

The title 'Agenda 2025' is centered on the page. The word 'Agenda' is in a large, bold, dark grey sans-serif font, and '2025' is in a slightly smaller, regular weight of the same font. Below this, the words 'ENDING HIV TRANSMISSION IN AUSTRALIA' are stacked in a smaller, all-caps, dark grey sans-serif font. The entire title is framed by four orange L-shaped brackets at the corners.

# Agenda 2025

ENDING HIV  
TRANSMISSION  
IN AUSTRALIA

Technical paper on science, trends and targets  
**June 2021**

# Foreword

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Forty years ago, on June 5 1981, the U.S. Centers for Disease Control and Preventions Morbidity and Mortality Weekly Report described five cases of *Pneumocystis Pneumonia* in young gay men in Los Angeles. The five men died in hospital from what researchers later understood to be AIDS-related illness. It didn't take long for HIV to reach Australia, with the first case being reported in September 1982.

Since the beginning of the epidemic, an estimated 32.7 million people have died from AIDS-related illness globally.

We have been world leaders in our response to the HIV epidemic. In Australia, under 10,000 people have died of an AIDS-related illness and approximately 26,000 people are currently living with HIV. In global terms our response has been a success, to a significant degree because Australia has implemented evidence-based policies crafted around real-world behaviour.

Now, four decades on, advances in HIV prevention and treatment along with new testing technology means Australia can realistically aim for virtual elimination of HIV transmission by 2025, provided we remove access barriers and commit additional funding.

*Agenda 2025* comes at a critical time in Australia's HIV response. With the right policy settings and investment, we can end HIV transmission in just four short years. The plan provides the path to a 90% reduction in HIV infections, compared to 2010. This requires 95% of people at risk of HIV infection using one or more forms of effective HIV prevention; 95% of people living with HIV diagnosed and treated; and 98% achieving undetectable viral load. This can only be achieved with a removal of barriers to testing and treatment, which requires further funding.

While Australia should be proud of its response to the HIV epidemic so far, some outstanding issues need to be addressed. Regulation has not kept up with changes in technology, and while we have seen a sharp decline in new HIV diagnoses amongst gay and bisexual men in inner cities, progress elsewhere is patchy and, in some cases, we have seen an increase in diagnoses for gay and bisexual men born overseas or living in regional and outer suburban areas.

It is clear there is still work to do to achieve our goal of eliminating new HIV transmission by 2025. The *Agenda 2025* blueprint is a fully costed plan which will achieve that. This document draws on the very latest research and insights of the nation's top HIV researchers, clinicians, and community leaders.

As *Agenda 2025* highlights, further investment in the HIV response now will free up significant amounts of resources in the health system in the future.

With a renewed focus on prevention in the form of full subsidisation of PrEP for all, regardless of visa status and more creative ways to make HIV testing more widely available, Australia can pioneer new world-leading innovations in the response to the HIV epidemic.

There is also further work to do in eliminating stigma. Research shows that stigma has been a significant barrier to the HIV response which is why *Agenda 2025* calls for a \$9 million per annum investment in targeted education programs in health care settings a media program to positively engage journalists and influencers, and research to better monitor HIV stigma and build evidence for effective interventions.

Operating on current settings will lead to thousands more preventable cases of HIV transmission and billions of dollars in lifetime HIV treatment and care costs. Further investment and a change in existing policy settings is required. If we want to achieve virtual elimination of HIV by 2025, the recommendations of this blueprint must be implemented.



Adjunct Professor Darryl O'Donnell  
Chief Executive Officer, AFAO



# Executive Summary

## Acronyms

ACCESS	The Australian Collaboration for Coordinated Enhanced Sentinel Surveillance of Blood Borne Viruses and Sexually Transmitted Infections
CALD	culturally and linguistically diverse
cART	combination antiretroviral therapy
DBS	dried blood spot
GCPS	Gay Community Periodic Survey
GBM	gay, bisexual and other men who have sex with men
MBS	Medicare Benefits Schedule
MSM	men who have sex with men
PBS	Pharmaceutical Benefits Scheme
PEP	post-exposure prophylaxis
PLHIV	people living with HIV
POCT	point-of-care test
PrEP	pre-exposure prophylaxis
PWID	people who inject drugs
STI	sexually transmissible infection
TasP	treatment as prevention
TGA	Therapeutic Goods Administration
U=U	Undetectable = Untransmissible
UNAIDS	Joint United Nations Programme on HIV/AIDS
UK	United Kingdom
US	United States of America
WHO	World Health Organization

## Key Insights

- Advances in HIV prevention bring the virtual elimination of HIV transmission in Australia within reach.
- People living with HIV (PLHIV) on treatment, with an undetectable viral load, cannot transmit HIV sexually (known as Undetectable = Untransmissible, or U=U).
- People who are adherent to pre-exposure prophylaxis (PrEP) reduce their risk of HIV to almost zero.
- A rapid scale-up of HIV testing, treatment and PrEP use is needed, plus continued support for condom use.
- Australia is not using existing HIV prevention, testing and treatment technology optimally because of restrictive conditions or costs to the consumer; these must be overcome on public health grounds.
- Reducing stigma related to HIV and homosexuality is vital to ensure the rapid uptake of prevention methods, as well as improving individual health, well-being and quality of life for people living with HIV (PLHIV).
- Investing in prevention, testing, treatment and care, and stigma reduction today will have long-term personal, societal and economic benefits.
- The Commonwealth and States and Territories must renew their partnership and their respective investments.
- Sustaining the HIV partnership of community, clinicians and researchers is essential to achieving virtual elimination of HIV transmission.
- Australia has a health sector which is capable of the implementation of urgent and rapid reforms that will allow us to eliminate HIV transmission in all priority populations by 2025.

## Current research and its implications

In the last five years, HIV treatment using combination antiretroviral therapy (cART) and PrEP in HIV-negative people have proved to be nearly 100% effective in preventing HIV transmission. This raises the possibility of the elimination of HIV transmission. In its *Global AIDS Strategy 2021–2026*, the Joint United Nations Programme on HIV/AIDS (UNAIDS) has called for “the end of AIDS” by 2030 and set a target of a 90% reduction in annual HIV incidence globally. However, in 2019 there were an estimated 1.7 million new HIV infections worldwide, representing a 23% decline since 2010, but still much too high for UNAIDS’ target of 0.5 million by 2020 to be reached. This also means the 2030 target is unlikely to be achieved. UNAIDS described this outcome as a “global HIV prevention crisis”.

While global progress towards HIV elimination has been slow, many examples suggest national elimination of HIV transmission is achievable. Australia is a world leader in HIV prevention, with extremely low rates of HIV in populations heavily affected elsewhere, including in sex workers and people who inject drugs, and has virtually eliminated mother-to-child transmission. About two-thirds of new HIV diagnoses in Australia are in gay, bisexual and other men who have sex with men (GBM), in whom the number of diagnoses declined 26% between 2014 and 2019. Nevertheless, much remains to be done to eliminate HIV transmission in GBM as the pathway to achieving the overall goal in Australia. Around 20% of new diagnoses are in heterosexual people, and the number of these diagnoses has been quite stable. In addition, in 2019 there were 354 HIV diagnoses in people who had been previously diagnosed elsewhere. These infections are not preventable in Australia.

## Insights for Aboriginal and Torres Strait Islander People

Inequalities in overall health outcomes for Aboriginal and Torres Strait Islander people compared to the general Australian population are also reflected in HIV indicators. To achieve the overarching elimination goal, we must set and meet targets for Aboriginal and Torres Strait Islander people, including GBM and other subgroups. Scale up of prevention programs is needed for Aboriginal and Torres Strait Islander GBM. Innovative approaches which make testing more convenient, culturally safe and discreet will (continued next page)



Overcoming the barriers to HIV prevention, testing and treatment uptake among people at risk of HIV will require a broad range of interventions, including increased access to services, faster registration and funding approval for new technologies, and more intensive support for people at risk of or living with HIV. Removing the negative impacts of visa conditions on people's willingness to seek and access HIV prevention, testing and treatment will also be required. Consumer costs are also a barrier to PrEP uptake and treatment. Medicare-ineligibility means many people at risk of or living with HIV are required to seek services in the public system, which has serious geographic limits and is under acute pressure. Many PLHIV who are not accessing HIV treatment or achieving viral suppression have complex social and comorbid health issues requiring sensitive, wrap-around support to make HIV treatment uptake and maintenance possible.

Each of these issues can be overcome if HIV is recognised as a national public health priority. COVID-19 provides an example of what can be achieved in responding to a communicable disease when it is recognised as a public health priority and governments remove the impediments to its control. COVID-19 also highlights the critical role of Commonwealth and State and Territory cooperation; virtually eliminating HIV transmission will require similar cooperation. It will be especially important that States and Territories enhance existing investments in community and other services and programs to bring to scale the initiatives needed to complement Commonwealth action.

In May 2021, AFAO convened an expert panel of Australia's most senior scientists, clinicians, and community leaders to review the evidence and set new targets and priorities to see Australia achieve the virtual elimination of HIV transmission by 2025. This technical paper provides the evidence assembled by the panel and priorities and targets they have endorsed to achieve virtual elimination.

The expert panel has, for the first time, endorsed a measurable target for the achievement of virtual elimination of HIV transmission in Australia. This target is *a 90% reduction in HIV diagnoses in Australia (compared to a 2010 baseline)*. The expert panel therefore confirms that Australia will have achieved virtual elimination when less than 91 local cases are reported each year.

If the number of HIV diagnoses in Australia continues to 2030 at 2019 levels, 9,010 people will acquire HIV. The cost of the status quo in lifetime HIV treatment and care alone is \$2.1b. By implementing the priorities set out in this paper and achieving virtual elimination by 2025, Australia will prevent over 6,000 people from acquiring HIV by 2030. By this time, Australia will have avoided \$1.4b in HIV treatment and care costs.

mean more Aboriginal and Torres Strait Islander GBM will access testing. More effort is required to improve the HIV treatment and care cascade for Aboriginal and Torres Strait Islander people and to increase those on treatment being virologically suppressed. This includes peer support. Layered stigma is particularly relevant for GBM and women living with (or at risk of) HIV who are Aboriginal or Torres Strait Islander, requiring increased investment in research and stigma reduction programs to improve health outcomes. Initiatives should be designed and led by Aboriginal and Torres Strait Islander people.

This paper highlights shortfalls in the uptake of existing HIV technologies – PrEP, testing and treatment – because of restrictive registration conditions or a failure to fund the optimal use of the technologies through Medicare. Australia must bring greater public health focus to its devices and medicines registration and funding processes if virtual elimination of HIV transmission is to be achieved. This includes removing barriers to existing technology uptake and establishing new tracks to allow the rapid, proactive consideration of registration and funding for new technologies.

Emerging disparities in HIV prevention success in Australia are worrying. During 2015–19, HIV diagnoses declined by 75% in Australian-born GBM living in the inner cities but declined less – or increased – in GBM born overseas, living outside inner cities and aged less than 25 years. These disparities reflect differing levels of uptake of HIV testing, treatment and PrEP, and stigma related to HIV and homosexuality acting as a deterrent to health service users. Reducing stigma, including removing non-evidence-based laws criminalising HIV transmission and exposure, is a critical part of the HIV prevention response.

Australia can virtually eliminate HIV transmission by 2025. To do so, existing investments in community action must be protected, and new investments to further drive down HIV infection are needed.

## Current Targets

UNAIDS has called for an end to AIDS as a global public health threat by 2030. It defines this as a 90% reduction in new HIV infections and AIDS-related deaths by 2030, relative to a 2010 baseline. In *Ending the HIV epidemic in the U.S.*, the United States of America aims for a 75% reduction in new HIV infections in 2025 and reflects the UNAIDS 2030 target of a 90% reduction by 2030. The United Kingdom is even more ambitious, targeting zero HIV transmission by 2030. Australia's eighth *National HIV Strategy 2018–2022* targets the virtual elimination of HIV transmission within the life of the strategy but does not define this goal precisely. State and Territory strategies generally reflect this goal. However, the recently released *NSW HIV Strategy 2021–2025* goes further, targeting a 90% reduction in HIV diagnoses by 2025, reflecting the UNAIDS strategy but setting the “elimination” goal five years earlier. Australia needs more ambitious targets to drive us towards the elimination of HIV transmission.

## Renewing Targets

### Overarching goal: Achieve the virtual elimination of HIV transmission in Australia by 2025

To achieve this goal, we must meet the following targets by 2025. They apply to all people at heightened risk of HIV and to subgroups of GBM defined by age group, geographical area of residence and country of birth, and in Aboriginal and Torres Strait Islander GBM.

#### Overarching targets

1. A 90% reduction in preventable HIV diagnoses in Australia (compared to a 2010 baseline)
2. A reduction in preventable new HIV infections in GBM to less than one per 1,000 GBM per year

#### HIV prevention targets

1. 95% of people at risk of HIV infection use one or more forms of effective HIV prevention (e.g. condoms, PrEP, U=U)
2. 95% of people for whom PrEP is beneficial to use it

#### HIV testing targets

1. 95% of PLHIV are diagnosed
2. 90% of all people at heightened risk of acquiring HIV have a yearly HIV test
3. 80% of all GBM at risk of HIV have a test every three months

#### HIV treatment targets

1. 98% of PLHIV diagnosed with HIV are on treatment
2. 98% of PLHIV on treatment have an undetectable viral load
3. 90% of newly diagnosed PLHIV commence treatment within two weeks of diagnosis

#### Stigma

1. >95% of PLHIV report no stigma in the last 12 months
2. >95% of GBM report no stigma in the last 12 months
3. >95% of the general public indicate they would not behave negatively towards a person because of their perceived or actual HIV status or sexuality
4. >75% of PLHIV report good quality of life

Australia's success in achieving extremely low rates of HIV in sex workers and people who inject drugs is a result of the leadership of their peer-based organisations supported by Commonwealth, state and territory governments over many decades. Sustaining this effort is crucial for the elimination of HIV transmission and will require continued support for condom use, needle and syringe programs and peer-led health promotion and prevention efforts. Reducing stigma related to sex work and drug use is also vital to ensure the rapid uptake of prevention methods. Greater effort is required to address the legal, regulatory and policy barriers which affect all priority populations and influence their health-seeking behaviours.

This Technical Paper has a strong focus on GBM and the actions required to achieve similar levels of success. For all priority populations, achieving the virtual elimination of HIV transmission requires safeguarding the hard fought wins to date and going further to achieve our goal for all.



# Prevention



## Priorities

### HIV prevention

- Make subsidised PrEP available to all people residing in Australia, regardless of visa status.
- Scale up prevention programs for GBM who have had less prevention success, including those residing outside the inner cities, men recently arrived from overseas, culturally and linguistically diverse men, Aboriginal and Torres Strait Islander men, young men and non-gay-identified men who have sex with men (MSM), while sustaining efforts in inner-city and Australian-born GBM.
- Invest in health promotion of appropriate forms of PrEP, including daily oral PrEP, event-driven PrEP and periodic PrEP and rapid assessment and approval of new PrEP technologies such as long-acting injectable PrEP.
- Investigate and (if feasible) implement the provision of PrEP in non-medical settings.
- Sustain investment in prevention initiatives in sex workers and people who inject drugs

### HIV testing

- Make subsidised HIV and other sexually transmissible infection (STI) testing available to all people residing in Australia, regardless of visa status.
- Remove visa conditions that inhibit temporary visa holders from accessing HIV testing contrary to public health outcomes.
- Increase access to and promotion of HIV point-of-care testing (POCT) and HIV self-testing.
- Investigate and implement opt-out HIV testing in settings of higher HIV prevalence.
- Investigate and implement molecular epidemiology to inform the public health response to HIV clusters.

### HIV treatment

- Make free HIV care and treatment available to all people residing in Australia, regardless of visa status.
- Enable all people newly diagnosed with HIV to commence treatment within 14 days of their diagnosis.
- Double the number of S100 cART prescribers in Australia by 2025 and increase reimbursements for all Medicare Benefits Scheme (MBS) items related to the treatment and care of PLHIV.

### Stigma

- Working with PLHIV and at-risk communities, investigate and implement multi-level interventions designed to reduce stigma at individual, interpersonal, organisational/institutional and policy/governmental levels.
- Conduct research to increase the evidence base for effective stigma-reducing interventions and improved design of stigma monitoring and evaluation systems.
- Repeal stigmatising non-evidence-based laws which criminalise HIV exposure and transmission.

### Enablers

- Implementation research is required to ensure new technologies and interventions have maximum impact.
- New forms of surveillance are needed to measure progress towards the HIV targets and overarching goal.
- A renewed Commonwealth and State and Territory partnership is required, bringing together public health leadership, governance, cooperation and effective coordination of efforts.
- Existing investments in HIV, including for community action, must be maintained and new investments made to bring to scale the initiatives needed to complement Commonwealth action.
- Wrap-around care is needed for people who experience complex social or co-morbid health issues at diagnosis and throughout their life.
- New, more sensitive and effective models of contact tracing are required, including peer-led models.
- A rapid, pro-active regulatory approach is required to consider the registration and funding requirements of new technologies to virtually eliminate HIV transmission.
- The continued cooperation of PLHIV and those at risk must be sustained. These populations remain mobilised to achieve Australia's goals. The investment and tools needed must be placed in their hands to bring HIV transmission to an end.

## Key Insights

- To reduce HIV transmission in Australia, any person at risk of HIV must be able to access an effective form of prevention acceptable to them, when they need it. Effective forms of HIV prevention include condoms, PrEP and treatment that results in an undetectable viral load.
- Since 2016, the widespread use of PrEP, mostly by GBM, has transformed Australia's HIV prevention response.
- Current PrEP use among people at risk of HIV in Australia is among the highest levels globally, but use needs to be increased further if we are to end HIV transmission.
- It is critical subsidised PrEP is available to all Australian residents at risk of HIV, regardless of their residency or visa status.
- Restrictions on PrEP initiation and dispensing should be relaxed to increase access and convenience.
- In the next five years, PrEP should become available in long-acting dosing versions.
- Post-exposure prophylaxis (PEP) is an important intervention for people who may have been exposed to HIV and must be easily accessible to all those who need it, regardless of their residency or visa status.

## Current Research

### Combination HIV prevention coverage and trends

Combination HIV prevention coverage (or net prevention coverage) means the proportion of people using any effective HIV prevention method when having sex with casual partners. Effective HIV prevention methods are defined as avoiding anal intercourse, using condoms consistently, using PrEP and/or having a sexual partner with an undetectable viral load. In Australian research, this concept has been applied to GBM having casual sex, the primary route of HIV transmission.<sup>1</sup> In national Gay Community Periodic Survey (GCPS) data, net prevention coverage among GBM increased from 68% in 2014 to 79% in 2020.<sup>2</sup> <sup>3</sup> Although consistent condom use with casual partners declined significantly (from 45% to 22%), this was more than offset by increased PrEP use (from 1% to 35%).<sup>3</sup> Net prevention coverage was higher among gay-identified men than non-gay-identified MSM and in inner-city suburbs with high concentrations of gay men than elsewhere and was lower among men aged under 25 years than in older men.<sup>3,4</sup>

### Condoms

Consistent condom use has been the mainstay of HIV prevention since the beginning of the epidemic and still remains a critical element of combination HIV prevention. Although consistent condom use with casual partners has fallen since the advent of biomedical prevention, it remains the primary HIV prevention strategy for a substantial minority of GBM, especially men from specific subgroups such as younger men and newly arrived migrants.<sup>3</sup> Many men also use condoms in combination with biomedical prevention, and to prevent STIs.<sup>3</sup> The role of condoms must continue to be supported, especially as some subgroups may not find biomedical prevention acceptable or desirable to use.

### Undetectable = Untransmittable (U=U)

Science has demonstrated that a person living with HIV with an undetectable viral load cannot transmit HIV sexually,<sup>5</sup> and this is reflected in the impact of increasing rates of HIV treatment and viral suppression on the Australian HIV epidemic.<sup>6</sup> Nonetheless, significant declines in new HIV diagnoses were not seen until the scale-up of PrEP.<sup>7</sup> The fact increasing treatment uptake did not drive decreases in HIV diagnoses is probably due to undiagnosed HIV infections causing ongoing transmission. A recent Australian modelling study estimated the proportion of transmissions from undiagnosed GBM rose from 33% in 2004 to 59% in 2015.<sup>8</sup>

The 2019 national PrEPARE study of attitudes to biomedical HIV prevention among Australian GBM showed most agree early HIV treatment is desirable.<sup>9</sup> However, willingness to rely on an HIV-positive sexual partner being unable to transmit HIV is much lower.<sup>10,11</sup> This is likely to be influenced by HIV stigma, but also by HIV-negative men wanting direct control over their means of preventing HIV acquisition when familiarity with and knowledge of their sexual partner is low. HIV-negative men with HIV-positive partners are consistently more trusting of U=U<sup>10</sup>. Community-based organisations can play a leading role in increasing GBM's understanding of U=U.



## PrEP

### Trends in PrEP uptake and use

Pharmaceutical Benefits Scheme (PBS) data show 42,076 individuals in Australia had been dispensed subsidised PrEP by the end of 2020.<sup>12</sup> PBS-subsidised PrEP dispensing (defined as at least one prescription filled in the last calendar quarter) increased from 6,433 individuals in the second quarter (Q2) of 2018 to 21,913 individuals in Q1 2020, prior to the COVID-19 pandemic. There was a subsequent decrease to 17,135 individuals in Q2 2020 and a rebound to 20,172 individuals in Q4 2020. The PBS dataset does not include individuals ineligible for Medicare or who personally import PrEP from online pharmacies. GCPS data suggest the proportion of PrEP users who obtained it online stayed stable at about 8% from 2018 to 2020. Thus, the PBS estimates of recent PrEP users may underestimate total PrEP use among GBM by about 10%.

Among all HIV-negative and untested men who participated in the GCPS, PrEP use increased from 4.5% in 2016 to 31.2% in 2020.<sup>3</sup> Among those reporting condomless sex with casual partners, it increased from 14.2% in 2016 to 64.2% in 2020.<sup>3</sup> In this sample of GBM, PrEP use is starting to approach Australia’s National HIV Strategy target of 75%.

### PrEP dosing

On-demand (or event-driven) PrEP refers to taking PrEP pills only around the time of sex (two pills 2–24 hours before sex and one pill per day for two days after their first dose) and is as efficacious as daily dosing in preventing HIV following anal intercourse.<sup>13</sup> On-demand PrEP is supported by World Health Organization (WHO) guidelines and since September 2019 is supported in the Australian PrEP guidelines. It should not be used in people whose risk exposure involves behaviours other than anal intercourse.<sup>14, 15</sup> In 2020, national GCPS data showed that among GBM who used PrEP, 87% took PrEP daily and 13% used PrEP on demand (up from 8% in 2019).<sup>3</sup> Australian studies have found considerable interest in on-demand PrEP. In NSW’s Expanded PrEP Implementation in Communities (EPIC-NSW) study, 12% of participants preferred on-demand dosing at baseline, increasing to 17% by the final follow-up survey.<sup>16</sup> In the PrEP in NSW Transition Study in 2019–20, 68% had heard of on-demand PrEP, 43% said they would like to use it, and 21% selected it as their top preference.<sup>11</sup> In the PrEPARE study, 8% of PrEP users and 27% of non-PrEP users preferred on-demand PrEP.<sup>9</sup> However, despite this interest, knowledge of how to take on-demand PrEP appears low. Of the participants in the PrEP in NSW Transition Study who had heard of event-driven PrEP, only 12% knew how to take it correctly.<sup>11</sup>

Periodic PrEP means taking PrEP only during periods of high risk of exposure to HIV. Recently, social marketing campaigns (one in NSW and one national) have explicitly promoted this way of taking PrEP. In EPIC-NSW, about 16% of participants preferred only using PrEP during periods of high risk instead of ongoing/indefinite daily or on-demand PrEP (this remained stable over follow-up).<sup>16</sup> Some studies have examined willingness to use “holiday PrEP” among GBM,<sup>17, 18</sup> but there is a dearth of data about periodic PrEP use in GBM and other populations. Many GBM may be uncertain about how to safely stop and start PrEP in line with their risk of HIV exposure.<sup>19</sup> It is important community-based organisations continue to update people about taking PrEP correctly, including offering specific information about on-demand and periodic PrEP.

### New PrEP options

Recently, a monthly dapivirine vaginal ring,<sup>20</sup> and eight-weekly injections of long-acting cabotegravir, have been proven to be efficacious forms of PrEP.<sup>21</sup> Several more options are in pre-clinical and clinical development, including a monthly oral pill, a six-monthly injectable and bioerodable or removable subcutaneous implants.<sup>22, 23</sup> A choice of protection modalities is useful, but each new product brings specific biomedical and psychosocial challenges. More research is needed to determine what people at risk of HIV infection want in a product. A long delay between evidence of efficacy and scale-up, as occurred with daily oral PrEP in Australia, must be avoided, to ensure advances in PrEP can have maximum impact on the HIV epidemic.

### Initiating PrEP

Several individual-level barriers to PrEP uptake have been documented. Clearly, people need to be aware of PrEP to be able to use it. Awareness can be raised by community-based social marketing/demand creation, as well as in conversations between patients and clinicians. In Australia, the goal should be high awareness among all GBM, not just among those who would currently benefit from PrEP, to acknowledge that HIV risk is not static and to build community-level support for PrEP use.<sup>9, 10</sup> Unwillingness to use PrEP is a critical issue and can explain non-use in some people who are aware of PrEP and could benefit from it.<sup>24</sup> It is a multifaceted concept that can incorporate lack of affordability or unwillingness to pay, fear of side effects, negative attitudes towards medicines generally and unwillingness to engage in the required clinical procedures. For an individual, the decision to take PrEP relies on at

least some recognition of risk.<sup>25</sup> Hence, on-demand PrEP should be promoted to individuals who believe their episodes of potential risk are too infrequent to warrant ongoing daily PrEP.

Prescriber-level barriers are also important. Not all GPs have sufficient PrEP knowledge, and some are unwilling to prescribe PrEP. There have been calls for demedicalisation of PrEP service delivery to increase access and convenience. This might include nurse-led or peer-based services, home-based telehealth or e-health models and initial PrEP supply without the need for a prescription, as already implemented in California.<sup>26</sup> Regulatory barriers can prevent the adoption of such strategies.<sup>28</sup> Further efforts are required to streamline the process of PrEP initiation; the various service adaptations implemented during the COVID-19 pandemic may offer lessons in this regard.<sup>27</sup> Community-based organisations can and should be central to investigating and developing new PrEP service delivery and access models.

### Prevention-effective adherence and persistence

Prevention-effective adherence means people only need to take PrEP during periods of risk.<sup>28</sup> Real-world PrEP use must accommodate people cycling through periods of use and non-use, as well as switching between dosing regimens or new PrEP modalities as they become available.<sup>29</sup> Generally, Australian data suggests adherence to PrEP is high. An analysis of EPIC-NSW data found 30% of participants discontinued PrEP over an average of two years follow-up, and 85% of these did not recommence PrEP during the study.<sup>30</sup> Given EPIC-NSW continued to find very low HIV incidence in the cohort, even in the year after PrEP provision ceased, it is likely many of the participants who discontinued PrEP did so because their level of risk fell.<sup>31</sup> The EPIC-NSW behavioural data support this hypothesis.<sup>32</sup> In the PrEPX trial in Victoria, 25% of participants discontinued PrEP during follow-up, and 78% of these did not recommence. Factors associated with discontinuation included young age, injecting drug use, methamphetamine use and consistent condom use with casual partners.<sup>33</sup> PrEP discontinuation is a serious issue that must be addressed: in EPIC-NSW 30 participants acquired HIV, almost all of whom had discontinued PrEP well before their HIV exposure.<sup>31</sup>

### PEP

Post-exposure prophylaxis (PEP) is an important intervention for people who may have been exposed to HIV. In recent years, about 5% of community-connected GBM report using PEP in the previous six months.<sup>3</sup> PEP must be taken within 72 hours after the potential exposure, and therefore, it must be available, free-of-charge, and easily accessible to all those who need it, regardless of their residency or visa status. As with PrEP, there may be ways to demedicalise PEP so that it is more convenient to access immediately after exposure. It is also critical that no matter where people access PEP, they are able to do so without encountering stigma.

## Current Targets

Globally, the UNAIDS *Global AIDS Strategy 2021–2026*<sup>34</sup> includes the high-level target that “95% of people at risk of HIV infection have access to and use appropriate, prioritised, person-centred and effective combination prevention options”. Australia’s *National HIV Strategy*<sup>35</sup> aims to “increase the proportion of eligible people who are on PrEP, in combination with STI prevention and testing to 75 per cent”. The recent *NSW HIV Strategy 2021–2025*<sup>36</sup> has three key prevention targets:

- 90% of men who have sex with male casual partners report at least one form of HIV prevention;
- 90% of HIV-negative men who have sex with male casual partners without a condom take PrEP; and
- reduce sharing of injecting equipment among people who inject drugs”.

## Renewing Targets

Given the goal is to initiate all people at high HIV risk onto PrEP and maximise the use of all effective HIV prevention methods among people at high risk, an overall prevention coverage goal is important. The proposed target is: “**95% of people at risk of HIV infection use one or more forms of effective HIV prevention (condoms, PrEP, U=U) by 2025**”. However, even with this broad HIV prevention coverage target, it is important to retain a specific PrEP target to ensure continued focus on new initiations and PrEP persistence among people at high risk of HIV. In monitoring a PrEP target, suitability may be defined in various ways, but it is recommended a relatively simple metric such as condomless anal intercourse with casual partners (in the case of GBM) be utilised. The proposed PrEP target is: “**95% of people suitable for PrEP use it by 2025**”. PrEP use can refer to daily, on-demand or periodic oral PrEP, or the use of new PrEP modalities as they become available.



# Testing



## Priorities

- **Prioritise and invest more in subgroups of GBM in which there is evidence of less HIV prevention success**, including immigrants (including Medicare-ineligible people, particularly those who have arrived in Australia in the last four years), those in suburban/regional areas, culturally and linguistically diverse men, Aboriginal and Torres Strait Islander men, men aged less than 25 years, men who travel and engage in high-risk practices overseas, non-gay-identified MSM and GBM who are not strongly connected to gay communities or clinical care. Overall, HIV prevention targets should be met in each of these groups.
- **Sustain investment in the groups in which we are doing well** (e.g. inner-city gay men and Australian-born GBM), sex workers, people who inject drugs.
- **Link new migrants and temporary residents, most of whom will not be eligible for Medicare, to sexual health care.** This will enable HIV testing, linkage to care and treatment for those diagnosed and linkage to ongoing prevention services, including PrEP, for those who test negative but are at risk of HIV. These services must accommodate varying levels of HIV and sexual health literacy. They must be culturally safe and readily accessible to people with diverse preferred languages other than English.
- **Increase PrEP use by:**
  - making subsidised PrEP available to all Australian residents at risk of HIV, regardless of visa status
  - promoting on-demand PrEP in social marketing and clinics, especially to those who have not previously wanted to use daily oral PrEP
  - supporting further exploration of how to demedicalise PrEP, given its proven safety, to increase access, convenience and individual control
  - avoiding a long gap between the evidence of efficacy and the licensing, availability and subsidisation of new PrEP products. Workforce development to prepare for these new options will be critical.
- **Invest in enhanced surveillance, monitoring and evaluation to ensure effective HIV prevention is reaching all subgroups.**

## Key Insights

- An increasing majority of HIV transmission in Australia is attributed to undiagnosed HIV, with estimates of the proportion of PLHIV who are diagnosed plateauing.
- Priority populations at risk of HIV, including most GBM, are testing for HIV at lower than recommended frequencies.
- Considerable regulatory, health system and psychosocial barriers to frequent HIV testing persist for those at risk of HIV in Australia. Current HIV testing models will not achieve the level of testing coverage or frequency needed to achieve HIV elimination targets by 2025.
- To support frequent HIV testing and early diagnosis among all populations at risk of HIV, more convenient, accessible and person-centred HIV testing and linkage to care models must be developed, expanded and maintained, including peer-led services and home-based and outreach testing models.
- Access to subsidised HIV and other STI testing should be made available to all people residing in Australia, regardless of visa status.

## Current Research

### The role of diagnostic testing in the HIV response

Achieving elimination of HIV transmission in Australia relies on high rates of treatment combined with frequent diagnostic testing and high testing coverage among those at risk of acquiring HIV.<sup>1</sup> Modelling suggests Australia's targets for elimination of HIV transmission will not be met without substantial increases in HIV testing frequency among GBM, despite the scale-up of HIV pre-exposure prophylaxis (PrEP).<sup>2</sup> High-frequency HIV testing among those at risk ensures people are diagnosed as soon as possible after HIV acquisition. This helps prevent onward transmission in two ways. First, people diagnosed with HIV can adopt preventive behaviours to avoid onward transmission.<sup>3</sup> Second, timely diagnosis allows for early treatment and viral suppression, eliminating the risk of HIV transmission.<sup>4,5</sup>

### Undiagnosed HIV and its contribution to HIV transmission in Australia

Australia has been extremely successful in implementing treatment components of the HIV care cascade, with proportions of people diagnosed with HIV who are on treatment (estimated at 96% in 2018) and the proportion virally suppressed (estimated at 95% in 2018) now meeting or exceeding UNAIDS 2030 95-95-95 targets.<sup>6</sup> We have also observed dramatic reductions in the intervals between diagnosis, referral to care, treatment and viral suppression among GBM.<sup>7</sup> However, estimates of the proportion of PLHIV who are diagnosed have plateaued and remain stubbornly below WHO targets, increasing from 88% in 2014 to 90% in 2018.<sup>6</sup>

With substantial proportions of people diagnosed with HIV in Australia being retained in care, treated and virally suppressed, the role of undiagnosed HIV (and therefore patterns of HIV testing) in sustaining HIV transmission rates has increased. Modelling of the Australian HIV epidemic among GBM estimated the proportion of HIV transmission attributable to people who were undiagnosed and unaware of their positive HIV status increased from 33% in 2004 to 59% in 2015, despite the estimated prevalence of undiagnosed HIV declining from 14.5% to 7.5% over the same period. These divergent trends were attributed to the prevention of transmission from the substantially increased proportions of GBM with suppressed viral loads due to treatment.<sup>8</sup> Given the continuous improvements in HIV treatment and viral suppression since 2015, it is likely the current proportion of HIV transmissions in Australia resulting from undiagnosed HIV is much greater than the 59% estimated in 2015. Therefore, current and future HIV prevention strategies must seek to improve the coverage of HIV testing and facilitate convenient, accessible and equitable ways for all people at risk of HIV to test frequently.



## Trends in the frequency of HIV testing

While HIV testing frequency is high among GBM in Australia and has increased consistently over time, few GBM test at the frequencies recommended in HIV risk-based guidelines (e.g. in 2013, an estimated 15% of GBM classified at high risk of HIV were testing three-monthly and only 36% were testing six-monthly).<sup>9,10</sup> HIV testing guidelines were updated in 2019 to remove risk-based testing criteria and now recommend all sexually active GBM test for HIV at three-month intervals.<sup>11</sup> However, updated analyses of surveillance data from clinics across all Australian jurisdictions participating in the ACCESS network continue to show inadequate levels of HIV testing among GBM not accessing PrEP. In 2019, among GBM testing for HIV at clinics participating in ACCESS and with no evidence of having accessed PrEP, only 29%, 46% and 62% were testing at three-, six- and twelve-month frequencies, respectively.<sup>12</sup> Analysis of national GCPS data also indicates HIV testing rates have fallen among GBM who do not use PrEP.<sup>13</sup> These testing rates suggest undiagnosed HIV remains a key driver of transmission amongst GBM in Australia.

## Barriers to HIV testing in Australia

Systems-level impediments make testing for HIV every three months unfeasible for many people at risk of HIV in Australia. Currently, most HIV testing is undertaken in clinical services using standard serological testing. While most sexual health services and many high-caseload general practices no longer require a return visit to receive negative HIV test results (usually communicating results via text message), the need to book appointments during working hours and long waiting times at walk-in testing services are significant impediments to three-monthly HIV testing.<sup>14</sup>

There are also concerns about the size and capacity of the sexual health clinical workforce and services in Australia. Some jurisdictions are funding minimal specialist sexual health services and hosting few specialist HIV and sexual health GP service providers. This has been exacerbated with the diversion of public sexual health service staff to COVID-19 priorities since early 2020. Key psychosocial barriers to HIV testing also remain; these include anxiety associated with the anticipation of testing positive and HIV-related stigma and discrimination that makes people reluctant to attend clinics for HIV testing and disclose risk behaviours.<sup>14-16</sup> Issues of stigma may be particularly pertinent for non-gay-identifying MSM, people residing in outer-metropolitan or regional areas and attending mainstream primary care services, and migrants.

## Strategies to enhance HIV testing frequency

Several approaches can be used to make HIV testing more accessible, largely involving moving responsibility for part or all of the testing process away from fixed-site clinical and laboratory services. These approaches must balance the extent to which models enhance accessibility and convenience and therefore support more frequent testing, against the need to ensure reliable testing methods (i.e. rare false positive or negative results).

In 2011, the Therapeutic Goods Administration (TGA) approved the first rapid POCT for HIV in Australia. HIV POCT allows testing to be delivered by non-clinically or laboratory-trained health workers in community-based settings. The results are provided on-site during the same visit, enabling more frequent testing. Australia was slow to introduce HIV POCT relative to other countries. However, while POCT was used in a small number of primary care settings,<sup>17</sup> adoption in clinical services has been slow. This has occurred because of challenges associated with POCT's integration into routine primary care (e.g. HIV POCTs are not Medicare rebatable and the time it takes the clinic to perform the HIV POCT), improved turnaround times for serological test results from public and private laboratories, and concern over longer test window periods (the time from a person's exposure until a test can detect an infection) than for standard laboratory tests.

The uptake of HIV POCT models has been limited mostly to peer-led and community-based testing services in capital cities. These services have added considerable HIV testing capacity in Australia and helped reduce structural and psychosocial barriers to HIV testing through person-centred models of care and the delivery of tests in supportive and "safe" environments.<sup>18,19</sup> Because these services are block-funded by state governments and deliver free testing, they have also expanded HIV testing coverage, including attracting many overseas-born and Medicare-ineligible clients.<sup>19-21</sup> The proportion of HIV positive tests in these services is high relative to other testing models, and they can attract people who are less likely to attend other testing sites. However, there is no evidence to suggest peer-led and community-based testing services enable more frequent HIV testing than established high-caseload clinical services.<sup>22</sup>

HIV self-testing using POCT technologies can improve testing coverage and frequency. It is a discreet and convenient approach and overcomes many structural and psychosocial barriers to routine testing.<sup>23,24</sup> A recent systematic review and meta-analysis indicated that, compared to standard HIV testing services, HIV self-testing approximately doubled both the frequency of HIV testing and the likelihood of detecting positive cases.<sup>25</sup> These findings are reflected in the only randomised controlled trial to assess the impact of self-testing on HIV testing in Australia, which found the provision of oral fluid self-test kits to GBM more than doubled their HIV testing frequency and did not affect participants' testing frequency for other STIs.<sup>26</sup> While these findings are encouraging, the less invasive and potentially more acceptable oral fluid tests<sup>27</sup> used in this study do not meet current TGA guidelines for HIV POCT performance<sup>28</sup> due to low sensitivity relative to blood-based (finger-prick) tests and are unlikely to be registered for use in Australia.

In 2018, the first finger-prick HIV self-test was registered in Australia, with the TGA restricting sales to the manufacturer's website or over the counter at a limited number of health services. Pharmacy sales are not approved. While these restrictions stemmed mainly from concerns about whether consumers could correctly use the test, the decision has limited its uptake and potential to increase the frequency of HIV testing in the population. HIV self-test sales figures are not made public, and coverage in Australia and the demographic and risk profile of purchasers are unknown, limiting our understanding of self-tests' role in the HIV response. However, GCPSs<sup>29,30</sup> in several jurisdictions show very few respondents (<1%) reporting HIV testing at home in the previous 12 months.

While HIV self-test kits are convenient and enable the immediate provision of results, current distribution models do not allow people who test presumptively positive at home to receive support; instead, they must self-initiate follow-up using information about services provided at the point of sale. While the availability of new and convenient HIV self-testing options can significantly expand the reach of HIV testing and increase testing frequency, much of the prevention benefit relies on people who screen HIV positive at home being linked to services for confirmatory diagnostic testing and early access to treatment. Hence, there are important surveillance and prevention gaps in current models of HIV self-testing in Australia.

ACON's YOU[TEST] service (<https://endinghiv.org.au/test-often/book-a-test-at-youtest/>) offers an innovative model that overcomes these issues, with the provision of peer support, via video call, for GBM who have ordered an HIV self-test. The model has considerable potential for scale-up.

In addition to self-testing, home-based finger-prick dry blood spot (DBS) specimens, posted to laboratories for HIV diagnostic testing, are used overseas (e.g. in the United States for over two decades<sup>31</sup>). NSW Health has implemented this approach since 2016 (<https://www.dbstest.health.nsw.gov.au/The-Test>), testing over 8,000 DBS specimens, with specimens from 10 service users returning reactive results, confirmed positive by venous testing and linked into care. The service has also reached a diverse and geographically dispersed population, with significant proportions of people tested for HIV identifying as Aboriginal and/or Torres Strait Islander, born in a high HIV prevalence country and reporting ever injecting drugs (the latter category largely a result of tests occurring in NSW prisons).<sup>32</sup> Testing for HIV using DBS samples is currently not Medicare rebatable. One advantage of the NSW Health model of home-based testing is that the DBS specimen is tested through a State reference laboratory, meaning the name and contact details of patients are known to NSW Health, allowing for appropriate linkage to care, confirmatory diagnosis and timely commencement of treatment.

## HIV testing in Medicare-ineligible groups

Multiple indicators suggest young, recently arrived overseas-born populations are an emerging HIV priority population in Australia. Surveillance data indicate success in reducing HIV notifications among Australian-born GBM is offset by increasing diagnoses among overseas-born GBM.<sup>33</sup> Lack of access to Medicare, difficulties navigating the Australian health system, stigma and discrimination, low HIV-related health literacy and anxiety associated with an HIV diagnosis in Australia act as barriers to testing for overseas-born GBM. Medicare ineligibility means many overseas-born GBM seek testing at sexual health and other HIV testing services (e.g. community-based POCT services) funded by State governments that provide free and anonymous HIV testing.

Delayed access to HIV testing raises the risk of HIV transmission within the sexual networks of recently arrived overseas-born and Medicare-ineligible populations at risk of HIV. A recent NSW analysis estimated that in 2018, 16.9% of overseas-born GBM living with HIV were undiagnosed,<sup>34</sup> substantially higher than the 2018 NSW estimate of 5.3% for all GBM.<sup>35</sup> Melbourne Sexual



Health Centre’s analysis of HIV incidence among newly arrived Asian-born GBM (many on student visas) between 2013 and 2017 showed these clients were less likely to report a range of sexual risk behaviours (e.g. condomless sex, group sex) but were four times more likely than other GBM to test HIV positive.<sup>36</sup> These data suggest a high concentration of undiagnosed HIV within the sexual networks of Asian-born GBM may be driving HIV acquisition and transmission. Similar findings have also been reported at PRONTO!, a GBM-specific, peer-based testing service provided by Thorne Harbour Health in Melbourne, where HIV and STI testing data were analysed among Medicare-eligible and ineligible clients. Medicare-ineligible clients reported lower levels of behavioural risk and lower test positivity for curable STIs but higher HIV test positivity; over 70% of Medicare-ineligible clients in this study were Asian-born and aged under 30 years, and half had lived in Australia for less than three years.<sup>37</sup>

### HIV sequencing and molecular epidemiology

Analysis of genetic variation in rapidly mutating viruses such as HIV can be used to identify groups of individuals with genetically similar viruses. Recent advances mean that HIV viral sequence analysis can now be performed in near real time.<sup>38</sup> This can allow rapid identification of patterns of transmission of new HIV infections, allowing the opportunity for interventions to disrupt chains of transmission including, for example, the use of intensive contact tracing informed by the molecular evidence. Work in this field will require collaborative networks between molecular virology and bioinformatics researchers, virology reference laboratories, State and Territory communicable diseases units, as well as community organisations working with affected populations. Further work in molecular epidemiology would be greatly facilitated by strong partnerships with community, new, more sensitive approaches to contact tracing (including community- and peer-led approaches) and the removal of non evidence-based laws which criminalise HIV transmission.<sup>39</sup>

## Current Targets

### Salient targets related to HIV testing

1. UNAIDS *Global AIDS Strategy 2021–2026*: 95% of PLHIV have been diagnosed by 2025.
2. *National HIV Strategy 2018–2022*: Increase the proportion of PLHIV (across all priority populations) diagnosed to 95% by 2022.
3. *NSW HIV Strategy 2021–2025*: 95% of PLHIV have been diagnosed (by 2025). Specific target for overseas-born to reduce the time between arrival and first HIV test.
4. *Victorian HIV Strategy 2017–2020*: 95% of PLHIV have been diagnosed by 2030.

## Renewing Targets

Establishing measurable targets remains difficult. Reliable measurement of some suggested targets may require strengthening existing surveillance and innovating new measurement approaches, particularly when measuring outcomes in some priority populations, to ensure equity of access to HIV prevention and care responses.

### Proposed testing targets required to achieve elimination of HIV transmission in Australia by 2025

1. 95% of PLHIV overall, within priority populations and regardless of country of birth, cultural background, area of residence, gender and age, have been diagnosed by 2025.
2. 90% of all people at risk of acquiring HIV have had an HIV test in the past 12 months by 2025.
3. 95% of all people identified as being at risk of HIV who attend a health service receive an HIV test by 2025.
4. 80% of all GBM at risk of HIV are testing every three months by 2025.

## Priorities

- **Make subsidised HIV and other STI testing available to all people residing in Australia, regardless of visa status.**
- Map the coverage of existing specialist sexual health and HIV primary care services and develop and fund a strategy to **increase the size of the general practice and other clinical workforce specialising in sexual health** and the coverage of sexual health services.
- **TGA to review the conditions under which HIV self-tests are sold or accessed in Australia** (as well as any other regulatory barriers for self-tests on the market), balancing consumer safety against the accessibility and convenience of self-test distribution models and their capacity to increase testing frequency and prevention impact.
- **Make Medicare rebates available for POCTs that meet TGA diagnostic standards** and DBS HIV testing available, and develop and fund accompanying testing models that allow these technologies to be integrated into suitable care and practice environments.
- Commonwealth and State and Territory governments to **work with self-testing manufacturers to develop HIV self-testing distribution models that encourage frequent testing**, allow for effective surveillance and connect users to clinical and other services that support their sexual health, including access to timely diagnostic testing and referral to care for those who receive a reactive self-test result.
- Develop and appropriately fund targeted health promotion, community engagement and service responses to **increase testing in recently-arrived overseas-born populations at risk of HIV in Australia.**
- Undertake consultations and participatory research to **explore possible opt-out models of HIV testing.**
- Investigate and implement the **deployment of near real-time molecular epidemiology** to inform the response to HIV clusters.



# Treatment



## Key Insights

- To eliminate HIV transmission by 2025, 98% of all people diagnosed with HIV must be taking cART, and 98% of people on cART must be virologically suppressed.
- To eliminate HIV transmission, Australia must provide free clinical care, laboratory monitoring and cART to all PLHIV in Australia, irrespective of their visa or residency status.
- To optimise health, quality of life, retention in care and prevention of HIV transmission, national programs involving clinicians, pharmacists, community-based organisations and peers must be funded so 90% of all people diagnosed with HIV can commence cART, ideally on the same day as diagnosis, but no later than 14 days after diagnosis.
- Upcoming novel antiretroviral treatments must receive priority evaluation for TGA registration and PBS subsidisation to enhance treatment uptake and sustained use by PLHIV.

## Current Research

### Benefits of antiretroviral therapy

#### Improved health and longevity

HIV antiretroviral therapy provides broad and comprehensive benefits to PLHIV at all stages of infection. Research shows that following the diagnosis of HIV in individuals with blood counts of more than 500 CD4+T cells per cubic millimetre, immediate application of cART reduced morbidity and mortality<sup>1,2</sup> and improved quality of life<sup>3</sup> significantly in comparison to delayed treatment. Additionally, initiation of cART within 12 months of infection is associated with a smaller HIV reservoir size.<sup>4</sup> The average life expectancy of a 20-year-old adult commencing cART during 2008–10 was estimated to be 78 years.<sup>5</sup>

#### Prevention of HIV transmission

Commencement of immediate versus delayed cART significantly reduced HIV transmission in heterosexual couples including one HIV-positive individual (serodifferent partners).<sup>6</sup> Subsequently, prospective observational studies of serodifferent gay and heterosexual partners practising condomless sex and with the HIV-positive partner stably virologically suppressed on cART, demonstrated that HIV transmission is effectively zero.<sup>7,8,9</sup> This aspect of cART is referred to as Treatment as Prevention (TasP) and at the individual level, is often referred to as U=U (“undetectable = untransmittable”).

#### Viral suppression and retention in care

A recent meta-analysis evaluated the outcomes of four randomised clinical trials undertaken in four low and middle-income countries where rapid cART initiation, defined as commencing cART within 14 days of HIV diagnosis, was compared to standard care, commencement of cART six weeks post-HIV diagnosis and referral to the nearest HIV clinic.<sup>12</sup> The meta-analysis found commencing cART within 14 days of HIV diagnosis was associated with better clinical outcomes, retention in clinical care and a higher rate of suppressed HIV viral load at 12 months.<sup>12</sup>

The benefits of rapid cART initiation are acutely relevant to people with advanced HIV immunosuppression, pregnant women and those experiencing HIV seroconversion illness, during which cART may substantially reduce immune system damage.<sup>13</sup> More broadly, rapid cART initiation shortens the time an individual is infectious to their sexual and injecting partners. For these reasons, several international HIV treatment guidelines, including those from Australia, the United States and the WHO recommend cART should be started immediately – at diagnosis or soon after confirmation of HIV diagnosis and clinical assessment.

## HIV Treatment and Care Cascade in Australia

### Time to commencement of cART

In Australia in 2019, 92% of people diagnosed with HIV were receiving cART and, of these, 97% had a suppressed HIV plasma viral load, preventing disease progression and onward HIV transmission.<sup>14</sup> Between 2004 and 2015, the proportion of newly diagnosed PLHIV who commenced cART within six months increased from 17% to 53%, attributed to an increase in the recommended CD4+ cell threshold at which to start treatment.<sup>15</sup> More recently, the time from HIV diagnosis to commencement of cART was evaluated in NSW; in 2019, the median time from diagnosis to cART commencement was 16 days, and 91% of people newly diagnosed with HIV had commenced cART within six weeks.<sup>16</sup>

The treatment of care cascades observed in some other countries are more advanced than in Australia. The Fast-Track Cities initiative<sup>17</sup> reports on Treatment and Care Cascades in major international cities. In 2019, in London, an estimated 95% of PLHIV were diagnosed; of these, 98% were on cART and, of those on cART, 97% were virologically suppressed.<sup>17</sup> In 2018, in Manchester, an estimated 92% were diagnosed, 98% were on cART, and 97% were virologically suppressed. Although comparing treatment uptake in selected cities in the UK to all of Australia is not straightforward, there are more PLHIV in London accessing HIV care than the total number of PLHIV in Australia, so on a volume basis, the UK's performance is very strong. It is important to note HIV testing, clinical care and cART are free in the UK, irrespective of immigration or residency status, unlike in Australia.<sup>18</sup>

### Delayed commencement of HIV cART in sub-populations in Australia

There is heterogeneity in time to cART commencement across HIV-positive populations in Australia. For example, culturally and linguistically diverse (CALD) populations were significantly less likely to commence cART within six months of HIV diagnosis than people born in Australia.<sup>19</sup> Migrants to Australia from Southeast Asia, Eastern Asia and Europe had larger gaps in their HIV treatment and care cascades than non-migrants: 85% of migrants were diagnosed, 85% of those diagnosed were on treatment, and 93% on treatment were virologically suppressed (85-85-93) versus 94-90-96 in Australian-born people.<sup>20</sup> The HIV treatment and care cascade for Aboriginal and Torres Strait Islander people in 2016 was not as good as in other Australians, with 80% diagnosed, 90% on treatment and 76% of those on treatment being virologically suppressed.<sup>21</sup> Comprehensive HIV cascade of care data are not available for people who inject drugs (PWID), but in sexual health clinics in Australia in 2017, HIV virological suppression was observed in 79% of PWID, compared to 92% of gay and bisexual men (GBM) and 89% of CALD patients.<sup>22</sup>

### Clinical care and HIV cART costs in Australia

In Australia, clinical care and cART is subsidised by Medicare and the PBS, respectively. In NSW, cART is free for PLHIV. Medicare-ineligible international students and workers living in Australia receive only partial reimbursement for HIV treatment and care services through their private insurance; free clinical care and cART is available via public sexual health services. However, the Australian Government recently committed to providing free cART to all Medicare-ineligible people living in Australia.

### HIV cART adherence in Australia

Adherence is crucial to achieving the benefits of cART. Recently, adherence to cART was evaluated in over 2,000 PLHIV in Australia; adherence was defined as the proportion of a patient's treatment coverage days being ≥80% during the first 12 months of treatment.<sup>23</sup> Overall, 83% of participants met the definition of “adherent”. Using modelling to characterise adherence patterns, a third of participants were identified as having moderate to low adherence.<sup>23</sup> Factors associated with suboptimal cART adherence include younger age, poverty, poor mental health, substance use and stigma, which is likelier to be experienced by people of colour, people who are homeless, PWID, sex workers and people from some ethnic and cultural backgrounds.

### HIV cART dosing options

In Australia, daily dosing of cART medication is the only treatment modality currently available. However, advances in pharmacotherapy have led to the recent approval in Europe, Canada and the United States of long-acting injectable antiretrovirals, given every two months. Soon, six-monthly antiretroviral injections and long-lasting implants will become available, and it is anticipated these options will enhance adherence in sub-groups with currently sub-optimal adherence.



## Elimination of HIV transmission

### The role of HIV cART in achieving the elimination of HIV transmission

In addition to being critical for optimising individuals' health, quality of life and longevity and reducing HIV transmission, cART has an important role in achieving the virtual elimination of HIV transmission, as the example of Denmark shows. Denmark has universal healthcare access, provides free cART and has offered this to all PLHIV since 2011. In 2013, of GBM diagnosed with HIV in Denmark, 92% were on treatment and, of these, a very high proportion (98%) were virologically suppressed.<sup>26</sup> In 2013, the incidence of HIV infections per 1,000 GBM in Denmark was 1.4 (median 95% credible interval 0.4–2.1),<sup>26</sup> very close to the WHO definition of HIV elimination.<sup>24,25</sup>

Similar findings were observed in a modelling study from British Columbia, which reported even relying on its current use of TasP and HIV pre-exposure prophylaxis (PrEP) to prevent HIV transmissions, the province would be close to reaching HIV elimination by 2030.<sup>27</sup> However, by optimising TasP and PrEP, British Columbia could achieve an HIV incidence rate as low as 0.4 (0.3–0.6) per 1,000 susceptible GBM per year.<sup>27</sup> In NSW, where TasP and PrEP are available, the crude HIV incidence rate was 2.7 per 1,000 susceptible GBM in 2017 in metropolitan suburbs defined as having a high proportion of GBM, approaching WHO's elimination threshold. Notably, other HIV priority populations in Australia, including heterosexuals and PWID, have already met this definition of HIV elimination.

These findings complement a recent review of the literature on the benefits of TasP at a population level. Bavinton and Rodger concluded TasP alone is unlikely to lead to HIV epidemic control without the intensification of concomitant use of primary prevention measures, such as PrEP and HIV testing and the removal of stigma and other structural barriers.<sup>28</sup>

### COVID-19 and the opportunity to achieve elimination of HIV transmission in Australia

Substantial declines in HIV notifications occurred across Australia during 2020. In NSW, there was a 33% decline in new HIV diagnoses, compared to the annual average in the previous five years.<sup>29</sup> There was a 46% reduction in newly acquired HIV infections in Victoria and a 30% reduction in overall HIV diagnoses compared to the previous five years.<sup>30</sup> These dramatic declines in HIV notifications are likely to have resulted from changes in national and international travel by Australian and overseas citizens and significant changes in sexual practices due to jurisdictional COVID restrictions<sup>31</sup> and changes in HIV testing practices. Few Australians will travel internationally, local tourism from overseas visitors will be markedly reduced, and only a small proportion of international students will come to Australia in the near future.<sup>32</sup> Hence, new HIV infections driven by international travel and overseas visitors, students and workers are likely to remain low over the next 18–24 months.

## Current Targets

### Salient treatment uptake, time to treatment commencement and viral load suppression targets

1. UNAIDS *Global AIDS Strategy 2021–2026*: 95% of all PLHIV on treatment; 95% of these with undetectable HIV viral load by 2025.
2. *National HIV Strategy 2018–2022*: 95% on treatment and 95% with undetectable HIV viral load.
3. *NSW HIV Strategy 2021–2025*: 90% of newly diagnosed PLHIV treated within 14 days; 95% of all PLHIV on treatment; 95% of these with undetectable HIV viral load.

## Renewing Targets

The relationship between the metrics of the HIV Care Cascade and the elimination of HIV transmission is complex and will vary between countries and within jurisdictions of individual countries.

### Proposed treatment targets required to achieve the elimination of HIV transmission in Australia by 2025

1. 98% of all people diagnosed with HIV will be on cART.
2. 98% of people on cART will be virologically suppressed.
3. 90% of all people diagnosed with HIV will commence cART, ideally on the day of diagnosis, but no later than 14 days from diagnosis.

## Priorities

### Priorities with respect to HIV treatment and the achievement of elimination of HIV transmission

- Obtain federal and jurisdictional funding commitments to **provide free clinical care, laboratory monitoring and cART for all people diagnosed with HIV in Australia, irrespective of their visa or residency status.**
- Create national programs **enabling people newly diagnosed with HIV to commence rapid cART.**
- **Double the number of S100 prescribers in Australia from 500 to 1,000 by 2025, and increase reimbursements for all MBS items related to the treatment and care of people diagnosed with HIV in Australia.**
- **Remove all barriers preventing the TGA and the Pharmaceutical Benefits Advisory Committee from calling for submissions for priority evaluation** of novel HIV treatments for registration and subsidisation.
- **Increase funding for surveillance and research** into cART uptake, ongoing cART use and HIV virological suppression in all HIV priority populations in Australia, irrespective of visa or residency status.





## Key Insights

- Stigma reduces individual health, well-being and quality of life.
- Stigma undermines elimination of HIV transmission targets via direct impacts at each stage of the prevention and care cascade.
- Australian policy frameworks contain a strong commitment to stigma reduction targets.
- Investment in research into methods of stigma reduction is needed to guide interventions in Australia.
- Involvement of the affected community in stigma reduction efforts is essential.
- Issues of intersecting or layered stigma require additional attention.

## Current Research

Stigma, based on real or perceived characteristics, leads to the social and economic exclusion of individuals and groups<sup>1</sup> and is a fundamental cause of population health inequalities.<sup>2,3</sup> Stigma is the co-occurrence of labelling, stereotyping, separation and status loss and is shaped by social, economic and political power.<sup>4</sup> Stigma operates through everyday interactions, organisational policies and large-scale social phenomena. Numerous studies have demonstrated an association between the experience or expectation of stigma and poorer health outcomes,<sup>5-7</sup> including its role in influencing health-related behaviours, such as willingness to access HIV or other testing, engage with recommended therapies and adhere to medical regimens.<sup>8,9</sup> For HIV, stigma comes from perceptions of blame and fear of contagion and moral transgressions and is closely entwined with stigma against homosexuality; gay and bisexual men (GBM) with HIV experience a double stigma.<sup>10</sup>

Each step involved in HIV prevention and care is vulnerable to stigma, which can result in significant cumulative impact on health outcomes by limiting connection to and engagement with prevention, testing, diagnosis and treatment.<sup>11</sup> For example, a recent meta-analysis showed people who had experienced HIV-related stigma were 21% less likely to attend health and social services and 32% less likely to adhere to cART for HIV than those who did not experience stigma.<sup>12</sup> A 2017 modelling study from South Africa showed 35–50% of infections among newborns of women with HIV were attributed to the cumulative effect of stigma at each step of the care cascade,<sup>13</sup> underlining its significant individual and societal costs.

Delayed health service engagement, as well as damaging health outcomes directly, amplifies onward transmission and the overall burden of disease. Modelling shows most new HIV infections in Australia are among undiagnosed GBM.<sup>14</sup> HIV stigma reduces screening, diagnosis and treatment uptake; it reduces willingness to disclose HIV status<sup>15</sup> and engage in HIV treatment.<sup>16,17</sup> Moreover, HIV stigma related to assumed HIV-positive status reduces access to health services in HIV-negative men who have sex with men (MSM).<sup>18</sup>

The most recent results from the Australian Stigma Indicators Monitoring Program among health workers show 78% indicated they would never behave negatively towards a person because of their HIV status. Among the general public, 48% indicated they would never behave negatively towards a person because of their HIV status. Among PLHIV, 44% reported no experience of stigma in the last 12 months, and 62% reported no health care workers had treated them negatively or differently in the last 12 months.<sup>19</sup>

There is agreement in the literature on the need for stigma reduction interventions to operate at multiple levels – individual, interpersonal, organisational and structural (government/policy)<sup>9</sup> (Figure 1).<sup>11</sup> Studies of stigma have typically focused on education or skills-building at the individual or interpersonal levels rather than organisational or systemic change.<sup>20</sup> However, stigma and its effects are not readily or enduringly dismantled by these types of educational approaches because they do not engage with organisational or structural factors. While these programs are well intended, their impact is often localised or unsustainable because stigma perseveres in institutions (and influences the behaviours of individuals within them), even those with an underlying ethos of access and equity, as in Australian healthcare systems.<sup>21</sup>

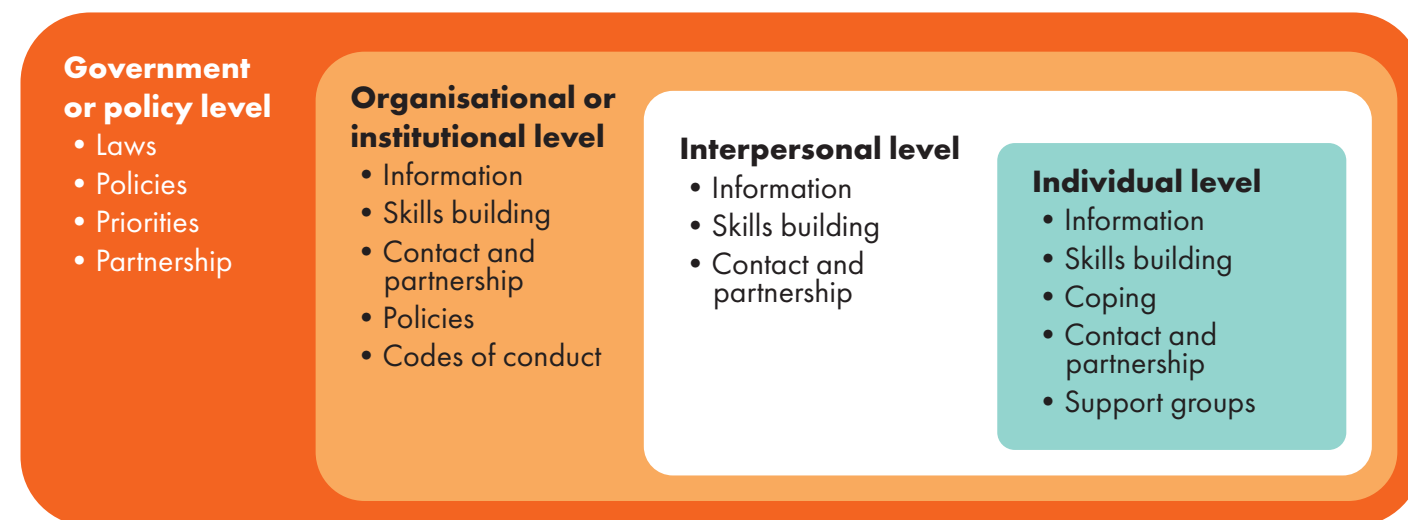


Figure 1. Stigma reduction approaches by social ecological level<sup>11</sup>

There is little research to inform the design of a multilevel program of stigma reduction; few studies address the impact of organisational policies and structural factors on stigmatised groups.<sup>22</sup> A review of HIV stigma reduction interventions indicated that, while the training of popular opinion leaders (an interpersonal strategy) is effective in reducing health workers' prejudicial attitudes and in improving compliance with universal precautions,<sup>23</sup> there is little evidence of effective strategies to guide interventions at organisational or structural levels.

Australia's national HIV strategies have recognised the importance of stigma since 1989. The current strategy commits to "eliminate the negative impact of stigma, discrimination and legal and human rights issues on people's health".<sup>24</sup> The *NSW HIV Strategy 2021–2025* includes stigma as a cross-cutting pillar across prevention, testing and treatment.

Research shows poor quality of life among PLHIV can reduce overall wellbeing, negatively affect cART adherence and impede retention in care.<sup>25,26</sup> Factors known to reduce quality of life among PLHIV include HIV-related stigma and discrimination, poorer mental health, social isolation<sup>27,28,29</sup> and financial or housing stress, which may be related to current or previous experiences of ill-health.<sup>30,31,32</sup> Investment in programs which build peer support for PLHIV, peer-navigation programs which provide peer-based pathways to care, social and community welfare initiatives, and stigma reduction campaigns that target the healthcare workforce and the community will ensure progress toward the target of 75% of PLHIV reporting good quality of life and support targets relating to HIV prevention, cART maintenance and care.<sup>30,33,34</sup>

## Current Targets

Globally, the UNAIDS *Global AIDS Strategy 2021–2026* has stigma targets including 1) less than 10% of PLHIV and key populations experience stigma and discrimination (both internalised and experienced); and 2) less than 10% of the general population report discriminatory attitudes towards PLHIV. In Australia, the *Victorian HIV Strategy 2017-2030* aimed to eliminate stigma and discrimination related to HIV by 2030. In Australia's *National HIV Strategy 2018-2022*, the target was to reduce by 75% the reported experience of stigma in PLHIV and for 75% of PLHIV to report good quality of life. The recently released *NSW HIV Strategy 2021-2025* has two stigma targets. The first target is a 75% reduction in reported experience of stigma in health care settings in PLHIV and people at risk of HIV. The second is a 75% reduction in discriminatory attitudes toward people at risk and living with HIV.



# Appendix

## Renewing Targets

New targets have been formulated, guided by existing data from the Stigma Indicators Monitoring Program.<sup>19</sup> Population-specific targets are proposed as follows.

### PLHIV

- >95% of PLHIV report no stigma in the last 12 months.
- >95% of PLHIV report health care workers do not treat them negatively/differently in the last 12 months.
- 75% of PLHIV reporting good quality of life.

### HIV-negative MSM

- >95% of HIV-negative MSM report no stigma in the last 12 months.

### Health care workers

- >95% of health care workers indicate they would not behave negatively towards PLHIV.

### General public

- >95% indicate they would not behave negatively towards a person because of their HIV status.

## Priorities

- **Involve affected communities in stigma reduction.** Best practice interventions for stigma reduction place people affected by stigma at the core of the response.<sup>11,35</sup> Hence, direct and deep community involvement at each stage is essential for achieving stigma reduction.
- **Invest in research designed to develop precise measures of layered stigma.** Issues of intersectional or layered stigma associated with multiple stigmatised identities require specific attention. These issues are particularly relevant for people living with (or at risk of) HIV who are Aboriginal or Torres Strait Islanders or from culturally and linguistically diverse backgrounds (especially men who have recently arrived from countries where HIV and homosexuality stigma is higher than in Australia). Layered stigma is also a consideration for people who are multiply labelled because of their HIV status and other practices/identities which attract stigma (such as sexual orientation, injecting drug use, sex work or co-occurring health conditions). We currently lack measures of stigma precise enough to permit intersectional analysis of its experience or expression.
- **Increase investment in stigma reduction programs.** There is an urgent need for increased investment in stigma reduction programs, including foundational research into ways to expand the evidence base and monitoring and evaluation of outcomes.
- **Advocate for recognition of the importance of stigma in the HIV epidemic and general health.** Reducing stigma will require a focused effort across individual, interpersonal, organisational and structural levels. This will require a commitment from health systems, in particular, to recognise stigma undermines the principles of quality and equity of care and undermines efforts to end HIV.

*Agenda 2025* adopts a measurable target for the achievement of virtual elimination of HIV transmission in Australia. This target is a 90% reduction in *HIV diagnoses in Australia (compared to a 2010 baseline)*. The table below compares a business-as-usual scenario with the targets proposed in *Agenda 2025* to show the number of infections in Australia to 2029 and the costs of HIV treatment and care under these scenarios.

Year	PLHIV Baseline	PLHIV Agenda 2025	New infections Baseline	New infections Agenda 2025	Cumulative new infections Baseline	Cumulative new infections Agenda 2025	Infections averted Agenda 2025	Cumulative lifetime ART costs new infections Baseline (Discounted lifetime costs)	Cumulative lifetime ART costs new infections Agenda 2025 (Discounted lifetime costs)	Total Savings Agenda 2025
2019	28,920	28,920	901	901						
2020	29,845	29,710	901	766	901	766	135	\$245,570,814	\$208,789,703	\$36,781,111
2021	30,760	30,356	901	631	1802	1397	405	\$482,837,302	\$374,981,579	\$107,855,723
2022	31,664	30,860	901	496	2703	1893	810	\$712,080,285	\$501,217,879	\$210,862,406
2023	32,558	31,224	901	361	3604	2255	1350	\$933,571,090	\$590,010,863	\$343,560,227
2024	33,441	31,448	901	226	4505	2481	2024	\$1,147,571,867	\$643,748,572	\$503,823,295
2025	34,315	31,534	901	91	5406	2572	2834	\$1,354,335,904	\$664,700,355	\$689,635,549
2026	35,178	31,620	901	91	6307	2663	3644	\$1,554,107,920	\$684,943,624	\$869,164,296
2027	36,032	31,704	901	91	7208	2755	4453	\$1,747,124,360	\$704,502,337	1,042,622,023
2028	36,876	31,788	901	91	8109	2846	5263	\$1,933,613,674	\$723,399,645	\$1,210,214,029
2029	37,711	31,871	901	91	9010	2937	6073	\$2,113,796,587	\$741,657,914	\$1,372,138,673

Modelling by Dr Richard Gray, June 2021.



# References

## Prevention

1. Down I et al, In Australia, most HIV infections among gay and bisexual men are attributable to sex with 'new' partners. *AIDS and Behavior*, 2017,21(8):2543-2550.
2. Holt M et al, Increasing pre-exposure prophylaxis use and "net prevention coverage" in behavioural surveillance of Australian gay and bisexual men. *AIDS*, 2021,35(5):835-840.
3. Bavinton BR et al, Unpublished analysis of national Gay Community Periodic Survey data. 2021, Centre for Social Research in Health, UNSW Sydney: Sydney.
4. Aung E et al, Identifying gaps in achieving the elimination of HIV transmission among gay, bisexual, and other men who have sex with men in Australia: The Gaps Project report. 2020, Kirby Institute, UNSW Sydney: Sydney.
5. Bavinton BR et al, Undetectable viral load and HIV transmission dynamics on an individual and population level: Where next in the global HIV response? *Current Opinion in Infectious Diseases*, 2020,33(1):20-27.
6. Callander D et al, Decreasing community viremia is associated with decreasing HIV incidence in Australia, in *Conference on Retroviruses and Opportunistic Infections*. 2020: Boston.
7. The Kirby Institute, National update on HIV, viral hepatitis and sexually transmissible infections in Australia. 2021, The Kirby Institute, UNSW Sydney: Sydney.
8. Gray RT et al, Undiagnosed HIV infections among gay and bisexual men increasingly contribute to new infections in Australia. *Journal of the International AIDS Society*, 2018,21(4):e25104.
9. MacGibbon J et al, Attitudes to biomedical HIV prevention among Australian gay and bisexual men: Key findings from the PrEPARE Project 2019. 2019, Centre for Social Research in Health, UNSW Sydney: Sydney, Australia.
10. Holt M et al. Trends in belief that HIV treatment prevents transmission among gay and bisexual men in Australia: results of national online surveys 2013–2019. *AIDS Education and Prevention*, 2021;33(1):62-72.
11. Fraser D et al, Report on the PrEP in NSW Transition Study, 2018-2020. 2020, Kirby Institute, UNSW Sydney: Sydney, Australia.
12. Fraser D et al, Unpublished analysis of PBS PrEP data. 2021, The Kirby Institute, UNSW Sydney: Sydney
13. Molina J-M et al. On demand PrEP with oral TDF-FTC in MSM: results of the ANRS Ipergay trial. *Conference on retroviruses and opportunistic infections*. 2015.
14. ASHM, The ASHM PrEP Guidelines Sept 2019 update. 2019.
15. World Health Organization, What's the 2+1+1? Event-driven oral pre-exposure prophylaxis to prevent HIV for men who have sex with men: Update to WHO's recommendation on oral PrEP. 2019, World Health Organization: Geneva, Switzerland.
16. Bavinton BR et al, Unpublished analysis of EPIC-NSW data. 2020, The Kirby Institute, UNSW Sydney: Sydney.
17. Elsesser SA et al, Seasons of Risk: Anticipated Behavior on Vacation and Interest in Episodic Antiretroviral Pre-exposure Prophylaxis (PrEP) Among a Large National Sample of U.S. Men Who have Sex with Men (MSM). *AIDS and Behavior*, 2016,20(7):1400-1407.
18. Vaccher SJ et al, Predictors of Daily Adherence to HIV Pre-exposure Prophylaxis in Gay/Bisexual Men in the PRELUDE Demonstration Project. *AIDS and Behavior*, 2019,23(5):1287-1296.
19. Philpot S et al, Unpublished analysis of qualitative interviews with Australian gay and bisexual men on HIV pre-exposure prophylaxis (PrEP). 2021, The Kirby Institute: Sydney.
20. Baeten JM et al, Use of a vaginal ring containing dapivirine for HIV-1 prevention in women. *New England Journal of Medicine*, 2016,375(22):2121-2132.
21. Landovitz RJ et al, Pre-exposure Prophylaxis containing long-acting injectable cabotegravir is safe and highly effective for cisgender men and transgender women who have sex with men, in *AIDS 2020: Virtual*. 2020.
22. Bekker L-G, Sustained Delivery and Long-Acting Agents for Prevention of HIV, in *Conference on Retroviruses and Opportunistic Infections: Virtual*. 2021.
23. Coelho LE et al, Pre-exposure prophylaxis 2.0: new drugs and technologies in the pipeline. *Lancet HIV*, 2019,6(11):e788-e799.
24. Holt M et al. HIV preexposure prophylaxis cascades to assess implementation in Australia: results from repeated, national behavioral surveillance of gay and bisexual men, 2014–2018. *Journal of Acquired Immune Deficiency Syndromes*, 2020,83(3):e16-e22.
25. Hammoud MA et al, HIV pre-exposure prophylaxis (PrEP) uptake among gay and bisexual men in Australia and factors associated with the non-use of PrEP among eligible men: Results from a prospective cohort study. *Journal of Acquired Immune Deficiency Syndromes*, 2019, Published online 4 April 2019.
26. Siegler AJ et al, A review of HIV pre-exposure prophylaxis streamlining strategies. *Curr HIV-AIDS Rep*, 2020,17:643-653.
27. Smith AKJ et al. Challenges of providing HIV pre-exposure prophylaxis across Australian clinics: qualitative insights of clinicians. *Sexual Health*, 2021;18(2):187-94.
28. Haberer JE et al, Defining success with HIV pre-exposure prophylaxis: a prevention-effective adherence paradigm. *AIDS*, 2015,29(11):1277-85.
29. Rutstein SE et al, Initiation, discontinuation, and restarting HIV pre-exposure prophylaxis: Ongoing implementation strategies. *Lancet HIV*, 2020,7(10):e721-e730.
30. Jin F et al, Long-term patterns of PrEP adherence and association with HIV seroconversion in a large-scale implementation study in New South Wales (EPIC-NSW), Australia, in *AIDS 2020: Virtual*. 2020.
31. Grulich AE et al, Continuing low HIV incidence in the Expanded Pre-exposure Prophylaxis (PrEP) Implementation in Communities - New South Wales study (EPIC-NSW), in *International AIDS Society Conference on HIV Science*. 2019: Mexico City, Mexico.
32. Bavinton BR et al, High levels of prevention-effective adherence to HIV pre-exposure prophylaxis (PrEP). *Journal of Acquired Immune Deficiency Syndromes*, 2021, published online 1 April 2021.
33. Ryan KE et al, Results from a large Australian PrEP demonstration study: Discontinuation and subsequent HIV and other sexually transmitted infection risk, in *10th International AIDS Society Conference on HIV Science*. 2019: Mexico City, Mexico.
34. UNAIDS, End Inequalities. End AIDS. Global AIDS Strategy 2021-2026. 2021, UNAIDS: Geneva.
35. Australian Government Department of Health, Eighth National HIV Strategy, 2018-2022. 2018, Australian Government Department of Health: Canberra.
36. NSW Ministry of Health, NSW HIV Strategy 2021-2025. 2021, NSW Ministry of Health: Sydney, NSW.
9. Wilkinson AL, El-Hayek C, Spelman T, et al. A 'test and treat' prevention strategy in Australia requires innovative HIV testing models: a cohort study of repeat testing among 'high-risk' men who have sex with men. *Sexually Transmitted Infections* 2016; 92(6): 464-6.
10. Wilkinson AL, El-Hayek C, Spelman T, et al. 'Seek, test, treat' lessons from Australia: a study of HIV testing from a cohort of MSM. *Journal of Acquired Immune Deficiency Syndromes* 2015; 69(4): 460-5.
11. STIs in Gay Men Action Group. Australian sexually transmitted infection and HIV testing guidelines 2019 for asymptomatic men who have sex with men. [https://stipu.nsw.gov.au/wp-content/uploads/STIGMA\\_Guidelines2019\\_Final-1.pdf](https://stipu.nsw.gov.au/wp-content/uploads/STIGMA_Guidelines2019_Final-1.pdf). Accessed May 18 2021.
12. Asselin J. HIV testing frequency among GBM with no history of accessing PrEP at ACCESS clinics. analysis of ACCESS data, 2019 personal correspondence.
13. Bavinton BR, Grulich AE, Broady T, et al. Increases in HIV Testing Frequency in Australian Gay and Bisexual Men are Concentrated Among PrEP Users: An Analysis of Australian Behavioural Surveillance Data, 2013–2018. *AIDS and Behavior* 2020; 24(9): 2691-702.
14. Prestage G, Brown G, Keen P. Barriers to HIV testing among Australian gay men. *Sexual Health* 2012; 9: 453-8.
15. Prestage G, Zablotska I, Bavinton B, et al. Previous and future use of HIV self-testing: a survey of Australian gay and bisexual men. *Sexual Health* 2016; 13(1): 55-62.
16. De Wit J, Adam P. To test or not to test: psychosocial barriers to HIV testing in high-income countries. *HIV Medicine* 2008; 9: 20-2.
1. Jansson J, Kerr C, Wilson D. Predicting the population impact of increased HIV testing and treatment in Australia. *Sexual Health* 2014; 11: 146-54.
2. Scott N, Stoové M, Kelly SL, Wilson DP, Hellard ME. Achieving 90-90-90 HIV targets will not be enough to achieve the HIV incidence reduction target in Australia. *Clinical Infectious Diseases* 2017: cix939-cix.
3. Fox J, White PJ, Macdonald N, et al. Reductions in HIV transmission risk behaviour following diagnosis of primary HIV infection: a cohort of high-risk MSM. *HIV Medicine* 2009; 10: 432-38.
4. Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 infection with early antiretroviral therapy. *New England Journal of Medicine* 2011; 365(6): 493-505.
5. Eisinger RW, Dieffenbach CW, Fauci AS. HIV Viral Load and Transmissibility of HIV Infection: Undetectable Equals Untransmittable. *JAMA* 2019; 321(5): 451-2.
6. The Kirby Institute. HIV, viral hepatitis and sexually transmissible infections in Australia: Annual Surveillance Report 2018. Sydney, Australia: University of New South Wales, 2018.
7. van Santen DK, Asselin J, Haber NA, et al. Improvements in transition times through the HIV cascade of care among gay and bisexual men with a new HIV diagnosis in New South Wales and Victoria, Australia: the longitudinal HIV cascade (2012-2019). *Lancet HIV* in review.
8. Gray RT, Wilson DP, Guy RJ, et al. Undiagnosed HIV infections among gay and bisexual men increasingly contribute to new infections in Australia. *Journal of the International AIDS Society* 2018; 21(4): e25104.

## Testing



# References

17. Eu B, Roth N, Stoové M, O'Reilly M, Clarke E. Rapid HIV testing increases the rate of HIV detection in men who have sex with men - using rapid HIV testing in a primary care clinic. *Sexual Health* 2014; 11(1): 89-90.
18. Leitingner D, Ryan KE, Brown G, et al. Acceptability and HIV Prevention Benefits of a Peer-Based Model of Rapid Point of Care HIV Testing for Australian Gay, Bisexual and Other Men Who Have Sex with Men. *AIDS and Behavior* 2017.
19. C. C, Patel P, Johnson K, et al. Evaluation of ACON's community-based a[TEST] HIV and STI testing services, 2015-2019. Sydney, Australia: Kirby Institute, UNSW, 2021.
20. Ryan K, Wilkinson AL, Asselin J, et al. Assessment of service refinement and its impact on repeat HIV testing by client's access to Australia's universal healthcare system, a retrospective cohort study. *Journal of the International AIDS Society* 2019; 22(8): e25353.
21. Lee E, Mao L, Bavinton B, Prestage G, Holt M. Which Gay and Bisexual Men Attend Community-Based HIV Testing Services in Australia? An Analysis of Cross-Sectional National Behavioural Surveillance Data. *AIDS and Behaviour* 2020; 24(2): 387-94.
22. Ryan KE, Wilkinson AL, Chow E, et al. A comparative, retrospective analysis of HIV testing among gay, bisexual and other men who have sex with men in Melbourne, Australia. *Australia and New Zealand Journal Public Health* 2019; 43(5): 419-23.
23. Figueroa C, Johnson C, Verster A, Baggaley R. Attitudes and Acceptability on HIV Self-testing Among Key Populations: A Literature Review. *AIDS and Behaviour* 2015; 19(11): 1949-65.
24. Brown W, 3rd, Carballo-Díéguez A, John RM, Schnall R. Information, Motivation, and Behavioral Skills of High-Risk Young Adults to Use the HIV Self-Test. *AIDS and Behaviour* 2016; 20(9): 2000-9.
25. Johnson CC, Kennedy C, Fonner V, et al. Examining the effects of HIV self-testing compared to standard HIV testing services: a systematic review and meta-analysis. *Journal of the International AIDS Society* 2017; 20(1): 21594.
26. Jamil MS, Prestage G, Fairley CK, et al. Effect of availability of HIV self-testing on HIV testing frequency in gay and bisexual men at high risk of infection (FORTH): a waiting-list randomised controlled trial. *Lancet HIV* 2017; 4(6): e241-e50.
27. Pant Pai N, Baram B, Shivkumar S, et al. Head-to-head comparison of accuracy of a rapid point-of-care HIV test with oral vs blood: systematic review & meta-analysis. *Lancet Infectious Diseases* 2012; 12: 373-80.
28. Therapeutic Good Administration. Proposed Performance Requirements and Risk Mitigation Strategies for HIV Tests. In: Australian Government Department of Health Canberra; 2014.
29. Broady T, Chan C, Bavinton B, et al. Gay Community Periodic Survey: Melbourne 2020. Sydney: 2020.
30. Chan C, Broady T, Bavinton B, et al. Gay Community Periodic Survey: Sydney 2020. Sydney: Centre for Social Research in Health, UNSW Sydney. Sydney: Centre for Social Research in Health, UNSW, 2020.
31. Frank AP, Wandell MG, Headings MD, Conant MA, Woody GE, Michel C. Anonymous HIV testing using home collection & telemedicine counseling. Multi-center evaluation. *Archives of Internal Medicine* 1997; 157(3): 309-14.
32. NSW Health. NSW HIV Strategy 2016 – 2020 Quarter 4 & Annual 2020 Data Report. Sydney: NSW Health, 2020.
33. Marukutira T, Gray RT, Douglass C, et al. Gaps in the HIV diagnosis and care cascade for migrants in Australia, 2013-2017: A cross-sectional study. *PLoS Medicine* 2020; 17(3): e1003044-e.
34. Patel PG, Keen P, McManus H, et al. Increased targeted HIV testing and reduced undiagnosed HIV infections among gay and bisexual men. *HIV Medicine* 2021: <https://doi.org/10.1111/hiv.13102>.
35. Keen P, Lee E, Grulich AE, et al. Sustained, Low Prevalence of Undiagnosed HIV Among Gay and Bisexual Men in Sydney, Australia Coincident With Increased Testing and Pre-exposure Prophylaxis Use: Results From Repeated, Bio-Behavioral Studies 2014-2018. *Journal of Acquired Immune Deficiency Syndromes* 2020; 85(3): e41-e7.
36. Medland NA, Chow EPF, Read THR, et al. Incident HIV infection has fallen rapidly in men who have sex with men in Melbourne, Australia (2013-2017) but not in the newly-arrived Asian-born. *BMC Infectious Diseases* 2018; 18(1): 410.
37. Ryan KE, Wilkinson AL, Asselin J, et al. Assessment of service refinement and its impact on repeat HIV testing by client's access to Australia's universal healthcare system: a retrospective cohort study. *Journal of the International AIDS Society* 2019; 22(8): e25353.
38. Wertheim JO, Chato C, Poon AFY. Comparative analysis of HIV sequences in real time for public health. *Current Opinion in HIV and AIDS* 2019; 14(3): 213-20.
39. Barré-Sinoussi F, Albert J, Karim S, Bekker LG, Beyrer C, Cahn P, Calmy A, Godfrey-Faussett P, Grinsztejn B, Grulich A, Kamarulzaman A, Kumarasamy N, Loutfy M, El Filali K, Mboup S, Montaner J, Munderi P, Pokrovsky V, Vandamme AM, Young B. Expert Consensus Statement on the Science of HIV in the Context of the Criminal Law. *Journal of the International AIDS Society*. 2018; 21: e25161.

## Treatment

1. The INSIGHT START Study Group. Initiation of Antiretroviral Therapy in Early Asymptomatic HIV Infection. *New England Journal of Medicine* 2015;373(9).
2. The TEMPRANO ANRS 12136 Study Group. A Trial of Early Antiretrovirals and Isoniazid Preventive Therapy in Africa. *New England Journal of Medicine* 2015;373(9).
3. Lifson AR, Grund B, Gardner EM, et al. Improved quality of life with immediate versus deferred initiation of antiretroviral therapy in early asymptomatic HIV infection. *AIDS* 2017;31(7).
4. Bachmann N, von Siebenthal C, Vongrad V, et al. Determinants of HIV-1 reservoir size and long-term dynamics during suppressive ART. *Nature Communications* 2019;10(1).
5. Trickey A, May MT, Vehreschild J-J, et al. Survival of HIV-positive patients starting antiretroviral therapy between 1996 and 2013: a collaborative analysis of cohort studies. *Lancet HIV* 2017;4(8).
6. Cohen MS, Chen YQ, McCauley M, et al. Antiretroviral Therapy for the Prevention of HIV-1 Transmission. *New England Journal of Medicine* 2016;375(9):830-9.
7. Rodger AJ, Cambiano V, Bruun T, et al. Sexual Activity Without Condoms and Risk of HIV Transmission in Serodifferent Couples When the HIV-Positive Partner Is Using Suppressive Antiretroviral Therapy. *JAMA* 2016;316(2).
8. Rodger AJ, Cambiano V, Bruun T, et al. Risk of HIV transmission through condomless sex in serodifferent gay couples with the HIV-positive partner taking suppressive antiretroviral therapy (PARTNER): final results of a multicentre, prospective, observational study. *Lancet* 2019;393(10189).
9. Bavinton BR, Pinto AN, Phanuphak N, et al. Viral suppression and HIV transmission in serodiscordant male couples: an international, prospective, observational, cohort study. *Lancet HIV* 2018;5(8).
10. Coffey S, Bacchetti P, Sachdev D, et al. RAPID antiretroviral therapy. *AIDS* 2019;33(5).
11. Cuzin L, Cotte L, Delpierre C, et al. Too fast to stay on track? Shorter time to first anti-retroviral regimen is not associated with better retention in care in the French DatAIDS cohort. *PLoS One* 2019;14(9).
12. Ford N, Migone C, Calmy A, et al. Benefits and risks of rapid initiation of antiretroviral therapy. *AIDS* 2018;32(1).
13. DHHS Panel on Antiretroviral Guidelines for Adults and Adolescents. Panel on Antiretroviral Guidelines for Adults and Adolescents. Guidelines for the Use of Antiretroviral Agents in Adults and Adolescents Living with HIV. Department of Health and Human Services. Available at <http://www.aidsinfo.nih.gov/ContentFiles/AdultandAdolescentGL.pdf>. Accessed May 18 2021.
14. Kirby Institute. HIV Data 2019. Kirby Institute. Available at <https://data.kirby.unsw.edu.au/hiv#:~:text=There%20were%20903%20new%20HIV,HIV%20numbers%20from%202018%2D2019>. Accessed May 18 2021.
15. McManus H, Callander D, Donovan B, et al. Early initiation of antiretroviral therapy for people newly diagnosed with <scp>HIV</scp> infection in Australia: trends and predictors, 2004–2015. *Medical Journal of Australia* 2019;210(6).
16. NSW Ministry of Health. NSW HIV Strategy 2016-2020 Quarter 4 & Annual 2019 Data Report. Sydney, 2020. Available at <https://www.health.nsw.gov.au/endinghiv/Pages/tools-and-data.aspx>. Accessed May 18 2021.
17. Fast-Track Cities. Available at <https://www.fast-track-cities.org/>. Accessed May 18 2021.
18. National AIDS Trust. HIV in the UK statistics. Available at <https://www.nat.org.uk/about-hiv/hiv-statistics>. Accessed May 18 2021.
19. Gunaratnam P, McManus H, Watchirs-Smith L, et al. People Born in Non–Main English Speaking Countries Are Less Likely to Start HIV Treatment Early in Australia: A National Cohort Analysis, 2014–15. *Journal of Acquired Immune Deficiency Syndromes* 2018;77(3).
20. Marukutira T, Gray RT, Douglass C, et al. Gaps in the HIV diagnosis and care cascade for migrants in Australia, 2013–2017: A cross-sectional study. *PLOS Medicine* 2020;17(3).
21. Ward JS, Hawke K, Guy RJ. Priorities for preventing a concentrated HIV epidemic among Aboriginal and Torres Strait Islander Australians. *Medical Journal of Australia* 2018;209(1).
22. Kirby Institute. Kirby Institute. HIV, viral hepatitis and sexually transmissible infections in Australia: annual surveillance report 2018. Sydney: Kirby Institute, UNSW Sydney; 2018.
23. de Oliveira Costa J, Schaffer AL, Medland NA, et al. Adherence to Antiretroviral Regimens in Australia: A Nationwide Cohort Study. *AIDS Patient Care STDs* 2020;34(2).



# References

24. Granich RM, Gilks CF, Dye C, De Cock KM, Williams BG. Universal voluntary HIV testing with immediate antiretroviral therapy as a strategy for elimination of HIV transmission: a mathematical model. *Lancet* 2009;373(9657).
25. Williams BG, Granich R. Ending AIDS: myth or reality? *Lancet* 2017;390(10092).
26. Okano JT, Robbins D, Palk L, Gerstoft J, Obel N, Blower S. Testing the hypothesis that treatment can eliminate HIV: a nationwide, population-based study of the Danish HIV epidemic in men who have sex with men. *Lancet Infectious Diseases* 2016; 16(7).
27. Lima VD, Zhu J, Card KG, et al. Can the combination of TasP and PrEP eliminate HIV among MSM in British Columbia, Canada? *Epidemics* 2021; 35.
28. Bavinton BR, Rodger AJ. Undetectable viral load and HIV transmission dynamics on an individual and population level: Where next in the global HIV response? *Current Opinion in Infectious Diseases*. 2020; 33(1):20–7.
29. NSW Government. NSW HIV Surveillance Data Reports. Available at <https://www.health.nsw.gov.au/endinghiv/pages/tools-and-data.aspx>. Accessed on May 18 2021.
30. Victorian Department of Health and Human Services. Local Government Areas Surveillance Report. Available at <https://www2.health.vic.gov.au/public-health/infectious-diseases/infectious-diseases-surveillance/interactive-infectious-disease-reports/local-government-areas-surveillance-report>. Accessed May 18 2.
31. Hammoud MA, Maher L, Holt M, et al. Physical Distancing Due to COVID-19 Disrupts Sexual Behaviors Among Gay and Bisexual Men in Australia: Implications for Trends in HIV and Other Sexually Transmissible Infections. *Journal of Acquired Immune Deficiency Syndromes* 2020;85(3).
32. The Commonwealth of Australia. Budget 2021-2022. Securing Australia's Recovery. Available at <https://budget.gov.au/>. Accessed May 18 2021.
18. Broady, T.R., et al., HIV stigma by association among Australian gay and bisexual men. *AIDS*, 2020. 34: p. S53-S62.
19. Broady, T., et al., Stigma Indicators Monitoring Project: Summary report. Phase Two. 2020, Centre for Social Research in Health: UNSW Sydney.
20. Nyblade, L., et al., Combating HIV stigma in health care settings: what works? *Journal of the International AIDS Society*, 2009. 12: p. 15-15.
21. Rao, D., et al., A systematic review of multi-level stigma interventions: state of the science and future directions. *BMC Medicine*, 2019. 17(1): p. 41.
22. Cook, J., et al., Intervening within and across levels: A multilevel approach to stigma and public health. *Social Science & Medicine*, 2014. 103: p. 101-9.
23. Feyissa, G.T., et al., Reducing HIV-related stigma and discrimination in healthcare settings: A systematic review of quantitative evidence. *PLOS ONE*, 2019. 14(1): p. e0211298.
24. Australian Government Department of Health, Eighth National HIV Strategy. 2018, Commonwealth of Australia, Canberra.
25. Lazarus JV, Safreed-Harmon K, Barton SE, Costagliola D, Dedes N, del Amo Valero J, et al. Beyond viral suppression of HIV—the new quality of life frontier. *BMC Medicine*, 2016. 14(1):94.
26. Katz, I. T., Ryu, A. E., Onuegbu, A. G., Psaros, C., Weiser, S. D., Bangsberg, D. R., & Tsai, A. C. Impact of HIV-related stigma on treatment adherence: systematic review and meta-synthesis. *Journal of the International AIDS Society*, 2013. 16, 18640.
27. Logie, C. and Gadalla, T.M. Meta-analysis of health and demographic correlates of stigma towards people living with HIV. *AIDS Care*, 2009. 21(6): 742-53.
28. Rueda, S. et al. Examining the associations between HIV-related stigma and health outcomes in people living with HIV/AIDS: a series of meta-analyses, *BMJ Open*, 2016. 6(7), e011453.
29. Mikołajczak, G., Brown, G., Power, J., Lyons, A., Howard, C., & Drummond, F. Social determinants of quality of life among PLHIV in Australia: implications for health promotion. *Health Promotion International*, 2021. daab029, <https://doi.org/10.1093/heapro/daab029>
30. Andersson, G. Z., Reinius, M., Eriksson, L. E., Svedhem, V., Esfahani, F. M., Deuba, K., ... and Ekström, A. M. Stigma reduction interventions in people living with HIV to improve health-related quality of life. *The Lancet HIV*, 2020. 7(2), e129-e140.
31. Gardiner, B. Grit and stigma: Gay men ageing with HIV in regional Queensland. *Journal of Sociology*, 2018. 54(2), 214-225.
32. Lyons, A., Pitts, M., Grierson, J., Thorpe, R. and Power, J. Ageing with HIV: health and psychosocial well-being of older gay men. *AIDS Care*, 2010. 22(10), 1236-1244.
33. Cabral, H. J., Davis-Plourde, K., Sarango, M., Fox, J., Palmisano, J. and Rajabiun, S. Peer support and the HIV continuum of care: results from a multi-site randomized clinical trial in three urban clinics in the United States. *AIDS and Behavior*, 2018. 22(8), 2627-2639.
34. Ghiasvand, H., Higgs, P., Noroozi, M., Ghaedamini Harouni, G., Hemmat, M., Ahounbar, E., ... and Armoon, B. Social and demographical determinants of quality of life in people who live with HIV/AIDS infection: evidence from a meta-analysis. *Biodemography and Social Biology*, 2020. 65(1), 57-72.
35. Nyblade, L., et al., Stigma in health facilities: why it matters and how we can change it. *BMC Medicine*, 2019. 17(1): p 25.
10. Gilmore, N. and M.A. Somerville, Stigmatization, scapegoating and discrimination in sexually transmitted diseases: overcoming 'them' and 'us'. *Social Science & Medicine*, 1994. 39(9): p. 1339-58.
11. Nyblade, L., P. Mingkwan, and M.A. Stockton, Stigma reduction: an essential ingredient to ending AIDS by 2030. *Lancet HIV*, 2021. 8(2): p. e106-e113.
12. Rueda, S., et al., Examining the associations between HIV-related stigma and health outcomes in people living with HIV/AIDS: a series of meta-analyses. *BMJ Open*, 2016. 6(7): p. e011453.
13. Prudden, H.J., et al., Can mother-to-child transmission of HIV be eliminated without addressing the issue of stigma? Modeling the case for a setting in South Africa. *PLOS ONE*, 2017. 12(12): p. e0189079.
14. Gray, R.T., et al., Undiagnosed HIV infections among gay and bisexual men increasingly contribute to new infections in Australia. *Journal of the International AIDS Society*, 2018. 21(4): p. e25104.
15. Cama, E., et al., The relationship between negative responses to HIV status disclosure and psychosocial outcomes among people living with HIV. *Journal of Health Psychology*, 2020. 25(4): p. 538-544.
16. Cama, E., et al., The impact of HIV treatment-related stigma on uptake of antiretroviral therapy. *AIDS Care*, 2015. 27(6): p. 739-42.
17. Newman, C.E., et al., 'Not Until I'm Absolutely Half-Dead and Have To' Accounting for Non-Use of Antiretroviral Therapy in Semi-Structured Interviews with People Living with HIV in Australia. *AIDS Patient Care STDs*, 2015. 29(5): p. 267-78.
4. Link, B. and J. Phelan, Conceptualizing stigma. *Annual Review of Sociology*, 2001. 27: p. 363-85.
5. Schmitt, M.T., et al., The consequences of perceived discrimination for psychological well-being: a meta-analytic review. *Psychological Bulletin*, 2014. 140(4): p. 921-48.
6. Major, B., J. Dovidio, and B. Link, eds. The Oxford handbook of stigma, discrimination, and health. 2018, Oxford University Press: New York.
7. Pascoe, E.A. and L. Smart Richman, Perceived discrimination and health: a meta-analytic review. *Psychological Bulletin*, 2009. 135(4): p. 531-54.
8. Logie, C. and T.M. Gadalla, Meta-analysis of health and demographic correlates of stigma towards people living with HIV. *AIDS Care*, 2009. 21(6): p. 742-53.
9. Heijnders, M. and S. van der Meij, The fight against stigma: An overview of stigma-reduction strategies and interventions. *Psychology, Health & Medicine*, 2006. 11(3): p. 353-63.









# Agenda 2025

ENDING HIV  
TRANSMISSION  
IN AUSTRALIA

Technical paper on science,  
trends and targets  
**June 2021**