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Late presentation of HIV infection among adults in New Zealand from 2011 to 2020

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Abstract

Objectives: Early diagnosis of HIV is essential for successful treatment and controlling HIV spread in a population. We examined the frequency and characteristics of adults diagnosed late with HIV in New Zealand from 2011–2020.

Methods: Routine surveillance data were analysed. Those previously diagnosed overseas or as part of immigration screening, or with missing CD4 count were excluded. 'Late presentation' was defined as a CD4 count <350 cells/μL or an AIDS-defining event. 'Advanced HIV disease' were those with a CD4 count <200 cells/μL or an AIDS-defining event. Relative risks were calculated using Poisson regression.

Results: Of 1145 people, 40.5% presented late; 24.9% had advanced HIV disease. Of the 464 late diagnoses, 65.5% occurred among men-who-have-sex-with-men (MSM), 26.1% among heterosexuals, 8.4% among others. Heterosexual men and women were more likely to present late (55.3%) compared to MSM (35.6%). Amongst MSM, those who were older, of an ethnicity other than European, acquired HIV overseas, tested because symptomatic, or had their last negative test >2 years prior were more likely to present late and have advanced disease. Amongst heterosexuals, older age, tested because symptomatic, and Pacific ethnicity were associated with late presentation, and Māori, Pacific and Asian people were more likely to have advanced disease.

Conclusions: There continues to be a high proportion of people diagnosed late with HIV. Identifying barriers for testing, missed opportunities for screenings and other factors that delay HIV diagnosis could help develop effective strategies to reduce this burden of late presentation – particularly among heterosexual individuals, non-Europeans, and older people.

Keywords

HIV, late presentation, New Zealand

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Introduction

Early diagnosis of HIV is essential for successful treatment with antiretroviral therapy (ART). Treatment with ART enables virological suppression, improving health and reducing infectivity to sexual partners. Early diagnosis is therefore important for improving outcomes for the individual and also for control of HIV in the population.[1,2]

In 2021, the Joint United Nations Programme on HIV/AIDS (UNAIDS) reaffirmed the global cascade of care targets, including ensuring that 95% of people living with HIV are aware of their status.[3] To achieve this target requires a high coverage of HIV testing, yet studies report missed opportunities for diagnosis.[4–6] There continues to be a large proportion of people unaware of their HIV and who are diagnosed late.[7–9] In New Zealand, we previously reported that half of the people diagnosed with HIV in the six years from 2005 to 2010 presented late and a third had advanced HIV disease at diagnosis, proportionately more common in heterosexual people, and amongst Māori, Pacific and older men who have sex with men (MSM).[10]

New Zealand is a low HIV prevalence country, with the epidemic concentrated in MSM. The number of MSM diagnosed annually has been declining since the peak in 2016, primarily in MSM of European ethnicity. Amongst people who acquire HIV heterosexually there has been steady, low annual numbers in the last 10 years. Laboratory HIV testing

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is available through primary care, hospitals and sexual health clinics, and rapid tests (in community clinics and through self-testing) are available from local HIV organisations. Treatment and care of people with HIV in New Zealand is publicly funded for all people living with HIV, regardless of clinical characteristics or immigration status.

New Zealand aims to eliminate local HIV transmission. To support this aim, an understanding of populations at risk of late diagnosis is essential for developing strategies to raise awareness and improve health promotion, encouraging individuals to seek HIV testing and care, and removing obstacles to screening to ensure they are diagnosed as early as possible. The purpose of this analysis, therefore, is to update our previous analysis of late diagnosis (2005–2010)[10] by examining the frequency and characteristics of people presenting late, and with advanced HIV disease, in New Zealand in the ten years from 2011 to 2020.

Methods

The AIDS Epidemiology Group (AEG) has undertaken surveillance of HIV infection and AIDS in New Zealand since 1989.[11] The AEG receives information on people diagnosed with HIV from laboratories and the diagnosing healthcare provider. Information collected includes the age at time of diagnosis, gender, means of acquisition, reason for the HIV test, prioritised ethnicity,[12] likely place of acquisition, date of previous negative HIV test if any, and the first CD4 cell count after diagnosis. All data collected uses an anonymised case code and, since 2017, the National Health Index (NHI) when HIV became notifiable under the Health (Protection) Amendment Act 2016.

This analysis replicates the methods used in our previous (2005–2010) analysis and includes adults (over the age of 15 years) diagnosed with HIV in New Zealand from 2011 to 2020.[10] Excluded are those tested as part of an immigration or refugee medical assessment, those previously diagnosed overseas, and those with no CD4 count available.

Two measures of timing of presentation were used. 'Late presentation' refers to those whose first CD4 count after diagnosis is < 350 cells/μL or have an AIDS-defining event within three months of HIV diagnosis. Presentation with 'advanced HIV disease' is a subset having a CD4 count <200 cells/μL and also includes all who have an AIDS defining event within three months of HIV diagnosis.[13]

Relative risks (RR) were calculated using Poisson regression with robust standard errors to account for the binary outcome. Age-adjusted estimates were obtained by including age at diagnosis as a continuous variable. Data were analysed using STATA 16.0.

Results

During the 10-year period 1 January 2011 to 31 December 2020 there were 1447 adults diagnosed with HIV infection in New Zealand. Of these, 139 had been tested as part of immigration or refugee screening, and 163 did not have a CD4 cell count available leaving 1145 included in this analysis.

Of the 1145, the main mode of HIV acquisition was through sex between men for 855 (74.7%), 219 (19.1%) heterosexual contact, 29 (2.5%) through other means, and 42 (3.7%) for whom the means of acquisition was unknown. Overall, 40.5% (464 of 1145) presented late, including 24.9% (285 of 1145) with advanced HIV disease. Of the 464 late diagnoses, the majority were MSM (304 cases or 65.5%), a quarter (121 cases or 26.1%) were heterosexual men and women, and the rest (39 cases or 8.4%) had an "other" means of HIV acquisition. Heterosexual men and women were however proportionately more likely to present late (55.3%: RR 1.6, 95% CI 1.3–1.8) and to present with advanced HIV disease (39.3%: RR 2.0, 95% CI 1.6–2.4), compared to MSM (35.6% and 19.9%, respectively).

Table 1 shows that late presentation and advanced HIV disease were more common among MSM in both age categories over 30 years. MSM of Māori, Pacific, Asian and the combined group of MELAA (Middle Eastern, Latin American and African) ethnicities were more likely to present late, and to have advanced HIV disease (except for MELAA), compared to those of European ethnicity. MSM who tested because they considered themselves to have been at risk were less likely to present late or to have advanced HIV disease compared to those who tested because of symptoms. Those who had a previous negative test more than two years earlier, or never/unknown, were more likely to present late and more likely to have advanced HIV disease.

The relationship of age and ethnicity among MSM with late presentation was explored further by examining past testing for HIV (data not shown). Of MSM for whom past testing information was reported (n = 579), a higher proportion of younger men aged <30 years had a negative test within the previous two years (46.4%) than men aged 30–39 (44.0%) or ≥40 (34.1%). A greater proportion of European (41.8%), Asian (44.6%) and MELAA (51.6%) MSM had had a negative HIV test within the previous two years compared to Māori (26.7%) and Pacific (17.6%) MSM.

Table 2 shows the results for late presentation and advanced HIV disease for men and women with heterosexually acquired HIV. Those aged 40 years or older were more likely to present late and more likely to have advanced HIV disease. In the age- and sex-adjusted analysis, heterosexuals of Pacific ethnicity were more likely to present late (ARR 1.4; 95% CI 1.0–2.1), and Māori (ARR 1.7; 95% CI 1.0–2.9), Pacific (ARR 2.2; 95% CI 1.4–3.5), and Asian (ARR 1.6; 95% CI 1.1–2.3) were more likely to have advanced HIV disease compared to Europeans. Similar to MSM, heterosexual men and women were less likely to present late if they considered themselves to have been at risk compared to those who tested because of having symptoms. Less than

Table 1. Relative risks (RRs) of 'late presentation' and 'advanced HIV disease' in New Zealand 2011–2020 according to characteristics of men who have sex with men (MSM).

		Late presentation			Advanced HIV disease		
Characteristic	Total	*n* (%)	RR (95% CI)		*n* (%)	RR (95% CI)	
	855	304 (35.6)			170 (19.9)		
Age at diagnosis							
<30 years	224	50 (22.3)	1.0		22 (9.8)	1.0	
30–39 years	225	72 (32.0)	1.4 (1.1–2.0)		39 (17.3)	1.8 (1.1–2.9)	
40+ years	406	182 (44.8)	2.0 (1.5–2.6)		109 (26.8)	2.7 (1.8–4.2)	
Ethnicity				Adjusted for age			Adjusted for age
European	519	158 (30.4)	1.0	1.0	86 (16.6)	1.0	1.0
Māori	94	40 (42.6)	1.4 (1.1–1.8)	1.7 (1.3–2.3)	29 (30.9)	1.9 (1.3–2.7)	2.4 (1.7–3.5)
Pacific Island	46	23 (50.0)	1.6 (1.2–2.3)	2.0 (1.4–2.7)	13 (28.3)	1.7 (1.0–2.8)	2.1 (1.3–3.4)
Asian	146	64 (43.8)	1.4 (1.1–1.8)	1.9 (1.5–2.4)	35 (24.0)	1.4 (1.0–2.0)	2.1 (1.5–3.0)
MELAA[a]	45	17 (37.8)	1.2 (0.8–1.8)	1.7 (1.1–2.6)	7 (15.6)	0.9 (0.5–1.9)	1.4 (0.7–2.9)
Unknown	5	2 (40.0)	1.3 (0.4–3.9)	1.4 (0.6–3.3)	0 (0.0)	—	—
Place of acquisition							
New Zealand	647	210 (32.5)	1.0		117 (18.1)	1.0	
Overseas	176	77 (43.8)	1.3 (1.1–1.6)		45 (25.6)	1.4 (1.0–1.9)	
Unknown	32	17 (53.1)	1.6 (1.2–2.3)		8 (25.0)	1.4 (0.7–2.6)	
Reason for testing							
Symptoms	172	110 (64.0)	1.0		80 (46.5)	1.0	
Risk	384	106 (27.6)	0.4 (0.4–0.5)		41 (10.7)	0.2 (0.2–0.3)	
Screening	0	0 (NA)	—		0 (NA)	—	
Other[b]	66	25 (37.9)	0.6 (0.4–0.8)		13 (19.7)	0.4 (0.3–0.7)	
Unknown	233	63 (27.0)	0.4 (0.3–0.5)		36 (15.5)	0.3 (0.2–0.5)	
Previous negative test							
<2 years	220	39 (17.7)	1.0		13 (5.9)	1.0	
>2 years/time unk	158	75 (47.5)	2.7 (1.9–3.7)		35 (22.2)	3.7 (2.1–6.9)	
Never/Unknown	477	190 (39.8)	2.2 (1.7–3.0)		122 (25.6)	4.3 (2.5–7.5)	
Year of diagnosis							
2011–12	130	44 (33.8)	1.0		26 (20.0)	1.0	
2013–14	191	59 (30.9)	0.9 (0.7–1.3)		31 (16.2)	0.8 (0.5–1.3)	
2015–16	232	82 (35.3)	1.0 (0.8–1.4)		50 (21.6)	1.1 (0.7–1.6)	
2018–18	162	56 (34.6)	1.0 (0.7–1.4)		30 (18.5)	0.9 (0.6–1.5)	
2019–20	140	63 (45.0)	1.3 (1.0–1.8)		33 (23.6)	1.2 (0.7–1.9)	

[a]MELAA includes Middle Eastern, Latin American and African.
[b]Other includes testing for blood transfusion and contact tracing.

a quarter (21.5%) reported they had had a previous negative test, and those who had a previous negative test more than two years earlier, or never, were more likely to present late.

Discussion

Among those testing positive for HIV in New Zealand in the last 10 years, 41% presented late, and more than half of those (25% overall) met the lower CD4 cell count threshold for advanced HIV disease at the time of diagnosis. While MSM continue to comprise the largest number of late HIV diagnoses, heterosexual men and women living with HIV were more likely than MSM to present late, as were people of older age and those of an ethnic group other than European.

Strengths of our study include the use of regular routine surveillance data for both HIV and AIDS that included information on the means of infection and demographic characteristics. New Zealand is one of a limited number of countries to collect ethnicity data,[12] enabling us to apply an equity lens to late diagnosis data that few other studies can achieve. CD4 count data was available for a large proportion of our sample and we used agreed definitions of late presentation and advanced HIV disease.[13]

Overall, the proportion of people presenting late and with advanced disease is less than that previously reported in the six years from 2005 to 2010 (50% and 32%, respectively).[10] The proportion presenting late in this current study (41% overall, 36% for MSM, 55% for heterosexual men and women) is consistent with proportions reported in other

Table 2. Relative risks (RRs) of 'late presentation' and 'advanced HIV disease' in New Zealand 2011-2020 according to characteristics of heterosexual men and women.

		Late presentation			Advanced HIV disease		
Characteristic	Total	*n* (%)	RR (95% CI)		*n* (%)	RR (95% CI)	
	219	121 (55.3)			86 (39.3)		
Sex				Adjusted for age			Adjusted for age
Male	122	71 (58.2)	1.0	1.0	51 (41.8)	1.0	1.0
Female	97	50 (51.5)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	35 (36.1)	0.9 (0.6–1.2)	0.9 (0.6–1.2)
Age at diagnosis							
<30 years	43	16 (37.2)	1.0		9 (20.9)	1.0	
30–39 years	68	34 (50.0)	1.3 (0.9–2.1)		26 (38.2)	1.8 (0.9–3.5)	
40+ years	108	71 (65.7)	1.8 (1.2–2.7)		51 (47.2)	2.3 (1.2–4.2)	
Ethnicity				Adjusted for age and sex			Adjusted for age and sex
European	111	62 (55.9)	1.0	1.0	38 (34.2)	1.0	1.0
Māori	19	12 (63.2)	1.1 (0.8–1.7)	1.2 (0.8–1.8)	10 (52.6)	1.5 (0.9–2.5)	1.7 (1.0–2.9)
Pacific Island	16	11 (68.8)	1.2 (0.8–1.8)	1.4 (1.0–2.1)	10 (62.5)	1.8 (1.2–2.9)	2.2 (1.4–3.5)
Asian	43	25 (58.1)	1.0 (0.8–1.4)	1.1 (0.8–1.5)	21 (48.8)	1.4 (1.0–2.1)	1.6 (1.1–2.3)
MELAA[a]	30	11 (36.7)	0.7 (0.4–1.1)	0.7 (0.5–1.2)	7 (23.3)	0.7 (0.3–1.4)	0.8 (0.4–1.6)
Place of infection							
New Zealand	114	58 (50.9)	1.0		45 (39.5)	1.0	
Overseas	100	59 (59.0)	1.2 (0.9–1.5)		38 (38.0)	1.0 (0.7–1.4)	
Unknown	5	4 (80.0)	1.6 (1.0–2.5)		3 (60.0)	1.5 (0.7–3.2)	
Reason for testing							
Symptoms	76	56 (73.7)	1.0		51 (67.1)	1.0	
Risk	45	16 (35.6)	0.5 (0.3–0.7)		5 (11.1)	0.2 (0.1–0.4)	
Screening[b]	13	5 (38.5)	0.5 (0.3–1.1)		3 (23.1)	0.3 (0.1–0.9)	
Other[c]	33	16 (48.5)	0.7 (0.5–1.0)		9 (27.3)	0.4 (0.2–0.7)	
Unknown	52	28 (53.8)	0.7 (0.5–1.0)		18 (34.6)	0.5 (0.3–0.8)	
Previous negative test							
<2 years	15	4 (26.7)	1.0		0 (0.0)	-	
>2 years/time unk	32	19 (59.4)	2.2 (0.9–5.4)		14 (43.8)	-	
Never/Unknown	172	98 (57.0)	2.1 (0.9–5.0)		72 (41.9)	-	
Year of diagnosis							
2011–12	41	26 (63.4)	1.0		22 (53.7)	1.0	
2013–14	54	30 (55.6)	0.9 (0.6–1.2)		20 (37.0)	0.7 (0.4–1.1)	
2015–16	54	27 (50.0)	0.8 (0.6–1.1)		15 (27.8)	0.5 (0.3–0.9)	
2018–18	29	18 (62.1)	1.0 (0.7–1.4)		13 (44.8)	0.8 (0.5–1.4)	
2019–20	41	20 (48.8)	0.8 (0.5–1.1)		16 (39.0)	0.7 (0.5–1.2)	

[a]MELAA includes Middle Eastern, Latin American and African.
[b]Antenatal screening for women only.
[c]Other includes testing for blood transfusion and contact tracing.

studies in Europe (49%),[7] the United Kingdom (43%),[14] and Australia (39%).[15] When considering changes over time, however, it is important to consider both the *numbers* and *proportions*. As New Zealand works towards the goal of eliminating local HIV transmission, new incident cases are likely to decline, which will result in an increase in the *proportion* of all diagnoses that are late.

Late presentation of HIV depends on the pattern of testing in a population. While it is estimated that there are around 3000 people living with HIV in New Zealand who are on antiretroviral therapy, the number and proportion who are undiagnosed is unknown.[16] An earlier study reported one-fifth of MSM were undiagnosed,[17] but over the past years local HIV organisations have undertaken a number of prevention and testing campaigns primarily targeting MSM whose population rates of HIV are over 348 times higher than among heterosexuals.[18] From March 2018 publicly funded pre-exposure prophylaxis (PrEP) became available, with eligibility criteria covering primarily the population of MSM at high risk of HIV. These interventions, as well as gay community norms that support regular testing, is the likely reason for the lower proportion of those

who are diagnosed late compared to heterosexual men and women. Within MSM, however, we found disparities, with older men and those of an ethnicity other than European more likely to present late. This is likely the result of different testing patterns in these groups as shown by the testing data in our study and also through behavioural surveillance with Pacific and Asian MSM being less likely to have ever, or in the previous 12 months, tested for HIV.[12] A study currently being undertaken will provide further insight on the overall undiagnosed rates in MSM to guide progress towards elimination of local transmission of HIV in this population.

The finding of late presentation and advanced HIV disease being proportionately more common in heterosexual men and women is similar to that found in other studies and surveillance systems overseas.[8,14,19] Heterosexuals can perceive themselves, and be perceived by healthcare providers, to be at low risk of having HIV, resulting in missed opportunities for early diagnosis even when presenting with symptoms indicative of HIV.[5,6] This suggests clinicians should actively test for HIV infection in people presenting with suggestive conditions, regardless of the presence of known risk factors. Moreover, our study found a greater risk of late presentation in Pacific people, and of advanced HIV disease in Pacific, Māori, and Asian heterosexual men and women. These groups are more likely to experience barriers to testing and intersectional stigma and discrimination. Strategies to better serve heterosexual men and women for HIV testing are therefore required.

Increasing awareness among healthcare providers to maintain a low threshold for HIV screening for all patients regardless of perceptions of their sexual practices continues to be a priority. Consistent inclusion of HIV indicator condition (IC) testing in clinical guidelines for specialty areas outside of HIV care may improve testing provision in healthcare settings,[20] however such guidance continues to be lacking in numerous clinical areas,[21] and collaboration between specialist groups is required to improve its comprehensiveness. Furthermore, research is needed to identify settings where opportunistic screenings could be implemented to reduce the number of late HIV diagnoses. For example, overseas, feasibility of universal screenings for HIV and viral hepatitis has been evaluated in selected London Emergency Departments, leading to recent broader implementation.[22]

In conclusion, there continues to be a large proportion of HIV positive people being diagnosed late – even among European MSM. Identifying barriers for testing, missed opportunities for screenings and other factors that delay HIV diagnosis could help develop effective strategies to reduce this burden of late presentation – particularly among heterosexual individuals, non-Europeans, and older people. Finally, culturally appropriate services that respond to the needs of Māori and other non-European people in New Zealand are needed to ensure equitable access to screening and HIV care.

Author contributions

This analysis replicates the methods used in our previous (2005–2010) analysis designed by Dickson et al. AdG collected the data; JPB analysed the data; JPB and SMM wrote the first draft; all authors contributed to the writing of the final manuscript.

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Data availability

Anonymous raw data from the full database are available upon request to the corresponding author.

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References

1. Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 infection with early antiretroviral therapy. *New Eng J Med* 2011; 365: 493–505.
2. Wilson DP. HIV treatment as prevention: natural experiments highlight limits of antiretroviral treatment as HIV prevention. *PLoS Med* 2012; 9: e1001231.
3. UNAIDS. Political declaration on HIV and AIDS: ending inequalities and getting on track to end AIDS by 2030, https://www.unaids.org/en/resources/documents/2021/2021_political-declaration-on-hiv-and-aids (2022, accessed 18 August 2021).
4. Lin YD, Garner SE, Lau JS, et al. Prevalence of HIV indicator conditions in late presenting patients with HIV: a missed opportunity for diagnosis? *QJM-Int J Med* 2019; 112: 17–21.
5. Nanditha NGA, St-Jean M, Tafessu H, et al. Missed opportunities for earlier diagnosis of HIV in British Columbia, Canada: A retrospective cohort study. *PLoS One* 2019; 14: e0214012.
6. Hopkins C, Reid M, Gilmour J, et al. Missed opportunities for earlier diagnosis of human immunodeficiency virus infection among adults presenting to Auckland district health board hospital services. *Intern Med J* 2019; 49: 495–501.
7. European Centre for Disease Prevention and Control. HIV infection and AIDS: annual epidemiological report for 2017, https://www.ecdc.europa.eu/sites/default/files/documents/hiv-infection-aids–annual-epidemiological-report-2017.pdf (2019, accessed 19 November 2021).

8. Kirby Institute. *HIV in Australia: annual surveillance short report 2018*. Sydney, Australia: Kirby Institute, UNSW, 2018.
9. Mårdh O, Quinten C, Kuchukhidze G, et al. HIV among women in the WHO European region–epidemiological trends and predictors of late diagnosis, 2009-2018. *Eurosurveillance* 2019; 24: 1900696.
10. Dickson N, McAllister S, Sharples K, et al. Late presentation of HIV infection among adults in New Zealand: 2005–2010. *HIV Medicine* 2012; 13: 182–189.
11. Dickson N, Lee B, Foster T, et al. The first 30 years of HIV in New Zealand: review of the epidemiology. *NZ Med J* 2015; 128: 6745–6748.
12. Lachowsky NJ, Saxton PJ, Dickson NP, et al. Ethnicity classification systems for public health surveys: experiences from HIV behavioural surveillance among men who have sex with men. *BMC Public Health* 2020; 20: 1–13.
13. Antinori A, Coenen T, Costagiola D, et al. Late presentation of HIV infection: a consensus definition. *HIV Medicine* 2011; 12: 61–64.
14. UK Health Security Agency. National HIV surveillance data tables, https://www.gov.uk/government/statistics/hiv-annual-data-tables (2021, accessed 18 March 2021).
15. Marukutira T, Gunaratnam P, Douglass C, et al. Trends in late and advanced HIV diagnoses among migrants in Australia; implications for progress on Fast-Track targets: a retrospective observational study. *Medicine* 2020; 99: e19289.
16. AIDS Epidemiology Group. AIDS - New Zealand newsletter, https://www.otago.ac.nz/aidsepigroup/newsletters/(2022, accessed 21 December 2022).
17. Saxton PJ, Dickson NP, Griffiths R, et al. Actual and undiagnosed HIV prevalence in a community sample of men who have sex with men in Auckland, New Zealand. *BMC Public Health* 2012; 12: 1–12.
18. Saxton PJ, McAllister SM, Thirkell CE, et al. Population rates of HIV, gonorrhoea and syphilis diagnoses by sexual orientation in New Zealand. *Sex Transm Infect* 2022; 98: 376–379.
19. Noble G, Okpo E, Tonna I, et al. Factors associated with late HIV diagnosis in North-East Scotland: a six-year retrospective study. *Public Health* 2016; 139: 36–43.
20. Bogers S, Hulstein S, van der Loeff MS, et al. Current evidence on the adoption of indicator condition guided testing for HIV in western countries: a systematic review and meta-analysis. *EClinicalMedicine* 2021; 35: 100877.
21. Lin YD, Eades L, Nair A, et al. Review of HIV testing recommendations in Australian specialty guidelines for HIV indicator conditions: a missed opportunity for recommending testing? *Internal Medicine Journal* 2020; 50: 293–298.
22. Orkin C, Flanagan S, Wallis E, et al. Incorporating HIV/hepatitis B virus/hepatitis C virus combined testing into routine blood tests in nine UK emergency departments: the "Going Viral" campaign. *HIV Medicine* 2016; 17: 222–230.