

HIV Outcomes Beyond Viral Suppression 1



Reorienting health systems to care for people with HIV beyond viral suppression

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The effectiveness of antiretroviral therapy and its increasing availability globally means that millions of people living with HIV now have a much longer life expectancy. However, people living with HIV have disproportionately high incidence of major comorbidities and reduced health-related quality of life. Health systems must respond to this situation by pioneering care and service delivery models that promote wellness rather than mere survival. In this Series paper, we review evidence about the emerging challenges of the care of people with HIV beyond viral suppression and identify four priority areas for action: integrating HIV services and non-HIV services, reducing HIV-related discrimination in health-care settings, identifying indicators to monitor health systems' progress toward new goals, and catalysing new forms of civil society engagement in the more broadly focused HIV response that is now needed worldwide. Furthermore, in the context of an increasing burden of chronic diseases, we must consider the shift that is underway in the HIV field in relation to burgeoning policy and programmatic efforts to promote healthy ageing.

Introduction

After the antiretroviral therapy (ART) breakthroughs of the late 1990s dramatically improved the prognosis for people living with HIV, high-income countries had rapid declines in HIV-related deaths.¹⁻³ The scale-up of ART has been much slower in low-income and middle-income countries, but sustained efforts have yielded steady progress, and 59% of the world's estimated 36.9 million people living with HIV received ART in 2017.⁴ The UNAIDS 90-90-90 target, introduced in 2014, continues to spur countries at all income levels to try to bring the epidemic under control. It calls for 90% of all people living with HIV to be diagnosed, for 90% of those diagnosed to receive ART, and for 90% of those receiving ART to be virally suppressed.⁵

Life expectancy for people living with HIV, although lower than that of the general population, has increased considerably since the late 1990s.⁶ Progress toward the 90-90-90 target thus means that health systems are responsible for the care of increasingly large numbers of ageing people with HIV. These individuals face the full array of health and social challenges commonly associated with ageing, such as decreasing physical mobility,⁷ cognitive decline, chronic comorbid diseases, social isolation, and suboptimal family support.⁸ At the same time, their HIV-positive status might exacerbate these challenges,^{9,10} as might their identification with marginalised groups such as men who have sex with men, transgender people, sex workers, migrants, and people who inject drugs. They also can have ongoing financial instability as a result of living with HIV-related health issues for many years. Stigma and discrimination remain implicated in health outcomes for people of all ages living with HIV.^{11,12}

Providing this population with the knowledge, skills, and tools to prevent onward transmission of HIV

continues to be a challenge in many settings worldwide. There is a recognised need to comprehensively address the syndemic nature of HIV and its most commonly co-occurring psychosocial conditions, including substance abuse, violence, mental health problems, and sexual risk behaviours, particularly in key populations. Multi-disciplinary interventions that more effectively address the intersection of HIV with these conditions are necessary to achieve and maintain viral suppression.¹³

In this complex landscape, the traditional focus on viral suppression as the ultimate goal of HIV care is beginning to give way to recognition that additional goals are needed, such as our fourth 90 target proposed to address the

Key messages

- Because life expectancy has increased greatly for people living with HIV, health systems face the challenge of meeting the complex health-care needs of growing numbers of ageing people living with HIV in the coming years
- People living with HIV have higher comorbidity than their HIV-negative peers, and face challenges relating to polypharmacy and health-related quality of life
- Viral suppression has long been regarded as the goal of HIV care, but health systems need to adopt new goals relating to long-term wellbeing
- The broader HIV care agenda that is emerging calls for health systems to focus on health-system integration, HIV-related discrimination, new measures of progress, and new roles for civil society
- As the global response to HIV is redefined, efforts should be aligned with the healthy ageing agenda for the general population

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This is the first in a Series of three papers on HIV outcomes beyond viral suppression

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health-related quality of life (HRQoL) of people living with HIV (figure 1).^{15,16} There has been little discussion, however, about the role of national and subnational health systems in broadening the HIV care agenda.

WHO defines a health system as all organisations, people, and actions whose primary intent is to promote, restore, or maintain health. The WHO health systems framework sets out the key functions of a health system in terms of six essential building blocks for improving health outcomes: leadership and governance, health workforce, financing, service delivery, health information, and medical products, vaccines, and technologies.¹⁷

Health system researchers have emphasised the importance of looking beyond how individual elements of a health system function and considering how these elements interact with each other, as well as with the political, social, and economic contexts.^{18,19} Innovations in the use of electronic technologies for health-related purposes (ie, e-health) are giving rise to new strategies for improving health system functioning.²⁰

Furthermore, a concerted effort has been made to study how health systems can become more people-centred.^{21–23} One aspect of people-centredness is attention to patient-reported outcomes, and the use of quantitative measures of patient-reported outcomes in health-care delivery is of growing interest.²⁴

This Series on HIV outcomes beyond viral suppression seeks to foster strategic thinking about the role of health systems in the current phase of the global HIV response. The Series premise is that the nature of the HIV epidemic is changing in ways that call for a comprehensive strategic reorientation to the challenges of providing lifelong care in the context of high HIV treatment uptake.

At the same time, the global community cannot allow our proposed fourth 90 target to distract stakeholders from the ongoing effort to achieve the 90-90-90 targets of increasing HIV diagnosis, treatment, and viral suppression. However, reorienting the HIV field to focus more holistically on the wellbeing of people living with HIV rather than merely their viral loads could potentially support better outcomes across the HIV care cascade. That is, a strategic emphasis on the importance of helping all people living with HIV enjoy good HRQoL might reduce barriers and improve outcomes for the progression of people infected with HIV to diagnosis, treatment initiation, and sustained viral suppression.

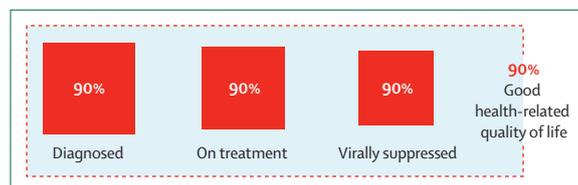


Figure 1: A proposed fourth 90 target for health-related quality of life
Reproduced from Lazarus and Safted-Harmon.¹⁴

Challenges

Clinical concerns

When ART is initiated in a timely manner and is successful in suppressing HIV replication, the immune system recovers its ability to fight off many of the diseases associated with untreated HIV. Thus, in settings with high ART coverage, once common HIV-related opportunistic infections such as *pneumocystis jiroveci* pneumonia and cryptococcal meningitis are occurring less frequently.

However, several chronic non-communicable diseases and disorders have emerged as major health issues, including cardiovascular, respiratory, renal and liver diseases, non-AIDS malignancies, bone thinning, and psychiatric and neurocognitive disorders.^{25–31} For example, a large cross-sectional study from the UK found that three-quarters of people with HIV were living with a diagnosed long-term health condition, most commonly mental health conditions such as depression and anxiety, along with precursors of cardiovascular disease such as hypertension, high cholesterol, and diabetes.³² Infectious diseases such as hepatitis B, hepatitis C, and tuberculosis also continue to contribute to the burden of disease.^{4,33}

People living with HIV have higher prevalence of multimorbidity than their HIV-negative peers.^{34,35} In a 2018 study, multimorbidity rather than age or HIV-specific markers predicted unplanned hospital admissions for people living with HIV in Australia.³⁶ Late presentation for HIV diagnosis has been identified as a risk factor for multimorbidity. Longer duration of HIV infection and longer time on ART are also risk factors for multimorbidity, independent of age.³⁵

Treating people living with HIV for multiple comorbidities often results in polypharmacy, which is commonly defined as the simultaneous use of five or more medications.³⁷ Commonly prescribed non-HIV medications that can potentially interact with antiretroviral regimens in harmful ways include statins, psychotropic drugs, and narcotic or analgesic drugs.^{38,39} Polypharmacy increases the risk of missing doses of ART or other medications and is associated with poor ART adherence.⁴⁰

People living with HIV taking multiple types of medications are less likely to be prescribed single-tablet ART regimens, a finding that might reflect health-care providers' concerns about the incompatibility of these regimens with other medications.⁴¹ Polypharmacy in people living with HIV has been associated with adverse outcomes such as cognitive alterations and falls,⁴² and in one large study it was found to be independently associated with risk of hospitalisation and risk of death after controlling for underlying health status.⁴³

Other areas of medicine, particularly geriatric medicine, have seen the emergence of an evidence base to guide so-called deprescribing, or the supervised discontinuation of inappropriate medications.⁴⁴ However, there is scant research on deprescribing in populations of patients with HIV. Multiple factors might contribute to the high

incidence of some comorbidities in people with HIV taking ART. A number of comorbidities are linked to smoking, condomless sex, and consumption of alcohol and illicit drugs, and some HIV populations have more of these behaviours.^{45–48}

Additionally, various antiretroviral drugs have toxicities that might increase the risk for some comorbidities such as cardiovascular disease, kidney disease, bone loss, and depression.^{49–52} Current treatment regimens are more tolerable in this regard. However, negative consequences of exposure to earlier antiretroviral drugs might persist for many years after the drugs were discontinued.⁵³ Also, some newer drugs with milder toxicities might have negative health implications because of the cumulative effects of prolonged use, although data are not sufficient to draw conclusions about this issue.

HRQoL

Although people living with HIV who can access ART have seen dramatic improvements in many aspects of their health, concerns persist about their HRQoL. A large study found that people living with HIV in the UK reported significantly lower HRQoL than the general population across all domains measured, with particularly low mental health scores.⁵⁴ Studies from different settings present a complex picture of HRQoL in people with HIV aged 50 and older.

A Swiss study found that perceived social support was correlated with better HRQoL outcomes in HIV populations aged 50 and older, whereas having a greater unmet need for support (eg, domestic, financial, emotional) was correlated with worse HRQoL outcomes.⁵⁵

In the HIV and Later Life study⁵⁶ in the UK, multivariate analysis identified two factors associated with better HRQoL in people with HIV aged 50 and older: not receiving state benefits and being partnered. As for the influence of age itself, older age has been associated with better mental HRQoL in people living with HIV in France and Ireland,^{57,58} although a Portuguese study found that people with HIV aged 50 and older scored better than their younger counterparts in only one of 29 domains: financial resources.⁵⁹

Since factors affecting HRQoL might vary greatly across different settings, doing studies at the national or subnational level is advisable to effectively target HRQoL interventions. As for what those interventions should be, a range of individual and group interventions has been studied such as peer support, physical activity, symptom self-management, and mindfulness-based stress reduction. A systematic review of HRQoL interventions for people with HIV taking ART found that many of the 28 studies included in the review had methodological shortcomings such as selection bias and insufficient reporting of information about study instruments, leading the authors to conclude that more methodologically rigorous research is needed on this topic.⁶⁰

Improving care for people living with HIV

Health service integration

Health service integration, although not a new strategy, is becoming relevant to increasingly more people living with HIV and their health-care providers, including primary care providers who are assuming a greater role in the long-term care of people with HIV. This interest is being driven in part by the emphasis that global health leaders have placed on integrated health services as a key to achieving universal health coverage and the Sustainable Development Goals.

In 2016, the World Health Assembly adopted WHO's Framework on Integrated People-Centred Health Services, which puts forth a vision of "equal access to quality health services that are... coordinated across the continuum of care, and are comprehensive, safe, effective, timely, efficient and acceptable".⁶¹ Furthermore the 2018 International AIDS Society–*Lancet* Commission⁶² on advancing global health and strengthening the HIV response in the era of the Sustainable Development Goals stated in one of its three penultimate recommendations that "HIV should be carefully and strategically integrated within primary care and the broader global health agenda".

Integration in the HIV field might entail expanding the range of services provided by existing HIV clinics, or alternately, primary health-care clinics or other types of clinical facilities might incorporate HIV care into their services.²⁴ Services that have been combined with HIV care in integrated clinics include services for sexual and reproductive health, sexually transmitted infections, cervical cancer screening, tuberculosis, diabetes, hypertension, chronic respiratory disease, mental health, substance use disorders, methadone maintenance, and hepatitis C treatment.^{63–66} The colocation of services is often a feature of integrated service delivery models, but is not an absolute requirement as effective referral, including the use of telemedicine, might be seen as a form of service integration.

Different health systems are likely to have different service integration priorities. For example, in a setting where high prevalence of depression and other mental health disorders has been observed in the HIV population engaged in care, integrating mental health services into HIV clinics might be an effective strategy for improving health outcomes. In a setting where people who inject drugs account for a sizeable proportion of the HIV disease burden, and harm reduction services are available, the integration of HIV clinical management services in needle and syringe programmes, safe injection rooms, and opioid substitution therapy clinics might be advantageous. The body of research on service integration in the HIV field contains examples of good results,^{65,67–69} but other findings are inconclusive,^{70,71} and the evidence base overall is undermined by a dearth of methodologically rigorous studies reporting on concrete health outcomes or cost-effectiveness outcomes.^{72,73}

The performance of integrated health services is probably highly context-specific, with numerous factors at play, including institutional norms and the level of health system centralisation or decentralisation. Despite gaps in the evidence to guide HIV service integration, exploring this strategy remains imperative for health systems because it seems questionable whether existing service delivery models can provide comprehensive high-quality care to large cohorts of patients with HIV and multiple major comorbidities in the coming years.

Achieving greater health system integration for people living with HIV will require the effective management of patient health information in the context of complex privacy concerns and data protection laws and regulations. Some countries and subnational jurisdictions have introduced laws to provide more protection to patients with health conditions that make them vulnerable to discrimination, including HIV, mental health disorders, and substance use disorders. Such laws might have implications for the design and operation of integrated services for people living with HIV.^{74,75}

HIV-related discrimination in health-care settings

People living with HIV experience HIV-related discrimination in health-care settings worldwide.^{4,76–78} Such discrimination is both a human rights violation and a threat to the individual's health and HRQoL. HIV-related discrimination in health-care settings has been linked to medication non-adherence, persistent viral activation, and other negative health outcomes.^{79–81}

In 2015, the Thai Government established a national network to monitor HIV-related stigma and discrimination in health-care settings, and findings are informing ongoing efforts to counter this problem. The Thai experience became the model for a similar monitoring project in Ho Chi Minh City, Vietnam, where the resulting training intervention was credited with reducing stigma and discrimination in local health facilities.^{4,82} Other than these examples, however, there appears to be little public documentation of health system initiatives to reduce HIV-related discrimination in health-care settings.

To counter such discrimination, health systems should begin by examining the available evidence about the nature and extent of the problem. One potential resource is the civil society-driven People with HIV Stigma Index, which has been used to document stigma and discrimination in more than 90 countries to date. For example, Stigma Index findings from Greece indicate that 11% of people living with HIV reported experiencing the denial of health care because of their HIV status at least once in the preceding 12 months.⁸³ National and community-level non-governmental organisations (NGOs) that address the social and legal aspects of HIV might be another valuable source of information regarding the occurrence of HIV-related discrimination in health-care settings.

Indicators to monitor progress toward new goals

Measuring how health systems respond to the needs of people living with HIV is essential for programme planning and resource allocation, and ultimately for achieving and sustaining better health outcomes. A key question in the beyond viral suppression era is whether the indicators that currently guide national and subnational HIV responses adequately reflect issues raised in this Series paper such as multimorbidity, HRQoL, service integration, and discrimination in health-care settings.

Historically, HIV indicators in low-income and middle-income countries have been dictated by monitoring frameworks from three major global institutions: UNAIDS, the U S President's Emergency Plan for AIDS Relief, and The Global Fund.^{84–86} European countries have increasingly used the Dublin Declaration questionnaire to contribute to a regional HIV monitoring process coordinated by the European Centre for Disease Prevention and Control and have incorporated these indicators into their national monitoring programmes.⁸⁷

A 2018 analysis of indicators in these three global frameworks and the Dublin Declaration questionnaire found that out of hundreds of indicators, only a few monitored major non-AIDS-defining comorbidities, and none of these indicators were harmonised across frameworks.⁸⁸ For example, the only items addressed comprehensively in the Dublin Declaration questionnaire were access to services for bacterial sexually transmitted infections, liver diseases, and psychiatric disorders, and there were several dissimilar findings regarding how these items were addressed in the other monitoring frameworks.

Furthermore, unpublished data collected by the European Centre for Disease Prevention and Control indicate that only five of the 48 countries that reported to them in 2018 measured HRQoL in people living with HIV as part of their national HIV monitoring (Azad Y, National AIDS Trust, consultant to European Centre for Disease Prevention and Control, personal communication).

These findings suggest that reviewing the available monitoring data to identify gaps should be a key component of re-thinking health system approaches to HIV care. Monitoring systems might require only minor modifications to assess the screening, diagnosis, and treatment of some major non-AIDS-defining conditions in people living with HIV, as well as associated lifestyle risk factors such as smoking and alcohol and drug use. Also, repurposing existing health system monitoring mechanisms relating to other health issues such as viral hepatitis and non-communicable diseases might be feasible.

However, monitoring HRQoL is likely to require novel approaches. Wellbeing is subjective and multidimensional, and data collection can be burdensome and costly. Still, a single global question such as self-rated health status, which has been shown to be significantly and independently associated with morbidity, mortality, and health service use,^{89–91} can provide insight into a patient's

subjective view of his or her health and can help to guide clinical consultations. Alternately, a multidimensional index can be used to generate an overall HRQoL score from several questions. The drawbacks associated with using an instrument with many questions might be outweighed by benefits such as increased sensitivity to changes over time and capacity to measure changes within individual dimensions of health, such as mental health or physical functioning.^{92,93} Further benefits of an HRQoL index include the availability of generic instruments that allow comparisons with the general population and of instruments that cover HIV-specific symptoms and problems such as antiretroviral side-effects and stigma.

Data on self-perceived wellbeing must, by definition, be patient-reported, as opposed to originating from a clinician or from laboratory reports traditionally used in HIV reporting. One way of obtaining data is to survey patients via HIV clinics or national HIV cohorts that can be linked to surveillance, using methods to ensure that the sample is representative.^{94,95} Alternatively, questions on wellbeing and quality of life can be integrated into routine clinical care and captured by electronic patient records for routine reporting.

Finally, there is the question of how to measure health system progress toward a fourth 90 target meant to represent whatever is crucial for people living with HIV to attain in addition to viral suppression. The desired outcome is widely described as good HRQoL, but this does not necessarily mean that progress should be assessed solely in terms of the self-reported data that are collected with HRQoL instruments. In fact we originally conceived of the fourth 90 target as encompassing two domains: self-reported quality of life and comorbidities.¹⁵

Guaraldi and colleagues⁹⁶ have suggested that health-adjusted life expectancy, frailty assessment, and measures of intrinsic capacity all might also contribute to providing a composite picture of healthy ageing in HIV populations. Further work is needed to develop consensus regarding the appropriate instruments for quantifying health system performance in regard to a new target and to pilot such instruments.

Civil society engagement

Historically, civil society actors, including NGOs, community-based organisations, and patient groups have been involved in many aspects of HIV care, such as patient education, peer support, and advocacy for sound HIV treatment policies. As health systems confront the question of how to better address the current needs of people living with HIV, opportunities to explore new roles for civil society arise. For example, the AIDS Community Research Initiative of America (known as ACRIA), an NGO established in 1991 to bring a community-based perspective to the study of new HIV treatments, now operates a Center on HIV and Aging. The centre receives public funding to provide ageing-related training and

technical assistance to service providers in New York, NY, USA.⁹⁷

The Canadian NGO Realize expanded its focus to ageing-related issues after being established in 1998 to address the rehabilitation needs of the Canadian HIV population. The Public Health Agency of Canada provides much of the funding for Realize, which published a series of policy briefings in 2018 to advise provincial and territorial ministers of health on various aspects of ageing with HIV.⁹⁸

Civil society also has the potential to guide health systems in becoming more responsive to the needs of people living with HIV in specific service-delivery settings. For example, a Norwegian hospital initiated a user-driven redesign of its outpatient HIV clinic in 2011, with decision making guided by a board of patients.⁹⁹ This board identified holistic care and treatment as a key service target and requested that the clinic provide patients with individual care plans. It also developed a checklist of 108 items to be monitored in individual patient care, including mental health, alcohol and drug dependence, and neurocognitive decline (Said M, Sorlandet Hospital, personal communication). Additionally, unexplored opportunities exist for health systems to leverage the expertise of NGOs that provide services to HIV populations by encouraging these stakeholders to address comorbidities and diseases of ageing. For example, NGOs might refocus their programming to support people with HIV who have new health-related goals relating to exercise, diet, smoking cessation, and effective self-management of chronic conditions such as diabetes.

Community-based NGOs have a long history of providing HIV populations with peer support, which is likely to remain a prominent element of psychosocial wellbeing as people living with HIV age and encounter new challenges in relation to their health and other aspects of their lives.¹⁰⁰ Health system leadership, technical support, and funding are needed to foster a new era of NGO activity addressing this broader agenda.

Conclusion

In countries worldwide, ongoing progress toward and beyond the 90-90-90 target is changing the face of the HIV epidemic. This Series paper has examined challenges faced by health systems in the increasing number of settings where the widespread availability of ART enables many people living with HIV to effectively control their HIV infection on a long-term basis.

High prevalence of multimorbidity has been observed in HIV populations in these settings, and the evidence base also raises concerns about the HRQoL of people living with HIV. We identified four strategies for meeting the new challenges of the beyond viral suppression era (figure 2): service integration, reduction of discrimination in health-care settings, the introduction of new health system indicators, and new forms of civil society engagement.

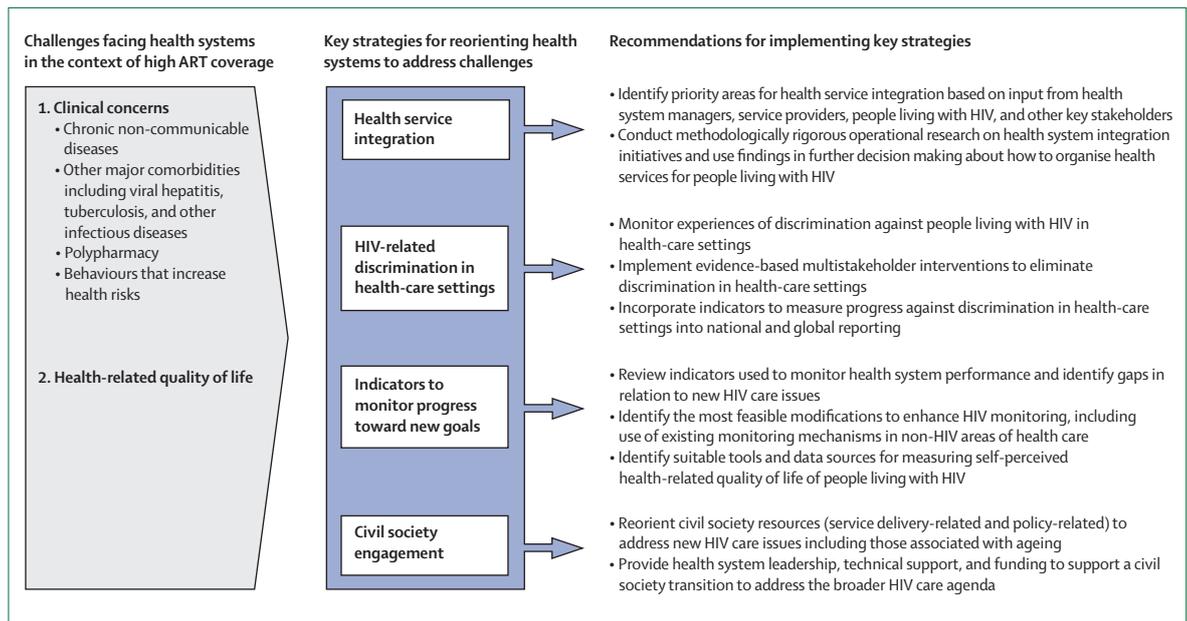


Figure 2: Meeting key health system challenges of the new HIV era
ART=antiretroviral therapy.

The two other papers in this Series examine patient-reported outcomes and interventions to reduce stigma in the context of this strategic agenda. Patient-reported outcomes can serve as effective indicators of patient wellbeing and health system progress in the HIV field, but an understanding of how to best use these instruments to address the challenges of a complex and changing epidemic is lacking.

The paper by Kall and colleagues¹⁰¹ presents an overview of validated patient-reported outcome instruments for HIV and discusses considerations in selecting these outcomes, data collection methods, and challenges and opportunities associated with further integrating them into the global HIV response. A key task for stakeholders working to reduce discrimination in health-care settings is to understand how the stigmatising attitudes that give rise to discrimination can be successfully challenged. The paper by Andersson and colleagues¹⁰² provides insight into this issue by examining the effects of stigma-reducing interventions in various populations.

Although this Series focuses on health system priorities, the health-related needs of people who are living with HIV on a decades-long basis are deeply intertwined with other fundamental needs. Thus, the health system agenda for achieving good HIV outcomes beyond viral suppression should be integrated with efforts to ensure that people living with HIV have food security, financial security, adequate housing and other forms of social support. Continuing to confront the health and socioeconomic disadvantages that have made some people more vulnerable than others to HIV and to poor health outcomes is essential, and doing so will

confront institutionalised forms of discrimination against marginalised groups.

Since high-income countries generally have the largest proportions of people living with HIV who are consistently virologically suppressed,^{4,103} much of the evidence in this Series paper has been drawn from these countries. However, high-income countries are simply at the forefront of a worldwide transition. In low-income and middle-income countries, similar challenges regarding long-term HIV care are beginning to emerge.^{66,104} Our observations and conclusions are intended to inform the health policy discourse globally, although we recognise that variations in progress toward the 90-90-90 target make the emerging agenda discussed here a more immediate priority in some settings than others. In the context of an increasing worldwide burden of chronic diseases, the shift that is underway in the HIV field must be considered in relation to burgeoning policy and programmatic efforts to promote healthy ageing.

HIV stands apart from other conditions in some ways, most notably for the stigma that it invokes and the many forms of discrimination arising from this stigma. Still many of the key health-care-related challenges faced by older people living with HIV are the same as those faced by other older people: a shortage of provider expertise in geriatric health issues, a lack of coordination among health-care providers, ageism, high out-of-pocket costs, and inadequate long-term care options.⁸ As policy makers and other health system actors define the healthy ageing agenda in the coming years, the HIV field should contribute to broadly targeted initiatives in this specialty and focus on how to provide

Search strategy and selection criteria

We searched PubMed for English-language publications relating to the broad range of topics addressed in this Series paper, using the search terms “HIV” and “AIDS” in combination with search terms such as “comorbidity”, “multimorbidity”, “polypharmacy”, “health-related quality of life”, “discrimination”, and “civil society”. We prioritised review articles published from Jan 1, 2013, to Aug 31, 2018, and used original research articles and commentaries when necessary to supplement information from review articles. We used publications from before Jan 1, 2013, when we were unable to locate more recent information. We also identified references through searches of grey literature published by major stakeholders including UNAIDS and WHO. We reviewed the reference lists of key publications that were retrieved to identify other relevant publications not located through the other search strategies.

the best care for people living with HIV. Coordinating the ageing agenda of the HIV field with that of the community at large will present opportunities to maximise financial and human resources, and might also enable HIV stakeholders to more directly counter discrimination in mainstream health-care settings.

Although government stakeholders typically have the most prominent role in setting health system agendas, the strategies discussed in this Series paper can best be operationalised through multistakeholder initiatives that bring together actors from government, medical and research societies, private industry, the HIV community, NGOs, and other relevant sectors. The sharing of information is vital as the HIV field reorients itself to the task of providing holistic long-term care to people living with HIV. Stakeholders are urged to report on operational research findings and other evidence emerging from new initiatives in this realm.

Contributors

JVL and KSH had the idea for this Series paper, designed it, and oversaw its development including preparing the first draft with input from all authors. JA worked with KSH and JVL in the preliminary stages of development and drafting. All authors reviewed and approved the final version of the manuscript.

Declaration of interests

JA, GMNB, and JVL report personal fees and non-financial support from Gilead Sciences, and personal fees from Merck Sharp and Dohme (MSD) and Janssen, outside of the submitted work. GMNB also reports personal fees from ViiV Healthcare, outside of the submitted work. UD reports grants from Gilead Sciences and ViiV Healthcare, outside of the submitted work. JDA reports personal fees from ViiV Healthcare, Gilead Sciences, and MSD, outside of the submitted work. MK reports grants from Gilead Sciences, outside of the submitted work. JVL reports grants from the HIV Outcomes Beyond Viral Suppression Coalition, during the conduct of the study, and personal fees from CEPHEID, outside of the submitted work. KP reports personal fees from ViiV Healthcare, outside of the submitted work. KSH reports grants from the HIV Outcomes Beyond Viral Suppression Coalition, during the conduct of the study. All other authors declare no competing interests.

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For more on HIV Outcomes see www.hivoutcomes.eu

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