

Cascade of care and rapid treatment pathway at Auckland City Hospital for patients with a new diagnosis of HIV infection, 2015–2019

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ABSTRACT

AIMS: Legislative changes in 2017 enabled subsidised HIV care for all people living with HIV in New Zealand. This enabled a rapid treatment pathway (RTP) to be developed at Auckland City Hospital (ACH). Our aims were to document the cascade of care for people referred with newly diagnosed HIV infection and evaluate the effect of the RTP.

METHODS: People with newly diagnosed HIV infection in New Zealand referred to ACH between 2015 and 2019 were included in the cascade of care. The 2-year periods before (2015 and 2016) and after (2018 and 2019) the RTP were compared for initiation of antiretroviral therapy (ART) and attainment of HIV viral suppression.

RESULTS: There were 240 people with newly diagnosed HIV infection referred. Of these, 197/200 (98.5%) were on ART and 195/197 (99%) had documented viral suppression. ART was initiated within 6 weeks of referral for 41/120 (34.2%) in the pre-RTP and 76/79 (96.2%) in the RTP periods ($p < 0.0001$). Viral suppression was achieved within 6 months of diagnosis for 66/118 (55.9%) in the pre-RTP and 73/75 (97.3%) in the RTP periods ($p < 0.0001$).

CONCLUSIONS: A high proportion of people referred with newly diagnosed HIV infection were commenced on ART and achieved viral suppression. The RTP facilitated earlier initiation of ART and achievement of viral suppression.

Early initiation of antiretroviral therapy (ART) has been shown to markedly reduce transmissions of HIV,^{1,2} and reduce mortality for people living with HIV (PLHIV),³ with health benefits occurring regardless of the initial CD4 count.^{4,5} With the evidence supporting early ART, in 2015 the World Health Organization recommended that ART be initiated for all PLHIV at any CD4 count.⁶

The “cascade of care” was developed for benchmarking HIV care using the steps of 1) diagnosed with HIV, 2) linked to HIV care, 3) retained in care, 4) on ART, and 5) suppressed HIV viral load.^{7,8} UNAIDS proposed the initial ambitious goals that 90% of all PLHIV will know their diagnosis, 90% of all people diagnosed with HIV infection will receive sustained ART and 90% of people receiving ART will have HIV viral suppression.⁹ These goals were subsequently updated to 95-95-95 to end the AIDS epidemic by 2030.¹⁰ The cascade of care for New Zealand, undertaken by the AIDS Epidemiology Group, was limited by incomplete data.¹¹

In New Zealand in January 2017, there were changes to infectious diseases management under the *Health Act 1956*, allowing subsidised HIV care

to be provided regardless of a person’s residency status.¹² Later, in July 2017, subsidised ART became available to all PLHIV, at any CD4 count.¹³ These major changes in policy enabled a rapid treatment pathway (RTP) for all people with newly diagnosed HIV infection to be developed and implemented at Auckland City Hospital, which came into effect in October 2017. A timeline was outlined to facilitate early engagement and prompt initiation of ART, with referrals for people with newly diagnosed HIV infection offered an outpatient appointment with an HIV specialist within 1 week of referral. ART was aimed to be initiated at this appointment. Support via telephone or face-to-face meetings would be provided by the community HIV team (a team of HIV nurse specialists and a nurse practitioner), with initial contact at the time of the referral and thereafter as required. Key performance indicators (KPIs) were proposed for timing of initiation of ART and attainment of viral suppression. These KPIs were created following careful discussion within the Infectious Diseases (ID) Service and were based on what was thought to be achievable at that time.

Aims

The aims of this audit were to 1) document the cascade of care for people with a newly diagnosed HIV infection referred to the ID Service at Auckland City Hospital, and 2) evaluate the periods before and after initiation of the RTP for people with a newly diagnosed HIV infection referred to the ID Service at Auckland City Hospital, with respect to linkage to care, timing of ART initiation and HIV viral suppression; and furthermore, to determine whether the KPIs were met with i) 90% of new HIV diagnoses initiating ART within 6 weeks of referral, and ii) 90% of new HIV diagnoses obtaining an undetectable HIV viral load within 6 months of diagnosis.

Methods

Adults (≥ 15 years) with a newly diagnosed HIV infection who were referred to the ID Service at Auckland City Hospital between the dates 1 January 2015 and 31 December 2019 were included. These people were identified from the department's HIV database. PLHIV newly referred to the ID Service at Auckland City Hospital, but those who had been previously diagnosed with HIV infection were excluded. Data extracted from the medical records included demographic details (including self-reported ethnicity) and date of diagnosis with HIV infection. The date of diagnosis was recorded as the date the first positive HIV test was taken, as recorded by the laboratory. If the first test was a rapid test, this date was recorded from the referral letter. Additional data extracted included the date of referral to the ID Service, date of first contact with the community HIV team, date of first HIV specialist appointment or inpatient consultation, date of initiation of ART and HIV viral load testing throughout the first year, as well as the most recent HIV viral load in the year prior to 31 December 2020.

Cascade of care

For the cascade of care, definitions were in accordance with recommendations published.^{14,15} As this was an audit of PLHIV referred to our service, the first step in the cascade of care (the proportion diagnosed with HIV) was not able to be assessed.

Linked to care was defined as review by an HIV specialist within 3 months of diagnosis. This did not include the initial contact made by the

community HIV team.

Retained in care was considered achieved if the patient was alive and living in New Zealand and in the most recent year had either a HIV viral load documented, or alternatively ART dispensed and evidence that adherence was maintained through a clinic appointment, phone call or contact with a general practitioner (GP).

On treatment was defined as having been dispensed or prescribed ART (not necessarily reflecting adherence to ART).

Viral suppression was defined as a HIV viral load < 200 copies/mL. PLHIV were considered to be currently virally suppressed if the HIV viral load had been documented within the 12 months prior to 31 December 2020.

For the cascade of care, the most recent HIV viral load in the year prior to 31 December 2020 was obtained to allow a minimum of 1-year follow-up for all PLHIV. If a PLHIV relocated to another region within New Zealand during this period, data were obtained from the HIV service involved.

Rapid treatment pathway

For comparison of the periods before and after the development of the RTP, accounting for the changes in policy in 2017 and the implementation of the pathway, we compared the 2-year periods of 1 January 2015 to 31 December 2016 and 1 January 2018 to 31 December 2019. For the RTP, the two groups were compared, with respect to linkage to care, timing of initiation of ART (from when the diagnosis was made, and from when the referral was received) and achievement of HIV viral suppression within 6 months of diagnosis.

This review was considered to be an audit of clinical care and did not meet requirements for formal ethical review from the Auckland District Health Board Research Review Committee.

The Fisher's exact test, Chi-squared test and Mann-Whitney U test were used to assess for statistically significant differences between the periods before and after the introduction of the RTP.

Results

There were 399 PLHIV referred to the ID Service during the 5-year audit period from 1 January 2015 to 31 December 2019. Of these, the 103 PLHIV diagnosed overseas and the 56 PLHIV diagnosed elsewhere in New Zealand who relocated to the Auckland Region were excluded.

The remaining 240 people with a newly diagnosed

HIV infection were included. Of these, 214 (89%) were male, with 102/240 (42.5%) self-reporting their ethnicity as NZ European and 16/240 (6.7%) as Māori. The median age was 39 years (interquartile range [IQR] 30–49 years). The likely mode of transmission was men who have sex with men for 179 (74.6%), heterosexual sex for 50 (20.8%), intravenous drug use for 4 (1.7%) and other/not available for 7 (2.9%). The median CD4 count at diagnosis was $396 \times 10^6/L$ (IQR 206 – $569 \times 10^6/L$), with 58 (24%) recording a baseline CD4 count of $<200 \times 10^6/L$ and 41 (17%) with a CD4 count of 200 to $349 \times 10^6/L$.

Cascade of care: Auckland City Hospital

Of the 240 PLHIV, 227 (94.6%) were linked to care with a first specialist appointment or inpatient review within 3 months of diagnosis. For the 200 PLHIV living in New Zealand as of 31 December 2020, 197 (98.5%) were retained in care (the remaining three were lost to follow-up) and 197 (98.5%) were on ART. For those on ART, 195/197 (99%) had documented HIV viral suppression within the last 12 months of the audit period (two had intermittent ART adherence). The additional 40 PLHIV included 33 who relocated overseas and seven who died.

Rapid treatment pathway

There were 123 people newly diagnosed with an HIV infection in the period from 1 January 2015 to 31 December 2016, prior to the development of the RTP, and 82 people diagnosed with an HIV infection in the period from 1 January 2018 to 31 December 2019 following the development of the RTP. The demographics of the before and after RTP groups are shown in Table 1, with no differences seen between these two groups.

Linkage to care

Linkage to care within 3 months of the diagnosis of HIV infection was achieved for 113/122 (92.6%) people newly diagnosed in 2015/2016 compared with 81/82 (99%) people newly diagnosed with an HIV infection in 2018/2019 ($p=0.053$). For the PLHIV not linked to care within 3 months in 2015/2016, all had initial contact with the community HIV team and baseline bloods within this timeframe. The one patient not linked to care within 3 months in 2018/2019 had a delayed referral to the ID service, which occurred 187 days following diagnosis.

The time from HIV diagnosis to HIV specialist care is shown in Table 2, and the time from referral to HIV specialist care is shown in Table 3. The median time from *diagnosis* to first specialist review was

32 days (IQR 13–54 days) prior to the RTP and 17 days (IQR 7–28 days) following the RTP ($p<0.0001$). The median time from *referral* to first specialist review was 23 days (IQR 8–41 days) prior to the RTP and was 8 days (IQR 4–16 days) following the RTP ($p<0.0001$). The median time from referral to initial contact with the ID service, usually with the HIV nurse specialists/practitioner, was 1 day during both periods.

Antiretroviral therapy

ART was initiated within 6 weeks of *diagnosis* for 28/120 (23.3%) PLHIV prior to the RTP and for 66/79 (83.5%) PLHIV following the RTP ($p<0.0001$). ART was initiated within 6 weeks of *referral* for 41/120 (34.2%) PLHIV prior to the RTP and for 76/79 (96.2%) PLHIV following the RTP ($p<0.0001$). At 3 months from diagnosis, ART had been initiated in 78/120 (65.0%) PLHIV prior to the RTP and 77/79 (97.5%) PLHIV following the RTP ($p<0.0001$).

The median time from *diagnosis* to initiation of ART was 68 days (IQR 44–133 days) prior to the RTP and 21 days (IQR 13–31 days) following the RTP ($p<0.00001$). The median time from *referral* to the ID service to initiation of ART was 51 days (IQR 36–114 days) prior to the RTP and 12 days (IQR 7–20 days) following the RTP ($p<0.00001$).

HIV viral suppression

At 6 months from diagnosis, 66/118 (55.9%) PLHIV prior to the RTP and 73/75 (97.3%) PLHIV following the RTP had documented HIV viral suppression ($p<0.0001$). The median time from diagnosis to first documentation of viral suppression was 174 days (IQR 124–272 days) prior to the RTP and 85 days (IQR 63–104 days) following the RTP ($p<0.0001$).

Discussion

The cascade of care for people newly diagnosed with an HIV infection referred to Auckland City Hospital for the 5-year audit period from 1 January 2015 to 31 December 2019 has shown very high rates of retention in care, initiation of ART and HIV viral suppression. In addition, the RTP has significantly reduced the time from diagnosis of HIV infection to linkage to care and has resulted in earlier initiation of ART and earlier achievement of HIV viral suppression.

This cascade of care, as assessed on 31 December 2020, has shown that 98.5% of PLHIV were on ART and of these, 99% had a suppressed HIV viral load during the last 12 months of the audit. This compares with the Wellington cascade of care—undertaken

Table 1: Demographics of groups before and after rapid treatment pathway for initiation of HIV care for PLHIV referred to the Infectious Diseases Service, Auckland City Hospital.

	Prior to rapid treatment pathway Jan 2015–Dec 2016	Rapid treatment pathway Jan 2018–Dec 2019	P-value
New diagnosis of HIV	123	82	
Male	112 (91.1%)	70 (85.4%)	0.26 [#]
Age at diagnosis (median years, IQR)	38 (30–48)	40 (32–51)	0.73 [^]
Ethnicity			
NZ European	60 (48.8%)	31 (37.8%)	0.51 [*]
Māori	8 (6.5%)	6 (7.3%)	
Asian	22 (17.9%)	18 (22.0%)	
Pasifika peoples	8 (6.5%)	10 (12.2%)	
Other European	18 (14.6%)	9 (11.0%)	
South American	4 (3.3%)	5 (6.1%)	
Middle East/Africa	3 (2.4%)	3 (3.7%)	
CD4 count at diagnosis, median (IQR)	417x10 ⁶ /L (209–602x10 ⁶ /L)	372x10 ⁶ /L (197–528x10 ⁶ /L)	0.32 [^]
<200x10 ⁶ /L	30 (24%)	21 (26%)	
200–349x10 ⁶ /L	21 (17%)	13 (16%)	
350–499x10 ⁶ /L	31 (25%)	24 (29%)	
≥500x10 ⁶ /L	41(33%)	22 (27%)	
Unknown		2 (2%)	
Outcome			
Available for retention in care assessment [†]	104	67	
Retained in care	103 (99%)	66 (98.5%)	
Not retained in care	1 (1%)	1 (1.5%)	
Not available for retention in care assessment	19	15	
Transfers overseas [†]	14	13	
Deaths [†]	5	2	

PLHIV = people living with HIV; IQR = interquartile range

[#]Fisher's exact test

[^]Mann–Whitney U test

^{*}Chi-squared test

[†]The follow-up period for retention in care assessment, transfer overseas and deaths was 31 December 2020 for both groups

Table 2: Time from HIV *diagnosis* to HIV specialist care for PLHIV referred to the Infectious Diseases Service, Auckland City Hospital.

	Prior to rapid treatment pathway Jan 2015–Dec 2016, n=123	Rapid treatment pathway Jan 2018–Dec 2019, n=82	P-value
Time from diagnosis to first contact with community HIV team, median days (IQR)	10 (2–16)	7 (2–14)	0.36 [^]
Linked to care within 3 months of diagnosis	113/122 ^a (92.6%)	81/82 (99%)	0.053 [#]
Time from diagnosis to linkage to care, median days (IQR)	32 ^a (13–54)	17 (7–28)	<0.0001 [^]
Time from diagnosis (blood test taken) to referral to ID service, median days (IQR)	7 (1–13.5)	6 ^b (2–13)	0.91 [^]
Time from diagnosis (result available) to referral to ID service, median days (IQR)	3 ^c (0–10)	2 ^d (0–10)	0.8 [^]
Time from diagnosis to initiation of ART, median days (IQR)	68 ^e (44–133)	21 ^f (13–31)	<0.00001 [^]
Initiation of ART within 6 weeks of diagnosis	28/120 ^g (23.3%)	66/79 ^f (83.5%)	<0.0001 [#]
Initiation of ART within 3 months of diagnosis	78/120 ^g (65.0%)	77/79 ^f (97.5%)	<0.0001 [#]
Initiation of ART within 6 months of diagnosis	96/120 ^g (80.0%)	78/79 ^f (98.7%)	<0.0001 [#]
Time from diagnosis to first documentation of viral suppression, median days (IQR)	174 ^h (124–272)	85 ⁱ (63–104)	<0.0001 [^]
Viral suppression within 6 months of diagnosis	66/118 ^j (55.9%)	73/75 ⁱ (97.3%)	<0.0001 [#]

PLHIV = people living with HIV; IQR = interquartile range; ART = antiretroviral therapy

[#]Fisher's exact test

[^]Mann–Whitney U test

^an=122 (1 PLHIV transferred care before being seen)

^bn=81 (data not available for 1 PLHIV)

^cn=112 (data not available for 11 PLHIV)

^dn=77 (data not available for 5 PLHIV)

^en=118 (3 PLHIV transferred care before starting ART; 2 PLHIV didn't start ART but later transferred care)

^fn=79 (3 PLHIV transferred care before starting ART)

^gn=120 (3 PLHIV transferred care before starting ART)

^hn=117 (5 PLHIV transferred care before starting ART/achieving viral suppression; 1 PLHIV didn't start ART)

ⁱn=75 (7 PLHIV transferred care before starting ART/achieving viral suppression)

^jn=118 (5 PLHIV transferred care before starting ART/achieving viral suppression)

Table 3: Time from *referral* to HIV specialist care for PLHIV referred to the Infectious Diseases Service, Auckland City Hospital.

	Prior to rapid treatment pathway Jan 2015–Dec 2016, n=123	Rapid treatment pathway Jan 2018–Dec 2019, n=82	P-value
Time from referral to first contact with community HIV team, median days (IQR)	1 (0–2.5)	1 (0–1)	0.08 [#]
Time from referral to first specialist clinic appointment/inpatient review, median days (IQR)	23 ^a (8–41)	8 (4–16)	<0.0001 [#]
Time from referral to initiation of ART, median days (IQR)	51 ^b (36–114)	12 ^c (7–20)	<0.00001 [#]
Initiation of ART within 6 weeks of referral	41/120 ^d (34.2%)	76/79 ^e (96.2%)	<0.0001 [^]
Time from referral to first documentation of viral suppression, median days (IQR)	161 ^f (117–272)	79 ^g (53–98)	<0.00001 [#]

PLHIV = people living with HIV; IQR = interquartile range; ART = antiretroviral therapy

[#]Mann-Whitney U test

[^]Fisher's exact test

^an=122 (1 PLHIV transferred care before being seen)

^bn=118 (3 PLHIV transferred care before starting ART; 2 patients didn't start ART)

^cn=79 (3 PLHIV transferred care before starting ART)

^dn=120 (3 PLHIV transferred care before starting ART)

^en=79 (3 PLHIV transferred care before starting ART)

^fn=117 (5 PLHIV transferred care before starting ART/achieving viral suppression; 1 PLHIV didn't start ART)

^gn=75 (7 PLHIV transferred care before starting ART/achieving viral suppression)

prior to the HIV policy changes—where 89% were on ART, of whom 93% achieved a suppressed HIV viral load,¹⁶ and the national cascade of care for people diagnosed with HIV infection between 2006 and 2017, where 94.5% initiated ART, of whom 82% had a suppressed HIV viral load.¹¹ The national cascade was limited by incomplete data and almost certainly is an underestimate of the true proportion of PLHIV initiated on ART who are virally suppressed in New Zealand.

Policy changes, based on the evidence supporting early initiation of ART,^{1,2,4} have been instrumental in facilitating treatment for all PLHIV in New Zealand, particularly in facilitating rapid treatment for all,

irrespective of the CD4 count at the time of diagnosis or of immigration status. The subsequent development of our service KPIs has led to 96% of PLHIV commencing ART within 6 weeks of referral, a significant improvement from the baseline of 34%, and 97% attaining HIV viral suppression within 6 months of diagnosis of HIV infection, again a significant improvement from the baseline of 56%. Potential benefits of earlier treatment and HIV viral suppression include the reduced transmission of HIV infection^{1,2} and improved general health for PLHIV.^{4,5} All major HIV infection treatment guidelines now recommend that ART is commenced as soon as possible following

diagnosis.¹⁷⁻¹⁹ Studies have shown that the availability of RTPs result in earlier linkage to care and earlier achievement of HIV viral suppression, although whether there are benefits in long-term retention in care or mortality remain unclear.^{20,21} The optimal timing for early ART initiation is still being fully assessed, as there are concerns that immediate initiation of ART on the same day as the diagnosis of HIV infection may result in less engagement in care compared with rapid treatment initiated within 2 weeks of the diagnosis of HIV infection,²² as the information and consideration of lifelong ART may be overwhelming. RTPs are more resource intensive, requiring multidisciplinary coordination and reprioritisation of clinic resources with more intensive initial support, but as we have shown, can result in earlier linkage to care, earlier initiation of ART and earlier attainment of HIV viral suppression.

Not all patients may be suitable for rapid treatment, particularly where there is a risk of immune reconstitution inflammatory syndrome (IRIS), such as occurs with cryptococcal or tuberculous meningitis. It is also important to consider likely engagement in ongoing care, as initiation of ART requires ongoing commitment and lifelong follow-up. Engagement in other programmes such as drug and alcohol support or addressing other barriers to HIV care may take priority.²³ We found only a very small number of PLHIV who did not initiate ART, who were lost to follow-up or who remained in contact with our service but maintained variable adherence to ART. Much of this success is due to the efforts of our community HIV team and social worker, who provide long-term support to PLHIV following their diagnosis of HIV infection and initiation of ART, and who help re-engage those who have been lost to follow-up and further support those with complex needs.

It is notable that late presentations in this audit were common, with 24% of those with a newly diagnosed HIV infection having a CD4 count $<200 \times 10^6/L$, suggesting that these PLHIV were likely to have had an HIV infection for many years. This has also been shown in other New Zealand studies, and provides further evidence to support the need for wider HIV testing in New Zealand.^{24,25} The first step in the cascade of care is almost certainly the most challenging, requiring increased HIV testing, reduced barriers to HIV testing and supportive contact tracing.²⁶ Increased emphasis on HIV testing in New Zealand is essential.

While we met the goal of 90% of new HIV diagnoses initiating ART within 6 weeks of *referral* to

our service, a lower proportion (83.5%) initiated ART within 6 weeks of the *diagnosis* of their HIV infection. In this audit there was usually a relatively short delay in the time taken for the person who ordered the initial HIV test to become aware of this result and subsequently make a referral to our service. Now that we have been able to illustrate the significant benefits of the RTP, we hope that people newly diagnosed with HIV infection will be referred as soon as the initial HIV test result becomes available, without waiting for confirmatory HIV testing.

There are several strengths of this audit. We have a comprehensive database with prospective recording of all PLHIV referred to our service. Additionally, for the assessment of the cascade of care, we were able to obtain a high level of follow-up for PLHIV relocating within New Zealand.

There are a number of limitations to this audit. Firstly, it was performed retrospectively. Secondly, our cascade of care only included PLHIV referred to the ID Service at Auckland City Hospital, while HIV care in the Auckland Region is also provided by the Auckland Sexual Health Service, private specialist providers and general practitioners. However, the ID Service at Auckland City Hospital is the largest provider of HIV care in New Zealand (currently providing care for 1,100 of approximately 3,000 diagnosed PLHIV). With the high degree of follow-up that was achieved for PLHIV who entered the cascade of care and who are currently living in New Zealand, this audit provides updated data and complements other New Zealand cascades of care.^{11,16} Thirdly, this audit does not provide information on the first step in the cascade of care (people living with undiagnosed HIV infection). This step is not well understood in New Zealand.²⁷ This step was not able to be assessed by this audit as we are only able to provide care to PLHIV who are diagnosed and then referred to our service. Fourthly, the time to achieve HIV viral suppression may be affected by factors other than the RTP. The documentation of viral suppression may vary with the timing of the follow-up HIV viral load testing; however, we aimed to test follow-up HIV viral loads at 3 and 6 months following initiation of ART throughout the audit period. The increased use of integrase inhibitors that occurred during the audit period, which achieve viral suppression more rapidly than other antiretrovirals,²⁸ may also have affected the time to achieve viral suppression.

For PLHIV referred to the Auckland City Hospital ID Service, we have shown a high attainment of initiation of ART and HIV viral

suppression in the cascade of care. The RTP, which required a refocus of clinic and multi-disciplinary resources, has enabled earlier linkage to care, more rapid initiation of ART and earlier HIV viral suppression. We do need to

obtain a greater understanding of the first step in the cascade of care for New Zealand. Increased resources dedicated to enhanced HIV testing will help reduce the proportion of people living with undiagnosed HIV infection.

COMPETING INTERESTS

Nil.

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