence for the suitability and efficacy of such tools for maintaining essential health services in the context of the COVID-19 pandemic, decreasing stigma, reducing socioeconomic disparities in health care access, and strengthening primary health care delivery. Telehealth in HIV care additionally provides a unique opportunity to improve patient-provider trust, connection, and communication, thereby promoting more patient-centered care and increasing patient preference for utilizing virtual services.

Future research should evaluate telehealth interventions in LMICs implemented to scale, evaluating their outcomes across different populations—particularly in rural and under-resourced settings where Internet connectivity remains limited, a key limitation among many of the articles reviewed. Additional funding options and increased advocacy for regulations that better support telehealth interventions are yet needed to extend their reach. Furthermore, additional research is required for tailored telehealth innovations for KPs.

There is also a continued need for interventions to incorporate demand creation using web-based and social media platforms for educational messaging and anti-stigma campaigns [3••]. Community leaders can also be engaged in promoting sexual health education, PrEP awareness, and peer support networks. Furthermore, machine learning can be used to identify individuals who might benefit from HIV-related care. Wearable devices can additionally be employed to provide reminders to improve adherence to daily medications or to provide location information for testing and pharmacy services.

Given the rapid pace of advancements in both digital technologies and HIV treatment strategies, we anticipate substantial changes in telehealth modalities, provider training, and virtual care coverage in the upcoming years to meet the needs of PLHIV. Even after the COVID-19 pandemic, telemedicine has the potential to offer more equitable, accessible, and differentiated care to vulnerable populations in LMICs as we work toward ending the HIV epidemic.

Declarations

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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•• Of major importance

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