BHIVA/BASHH/BIA Adult HIV Testing Guidelines 2020

Guideline writing group

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[a]From September 2016 to June 2018

[b]From June 2018 to November 2019

Contents

1 Executive summary

Despite the UK achieving the UNAIDS 90-90-90 target 2 years before the 2020 deadline, it is estimated that in 2018, 7% (95% CrI 5.2–11%) of people living with the human immunodeficiency virus (HIV) in the UK remained unaware of their HIV status and 43% were diagnosed at a late stage of infection [1]. Given the benefits of treatment, both to an individual's health and to public health, more needs to be done to ensure that all those with HIV are diagnosed promptly and can rapidly access treatment and care. Similarly, those who test negative but remain at risk should have equitable access to combination prevention (including pre-exposure prophylaxis [PrEP]). In the absence of further progress on these fronts, the target of HIV elimination will not be reached any time soon, and certainly not by 2030.

All healthcare workers should be able to offer an HIV test in their setting. Pre-test discussion is not required. Individuals should be made aware that they will be tested for HIV and informed how they will receive their result; for clinical settings, opt-out testing is the most effective method to increase testing coverage. Community testing and self-sampling and testing may increase access to testing for specific groups.

HIV testing is recommended for:

- People belonging to groups at increased risk of testing HIV positive (e.g. men who have sex with men [MSM], people who inject drugs [PWID], people from countries with high HIV seroprevalence and trans women);
- People attending health services associated with increased risk of HIV (e.g. sexual health services, tuberculosis [TB] clinics and addiction and substance misuse services);
- All people presenting with symptoms and/or signs consistent with an HIV indicator condition;
- People accessing healthcare in areas with high (if undergoing venepuncture) and extremely high (all attendees) HIV seroprevalence.

The window period for fourth-generation serological HIV testing is 45 days; this has been revised in light of published evidence.

Barriers to testing include HIV stigma and reluctance to offer testing by healthcare professionals. Normalisation of HIV testing, and education and training, can address both to a degree; however, larger-scale interventions are likely to be required to have a meaningful impact on societal stigma and discrimination.

2 Introduction

The UK government has recently committed to the elimination of HIV transmission in the UK by 2030 [2]. To achieve this, individuals living with undiagnosed HIV infection will need to be identified, offered testing and commenced on antiretroviral therapy (ART), thereby eliminating the risk of further onward transmission. Those identified as being at ongoing risk of infection, will require combination prevention, including PrEP, to significantly reduce their risk of becoming HIV positive.
HIV treatment guidelines universally acknowledge the benefits of immediate antiretroviral treatment, regardless of CD4 cell count, for an individual's health. Individuals who are diagnosed promptly can expect a near-normal life expectancy.
Implementation of the above approaches has resulted in dramatic falls in the number of new HIV diagnoses for almost all groups in the UK. HIV testing is the gateway both for accessing effective treatment and for combination prevention but improvements are required to ensure all individuals can benefit equally.
Of note, the term 'HIV' refers to HIV-1 throughout these guidelines, unless HIV-2 is specified.

2.1 UK epidemiology

In 2018, there were an estimated 103,800 (95% CrI 101,600–107,800) people living with HIV in the UK; 93% were diagnosed and 98% were on ART. Of those individuals accessing care with a viral load result in 2017, 97% had an undetectable viral load [1].

Among adults receiving specialist HIV outpatient care in the UK in 2017, there were no significant differences in the proportions receiving ART by gender, ethnicity, age or mode of HIV acquisition (range 95–99%). Rates of viral suppression were similarly high [1].

With 7% of people with HIV living with undiagnosed infection, the main area where progress is needed is therefore testing.

There has been a significant decline in new HIV diagnoses in the UK in the past few years from a peak of 6,185 in 2014 to 4,363 in 2017 [1]. This decline, while evident in both MSM and African populations, is most marked among MSM, particularly in London. The decline in new HIV diagnoses reflects a decrease in incidence, which began in 2012, and is most likely due to an increase in testing, repeat testing and prompt initiation of ART (i.e. treatment as prevention [TasP]). More recently PrEP will have contributed to the continuing decline.

There are significant differences observed in the most affected populations in testing coverage and rates, and consequent late presentation. This varies by ethnicity, age and locality [1]. It is therefore essential that planning of interventions to increase HIV testing is done in the context of the local epidemic to achieve the maximum impact without risking stigmatising potentially vulnerable communities. Monitoring and evaluation of such programmes should be carried out to assess effectiveness and inform future adaptations. With expansion of testing settings to non-specialist services, time to linkage to HIV specialist care will be an important metric to monitor.

2.2 Cost-effective threshold for testing

An undiagnosed prevalence of 0.1% is consistently considered to be cost-effective for HIV screening [3]. The evidence shows a greater cost-effectiveness in settings and populations where the undiagnosed prevalence is higher. In antenatal settings, a lower threshold of 0.0075% has been estimated, due to the large extended lifetime costs of an infant acquiring HIV vertically [4]. The estimated prevalence of undiagnosed HIV infection in England in 2017 was 0.02% (95% CI 0.01–0.03%) among those aged 15 to 59 years. Estimates of the undiagnosed prevalence of HIV varies by at-risk population and geography. Thus, universal HIV testing is not recommended in the UK. It is worth noting that since this evidence was published, the cost of HIV treatment has decreased and life expectancy has increased leading to a likely downward revision of the cost-effective threshold.

2.3 Overarching principals

HIV-related stigma continues to be reported and feared by people living with HIV, compounded for some by pre-existing stigma based on actual or perceived membership of different social groups (e.g. gender identity, religion, class, ethnicity and sexuality). HIV testing, including the offer of a test, can have similar associations for both individuals and healthcare workers. Easy, equitable, non-discriminatory access to HIV testing in all settings should be available to all individuals who wish to test or should have testing recommended to them.

All patient-related information and testing behaviour and outcome data should be kept according to information governance standards and national legislation, regardless of setting.

The General Medical Council (GMC) provides guidance on obtaining consent for any medical investigation and this should be adhered to regardless of setting [5]. Individuals should be aware they are being tested for HIV and that testing is voluntary and informed how their results are managed. How much additional information is provided will vary to an extent based on the setting, the purpose of testing and the individual being offered testing. How information is delivered should be adapted to the circumstances. Basic information should include how results can be accessed, the advantages of testing, availability and effectiveness of treatments, prevention and the window period. Not all situations will require all this information, which in many cases can be provided in written form (leaflet or website link).

In all settings, irrespective of who is delivering the testing, there should be clear, agreed pathways to HIV treatment and care services delivering timely linkage to care. For those testing negative who remain at risk there should be clear pathways to prevention services.

2.4 Guideline development process

These guidelines were jointly commissioned by the British HIV Association (BHIVA) Guidelines Subcommittee, the British Association for Sexual Health and HIV (BASHH) Clinical Effectiveness Group and the British Infection Association (BIA). The guideline development process followed BHIVA's guideline development manual (www.bhiva.org/GuidelineDevelopmentManual), applying the modified GRADE system for the assessment, evaluation and grading of evidence and the development of recommendations [6, 7]. The co-chairs of the writing group, who were nominated by BHIVA, BASHH and BIA, nominated a writing group of experts. In addition, members of all three organisations were invited to volunteer to join the writing group by an open process of self-

nomination. Community groups representing people living with HIV were invited to nominate representatives via the UK-CAB.

The scope, purpose and guideline topics that were identified as requiring an update from the previous guidelines were agreed by the writing group. PICO questions pertaining to each topic were agreed and a systematic literature review undertaken by an information scientist. Details of the search questions (including the definition of populations, interventions, comparators and outcomes) and the search strategy can be found on the BHIVA website (https://www.bhiva.org/file/5dfcdefd0eb5d/Testing-guidelines-literature-search-strategy.pdf). The literature searches for the 2020 guidelines covered the period from January 1998 to January 2017 and included abstracts from selected conferences between January 2014 and January 2017. For each topic and healthcare question, evidence was identified and evaluated by writing group members with expertise in the field. Using the modified GRADE system (taking into consideration these guidelines are public health guidelines and thus reliant on different forms of evidence) members assessed and graded the quality of evidence for predefined outcomes across studies and developed and graded the strength of recommendations. All writing group members received training in the use of the modified GRADE criteria before assessing the evidence. Grade reflects the strength of the evidence of the recommendation to the healthcare worker.

Where the evidence is strong (e.g. 1A) we use the term recommend, indicating the healthcare worker should in almost all situation follow this recommendation. Where evidence is less robust (e.g.2D) we use the term consider. These have no bearing on who the test is offered to the patient or the language used, this will depend on the individual circumstance.

The guidelines were published online for public consultation for 6 weeks and external peer review was sought.

The writing group included patient representatives who were involved in all aspects of the guideline development.

3 Who should test

Recommendations

An HIV test is recommended for:

1) People belonging to groups at increased risk of testing HIV positive

HIV testing should be routinely recommended to the following individuals (all Grade 1A):

- MSM;
- Female sexual contacts of MSM;
- People reporting current or prior injecting drug use;

- Sex workers;
- Trans women;
- People from a country with high diagnosed seroprevalence (>1%)*;
- People reporting sexual contact with anyone from a country with high diagnosed seroprevalence regardless of where contact occurs.

HIV testing should be considered for the following individuals (Grade 1D):

- Trans men;
- Heterosexuals who have changed sexual partner(s).

*For an up to date list see [8].

2) People attending certain health services

HIV opt-out testing is recommended in the following settings (Grade 1C):

- Specialist sexual health services;
- Addiction and substance misuse services;
- Antenatal services;
- Termination of pregnancy services;
- Healthcare services for hepatitis B and C, TB and lymphoma.

3) People presenting with symptoms and/or signs consistent with an HIV indicator condition

All individuals presenting to any healthcare provider in any healthcare setting with an indicator condition should be recommended to have an HIV test (Grade 1C–2D; 1D for AIDS-defining conditions)*.

Individuals who decline on first offer should have at least one repeat offer made at a subsequent visit (Grade 1D).

Services providing HIV testing should have adequate results governance and agreed documented transfer to care pathways (Grade 1D).

*See explanatory notes in the evidence review below.

4) People accessing primary and secondary healthcare in areas of high and extremely high HIV seroprevalence

Routine HIV testing is recommended for all individuals who have not previously tested who are (Grade 1B):

- Accessing healthcare in areas of high HIV prevalence (2–5 per 1000) and undergoing venepuncture;
- Accessing healthcare in areas of extremely high HIV prevalence (>5 per 1000), whether or not they are undergoing venepuncture for another indication.

Recommendations for repeat testing should be based on clinical judgement and risk assessment; for example, emergence of an indicator condition or ongoing risk.

5) Sexual partners of those with diagnosed HIV (Grade 1A)

All sexual partners of an individual diagnosed with HIV should be offered and recommended an HIV test unless all episodes of sexual contact were known to be protected by TasP (i.e. the person living with HIV was on ART with a maintained undetectable viral load).

These guidelines do not cover children (see chiva.org.uk) or blood donors, transplant donors and recipients, renal dialysis patients and patients receiving immunosuppressant treatment; the relevant Department of Health and Social Care guidance should be followed [9] or the relevant drug summary of product characteristics.

Evidence review

Specific groups

Applying the cost-effectiveness threshold of undiagnosed HIV prevalence of 1 per 1000, the recommendation for testing specific populations is underpinned by the following estimated undiagnosed prevalence for:

- MSM: 0.81% (95% CI 0.45–1.60%); the corresponding figures in London and elsewhere in England were 0.77% (95% CI 0.38–1.63%) and 0.80% (95% CI 0.36–1.83%);
- African men and women: 0.17% (95% CI 0.14–0.22%); 0.11% (0.09–0.16%) among men and 0.23% (95% CI 0.18–0.29%) among women;
- PWID: 0.16% (95% CI 0.0–-0.37%) [10].

Currently there are no UK seroprevalence data available on trans people.

Antenatal services

Uptake of HIV screening among women who attend for antenatal care is very high (>99%). While positivity remains low (0.013%) [11], this uptake rate is deemed cost-effective when considering the benefit to both the mother and the unborn child.

A review confirmed the cost-effectiveness of universal antenatal HIV screening, as well as rescreening in the late gestation period in both developed and developing countries [4]. Universal antenatal screening for HIV in Australia where the prevalence of the unscreened population ranges

between 0.02% and 0.001% was found to be cost-effective using cost information from 2001–2002. Taking into account the costs of HIV testing, the additional antenatal and delivery care necessitated, training of healthcare staff and lifetime medical care for infants who acquired HIV vertically, the authors concluded that universal HIV screening was cost-effective at or above an undiagnosed HIV prevalence of 0.0043% (no cost ratio per quality-adjusted life year [QALY] provided). Similarly, in the USA, the cost-effectiveness of antenatal screening was found to be high in populations with an undiagnosed prevalence as low as 0.0075% in 2000 (cost ratio per QALY was not provided) [12].

High and extremely high prevalence areas

Geographical targeted testing aims to reduce the number of individuals living with HIV who are unaware of their infection in geographical areas where undiagnosed prevalence is high (previous US studies set this at >1 per 1000) and overcomes the need to target HIV testing to any specific population, potentially preventing further stigmatisation of these populations. However, undiagnosed infection rates cannot be accurately measured and available estimates do not provide local level data. By contrast, Public Health England (PHE) has accurate measures of the diagnosed prevalence available for small areas. To better tailor thresholds to more effectively identify those at increased risk of late diagnosis, PHE performed a k-median cluster analysis to model diagnosed HIV prevalence distribution in local authorities in England as part of the development of the 2016 National Institute for Health and Care Excellence HIV testing guidelines [13]. This produces three strata based on prevalence of diagnosed HIV: low (<2 per 1000), high (2–5 per 1000; 50 local authorities based on 2016 data) and extremely high (>5 per 1000; 20 local authorities based on 2016 data). When the model was applied to national late HIV diagnosis data, two-thirds of late HIV diagnoses were found to occur in high and extremely high prevalence local authorities. This suggests that successful application of this guidance could potentially impact on two-thirds of late diagnoses nationally. PHE produces the strata data, based on the national HIV surveillance data each year [11].

Indicator conditions

An indicator condition is any medical condition associated with an undiagnosed HIV seroprevalence $\geq$1 per 1000. This may be due to either shared transmission routes with HIV (e.g. hepatitis B and C) or dysregulated immunity.

There are two categories:

1. Conditions that would be AIDS defining in an individual living with HIV (category 1; see Appendix 1, Table 1).

2. Non-AIDS-defining conditions associated with an undiagnosed HIV seroprevalence ≥1 per 1000 (category 2; see Appendix 1, Table 2).

The strength of the recommendation in category 2 is divided on the basis of the available evidence:

- The strength of the recommendation is Grade 1C for those conditions that have been demonstrated unequivocally as having an undiagnosed HIV seroprevalence ≥1 per 1000 in prospective studies, where previously undiagnosed HIV infection was either a primary or secondary outcome of an HIV testing intervention.

The strength of the recommendation is Grade 1D or 2D for those indicator conditions considered by experts to be highly likely to be associated with undiagnosed HIV seroprevalence rates ≥1 per 1000. For 1D recommended indicator conditions, a variety of data sources have been used to inform this strength of recommendation, ranging from large-scale case–control studies using national and other large data registries in primary and secondary care to retrospective observational studies and audits. For 2D recommendations, only poor-quality evidence or expert opinion exists, or existing poor-quality data have failed to demonstrate an association with a prevalence >1 per 1000. We suggest that HIV testing is done in these conditions as an important differential, even if the prevalence is <1:1000.

4 Frequency of HIV testing

Recommendations

All individuals having an HIV test should undergo repeat testing at the appropriate time interval if the current test does not adequately cover the window period for a high-risk sexual contact (see Section 7, page 20).

An annual test is recommended for (Grade 1C):

- Heterosexuals who have changed sexual partner(s);
- PWID;
- Sex workers;
- Sexually active MSM (other than those with one long-term mutually exclusive partner).

MSM reporting any of the following should test every 3 months:

- Condomless anal intercourse with partner(s) of unknown or serodifferent HIV status, where the contact is not known to be virologically supressed (i.e. not protected by TasP), over the last 12 months (Grade 1B);
- Multiple or anonymous partners since the last HIV test (Grade 1C);
- More than 10 sexual partners, over the last 12 months (Grade 1B);
- Drug use during sex over the last 6 months (Grade 1B for methamphetamine or inhaled nitrites; Grade 1C for GHB/GBL, ketamine or other novel psychoactive substances).

MSM should be offered repeat HIV testing at follow-up attendance after treatment for syphilis, or anogenital gonorrhoea or chlamydial infection (Grade 1C).

Three-monthly HIV testing should be routinely offered as part of monitoring for PrEP (Grade 1B).

Systematic recall strategies should be considered for those who are eligible for but decline PrEP (Grade 1C for MSM and transgender women and Grade 1D for other populations).

The provision of home-based self-sampling and testing can increase testing frequency in MSM and may benefit all at-risk groups (Grade 1B for MSM).

SMS text reminders should be used to increase re-attendance and HIV testing rates in MSM and others at elevated risk (Grade 1C).

Regular, repeat HIV testing should form part of an integrated risk reduction strategy aimed at reducing behavioural risk (Grade 1A for MSM; 1C for other groups).

Evidence review

There are few data to support recommendations on routine testing frequency in groups with elevated HIV incidence and prevalence other than in MSM, so in most groups repeat testing should be triggered by the identification of individual behavioural risk factors, symptoms suggesting seroconversion, or the identification of indicator conditions.

A retrospective review of 31,469 heterosexual patients of a diverse range of ethnicities attending London sexual health services found that of 4584 retested for HIV within 12 months of an initial negative test only one retested positive [14]. Cost-effectiveness studies support annual testing in UK heterosexual populations at a prevalence of 0.8% [14-16].

Testing 3-monthly is cost-saving in high-risk MSM [17, 18]. A cost-effectiveness study of MSM and PWID found that HIV testing for MSM was cost-saving or cost-effective over a 1-year period for both 6-month compared with annual testing and quarterly compared with 6-month testing using either fourth-generation serology or point-of-care testing.

Testing PWID every 6 months compared with annually was moderately cost-effective over a 1-year period with a fourth-generation test, whereas testing with rapid, point-of-care tests (POCTs) or quarterly was not cost-effective [18].

A study of sex workers in Victoria, Australia demonstrated that it was not cost-effective to test sex workers for HIV more frequently then every 40 weeks [19].

The rationale for testing frequency recommendations in MSM is detailed in the UK national guideline on the sexual health of MSM [20]. Stratification of risk for HIV infection in MSM is based on several international sources including US Centers for Disease Control PrEP guidance [21] and supporting observational evidence [22]. HIV incidence varied by the rate of incident syphilis in the iPrEx study of HIV PrEP [23]. In a study of 301 MSM diagnosed with a bacterial sexually transmitted infection (STI) in a London clinic recalled at 3 months for retesting (of whom 206 attended), 29 MSM per 100 person-years of follow-up were diagnosed with a new STI and there were five new cases of HIV infection [24]. The high rates of HIV acquisition observed in MSM in the deferred arm of the PROUD trial of PrEP [25] and in the control arm of the ANRS IPERGAY study [26] suggest that MSM and transgender women meeting UK eligibility criteria for PrEP provision, but who are unable or do not wish to take PrEP, should receive particular attention for active recall HIV testing strategies which may include interval self-sampling and testing.

Australian MSM offered self-testing plus clinic-based testing versus clinic-based testing alone in a randomised trial had a mean of 4.2 HIV tests per year versus 1.9 (relative risk 2.08; 95% CI 1.82–2.38; *P*<0.0001) [27] . An Australian randomised controlled trial of rapid HIV testing versus conventional serology in MSM who had had an HIV test in the preceding 2 years showed an increase in uptake of initial tests but no significant difference in the incidence of repeat testing [22].

SMS text message reminders significantly increased re-attendance for HIV testing in UK [28]and Australian MSM [29]. Findings from UK studies suggest that SMS text reminders may be more effective in MSM than other risk groups but effectiveness is highly dependent upon physician prompts, such as automatic clinic recall for testing [30].

5 Community and self-testing/sampling

Recommendations

> Self-testing and sampling should be made available to at-risk groups and in areas of high seroprevalence to increase testing uptake and testing frequency (Grade 1B).
>
> Community testing increases testing rates in at-risk groups and should be provided or commissioned as part of local HIV testing programmes (Grade 1B).

People report significant barriers associated with healthcare facility-based testing, including inconvenience, confidentiality concerns and fear of stigma [31]. Increasing early and repeat HIV testing among high-risk populations is key in reducing the time from infection to treatment initiation [31, 32].

HIV self-testing (administering the test and interpreting the result at home), self-sampling (collecting a sample at home, posting to a clinic/laboratory and receiving the results at a later date) and outreach community testing all offer alternatives to testing in sexual health services and other medical settings. The proportion of HIV diagnoses made outside sexual health services has increased year on year over the last decade [33].

Community-based testing and self-administered tests, although delivered on a smaller scale than facility-based testing, demonstrate high acceptability, may increase HIV testing uptake among key populations and deliver comparable reactivity rates to facility-based screening [33]. However, evidence regarding value for money and linkage to care for self-administered tests is limited.

Evidence review

In Europe, evidence for HIV self-sampling and self-testing is limited to a small number of countries (UK, Belgium, France, Spain and the Netherlands) with no studies available from Eastern Europe. Most studies relevant to the UK context focus on MSM and there are limited data on self-sampling and self-testing in other key groups or the general population.

Most HIV self-sampling and self-testing in the UK has been based on online request platforms.

Self-testing

To date, five blood-based self-tests have been approved (CE marked) in Europe [34]: all have a sensitivity and specificity of greater than 99% and are either second- or third-generation assays. To be lawfully sold and advertised in the UK, HIV self-test kits need to be CE marked by the manufacturer to ensure the test meets regulatory requirements. They can be ordered online or purchased in some high-street pharmacies [35]. Oral fluid self-tests are preferred overall but blood-based tests are preferred by some groups including those MSM who test frequently and PWID [36, 37].

Results of self-administered tests are considered 'reactive' when they indicate the presence of HIV antibodies or antigens. A single rapid diagnostic test is not sufficient to diagnose HIV and confirmatory testing is required.

Populations that may benefit from HIV self-testing include those with a high prevalence of HIV, vulnerable populations who may be less likely to access testing and those who test frequently due to ongoing risk.

HIV self-testing is highly acceptable among different groups and in different settings [38]. The most commonly cited benefits of self-testing are ease, convenience, privacy, immediacy, anonymity and not needing to visit a healthcare facility [39].

A systematic review and meta-analysis of oral-fluid self-tests in men demonstrated a two-fold increase, compared to standard HIV testing services, in testing uptake, testing frequency and likelihood of an HIV diagnosis with no evidence of harm and minimal increase in risk-taking behaviour [40]. Another systematic review found little evidence of adverse events associated with self-testing, such as adverse emotional reactions, inter-partner violence, coerced testing, psychosocial or mental health issues, suicide or self-harm [39]. Self-reported barriers to self-testing include cost, and fear of carrying out blood tests themselves, interpreting the outcome, or having a reactive test result without any immediate personal support. Concerns about accuracy, user error, lack of experience with self-testing and awareness of the availability of a self-testing option are also reported [39, 41].

Where reported, the HIV self-test positivity rates have been high [42]. An internet-based self-test scheme targeted at UK MSM and African individuals yielded a new HIV diagnosis rate of 0.83%; around 20% had not previously tested for HIV, 99% described the process as 'easy' and 98% would use the service again. Of the 92% who were contactable, all reported confirmatory testing and engagement with HIV services [43]. Reported linkage to care rates following self-testing vary globally, from 20–100% [39].

In one systematic review, the majority of participants reported the intention to link into care following performing a self-test, particularly if the result was reactive; however, the evidence of actual linkage into care is limited and further research is required [39].

A small, randomised study in the USA of emergency department attendees who declined an HIV test demonstrated higher subsequent HIV testing among individuals provided with an HIV self-test kit compared with those who were only offered advice [44].

Self-sampling

Since 2015, a national self-sampling service has been offered to key populations in England; a fourth-generation assay was used until October 2017 and thereafter a fifth-generation assay has been used. Between November 2015 and October 2017 the service was routinely commissioned by 55% of local authorities at some point during this period. The service distributed over 122,000 kits with a 57% return rate, yielding a reactive rate of 1.14% at a cost of £950 per reactive test result. The programme engaged individuals who had never previously tested for HIV (29% of returned kits and 29% of reactive tests) [45].

One London-based study found that 88% of MSM who received a reactive result from an HIV self-sampling kit were linked to care [46].

Self-sampling is considered acceptable by users, though some have found that obtaining a blood sample is challenging. Some users report concerns about confidentiality, test accuracy and lack of access to support from healthcare worker [42].

A small UK study investigating HIV self-sampling in a service that switched from mini-tube (MT) to dried blood spot (DBS) samples demonstrated significantly better processing rates for DBS at 98.8% versus 55.7% for MT samples ($P<0.001$), driven primarily by inadequate MT blood volume. False reactive rates were also higher for MT samples (5.4% *vs* 0%) [47].

Community-based testing

In a systematic review of community-based HIV testing, six cluster randomised trials (performed in Africa, Thailand and China) met the inclusion criteria. Community-based HIV testing reached all target groups at higher coverage than facility-based testing, increased simultaneous testing of partners, lowered high-risk behaviour and facilitated earlier HIV diagnosis [48].

A survey of community-based voluntary counselling and testing services in 32 EU countries found that there is wide heterogeneity; just over half the services were included in national strategic plans, and most were MSM-focused and primarily peer-driven [49]. In a study of more than 3000 community-based rapid HIV tests in MSM in Denmark, there were 37 new diagnoses and 36 of those newly diagnosed were linked to care and virally suppressed after a median of 8 months; 12% had never previously tested for HIV [50].

A small study in Uganda demonstrated that peer-based HIV self-test distribution yielded high rates of test uptake [51].

6 Testing approach

Recommendations

- In a broad range of healthcare settings, HIV testing programmes should employ an opt-out approach when the local prevalence of undiagnosed HIV means that testing is cost-effective, or where 100% of testing coverage is desirable (e.g. sexual health clinics and antenatal services) (Grade 1C).

- Clear, unambiguous communication should be used when establishing opt-out testing in any setting to ensure that both patients and staff understand what is meant by the term ‘opt-out’ (GPP).

'Opt-out' testing, whereby attendees are informed that they will be automatically tested unless they actively decline, aims to increase coverage and normalise HIV testing.

Evidence review

Opt-out models of testing in acute care settings have been shown to be acceptable, feasible and, with appropriate resources, sustainable. This method addresses the key barriers with better coverage and sustainability across a range of different healthcare settings [52-58].

Opt-out testing is accepted as standard practice in antenatal and sexual health clinics and is highly effective [59].

Opt-in models of testing suffer from low test offer rates despite the high acceptability to patients [60-62]. Interventions to increase offer rates in opt-in models (e.g. staff education and paper and computer prompts) can lead to increased test rates but are difficult to sustain in acute care settings and over the long term [63-66].

Offering home sampling and testing kits for HIV may increase the frequency of testing in certain patient groups but does not suit all individuals [67].

Point-of-care testing is acceptable and effective in some areas but is not practical or appropriate for use in busy urgent care settings. It has been highlighted as a barrier to widespread HIV testing in these settings [68].

7 Testing technology

Recommendations (Grade 1A)

- Clinic policies and patient information regarding the HIV test window period should be based on 99th percentile estimates; where a test is undertaken sooner than this time interval, window period data should be used to counsel patients as to the likelihood of a false-negative result.

- Fourth-generation laboratory tests reliably exclude HIV by 45 days post-exposure, and this should be the window period applied when utilising these tests.

- Third-generation laboratory tests reliably exclude HIV by 2 months post-exposure, and this should be the window period applied when utilising these tests.

- POCTs reliably exclude HIV by 90 days post-exposure, and this should be the window period applied when utilising these tests.

There are two methods for routine HIV testing: (i) laboratory-based tests performed on samples obtained through venepuncture; and (ii) self-sampling, self-testing and rapid POCTs which can be performed in the clinic, in the community setting or as a home test.

The window period of a test can be defined as the time interval between exposure to infection and accurate detection of that infection; the window period ends when HIV can be detected consistently by the test in question [69]. Knowledge of window periods guides clinicians to offer the appropriate test, at the most appropriate time, and to advise patients accordingly. Factors governing the window period include characteristics of the virus, the test and the exposed individual's immune response [69].

HIV tests have evolved considerably since the start of the epidemic, yielding progressive reduction in window periods over time [70] (see Appendix 2 for definition of HIV tests).

Consensus guidelines recommend fourth-generation HIV tests first line for venous sampling with availability of POCTs, which are largely third generation [13,70-72].

Evidence review

A literature review revealed two recent studies that specifically addressed window periods for different HIV screening tests and the implications for interpreting results and counselling patients.

Taylor *et al.* [73] reviewed data from commercial and literature-reported seroconversion panels to calculate the window period for third- and fourth-generation tests and calculate the probability of a negative test result during the window period. For third-generation tests the cumulative probability of a negative HIV test results was 5%, 1% and 0% by 40, 85 and 99 days post-exposure, respectively, and for fourth-generation tests the corresponding intervals were 34, 42 and 50 days. Rapid POCTs were excluded from this analysis and are expected to have longer window periods than laboratory-based investigations.

Delaney *et al.* [69] evaluated 20 US Food and Drug Administration (FDA)-approved HIV immunoassays against the Aptima HIV-1 RNA test (the only HIV-1 nucleic acid test approved for diagnosis by the FDA) using 222 longitudinal samples from 25 HIV seroconvertors in the USA. Time between detection of HIV RNA and reactive immunoassay results was combined with simulated eclipse period (time from exposure to HIV RNA detection) data to estimate the window period for each test. The median window period data for each type of screening test are presented in Table 1 including 99th percentile values (i.e. the number of days post-exposure by which time 99% of HIV infections would yield a reactive result).

Table 1 Estimated median, interquartile range (IQR) and 99th percentile window period by test type

Type (no. of inclusive tests)	**Median (IQR), days**	**99th percentile, days**
Antibody/antigen laboratory (4)	17.8 (13.0–23.6)	44.3
IgG/IgM-sensitive laboratory (3)	23.1 (18.4–28.8)	49.5

IgG-sensitive rapid screening (6)	31.1 (26.2–37.0)	56.7
IgG-sensitive supplemental (2)	33.4 (28.5–39.2)	58.2
Western blot (viral lysate) (1)	36.5 (31.0–43.2)	64.8

The authors concluded that 99% of HIV infections would be picked up by fourth-generation tests by 45 days post-exposure, and most by 50 days post-exposure using third-generation tests. All tests were capable of detecting infection by 3 months post-exposure.

Atypical results on antiretroviral treatment

Post-exposure prophylaxis, PrEP and early ART initiation in acute infection can blunt the HIV antibody response [69] yielding non-reactive, atypical or non-progressive HIV serology in a setting in which the HIV viral load is likely to be undetectable. BASHH/BHIVA PrEP guidelines [74] recommend that atypical test results in individuals taking, or after recent, PrEP should be discussed with a regional expert and investigated further for possible seroconversion and the Antiviral Unit of PHE Colindale should be informed (non-identifying information sent to csuqueries@phe.gov.uk).

Diagnosing breakthrough HIV infections on PrEP is challenging and may involve multiple tests including western blot, RNA and proviral DNA molecular assays [74]. Any sudden increase in the level of reactivity in a repeat sample in a diagnostic assay, even if still below the negative cut-off, should be considered suspicious and monitored. Anyone with atypical HIV tests on PrEP should undergo repeat testing 4 and 8 weeks after PrEP cessation. See boxes 1 and 2 for more information:

Box 1: Atypical HIV results: what to look for

1	Low signals near to cut-off in screening assays (including either just below or below cut-off)
2	Seroreversion on follow-up specimens
3	Discrepant results between assays
4	Slow development of antibody/antigen signals in subsequent samples
5	Weak and/or incomplete banding patterns on line immunoassay or western blot

Box 2: HIV tests available at Reference Laboratory Services at PHE Colindale

1	Wide range of assays (non-standard commercial and in-house enzyme-linked immunosorbent assays, proviral DNA and novel sequencing)
2	Western blot to determine antibody-specific responses

3	Collation of test results from a variety of platforms to determine PrEP interference with particular assays
4	Referral to clinic specialising in atypical serological responses to HIV infection (difficult diagnoses)

8 Barriers to HIV testing and interventions to address these issues

Recommendations (Grade 1A)

- Any doctor, nurse or other health professional should be competent to offer an HIV test.
- An opt-out HIV testing approach should be adopted to address barriers to HIV testing.
- Education and training on HIV testing should be provided to healthcare workers who may be expected to act on these guidelines.
- The offer of an HIV test should be integrated into routine practice to normalise HIV testing.

Evidence review

Barriers to testing

Barriers to HIV testing can occur at various levels including policy, health system, healthcare provider and individual.

Barriers at the structural, policy, legal and organisational levels:

1) Access to services

Barriers to access may include the geographical distance to a testing venue, necessitating expenditure of time and money [75-77], limited or inappropriate service opening hours, length of waiting time and the time taken to receive test results [69]. Individuals may also be concerned about testing for HIV in relation to their immigration status [76, 78] or for fear of prosecution for reckless transmission [79].

2) Testing environment

Consideration should be given to making the testing environment accessible and conducive to testing. These considerations may be more acute for marginalised, young or vulnerable patient populations. A lack of cultural sensitivity can result in a perceived stigma, leading to non-attendance [76, 77]. Transgender people report gaps in provider competence relating to HIV testing [80].

3) Service capacity

Services and staff report insufficient time , staff and training to expand HIV testing [81].

4) Cost

A lack of funding or reimbursement [81] may act as a disincentive to implementation of testing.

Barriers to testing at a healthcare provider level:

1) Clinicians may lack the relevant knowledge and skills to effectively offer an HIV test to an individual for whom it is indicated.
2) Non-HIV specialist physicians may be unaware of who to test and when and the benefits of testing to the individual [81].
3) Lack of relevant communication skills and ability to undertake risk assessment [82].
4) Lack of skill in relation to rapid POCTs.

Barriers to testing at the individual level:
1) Lack of awareness, or the perception of being at low risk for HIV: individuals may have never tested despite risk of exposure, they may assume on-going negative status following a negative test result, or they may have failed to seek healthcare for relevant symptoms.
2) Fear of a positive result: due to cultural or psychosocial factors, particularly if stigma is anticipated, individuals may fear testing for HIV due to concerns relating to disclosure and risks to their confidentiality, or for fear of rejection or discrimination in the home, workplace or healthcare setting. Fear of HIV illness or dying may underpin reluctance to test for HIV. These concerns will be fuelled by lack of knowledge of the impact of treatment, including benefits to the individual with regard to prevention of transmission, and of the ability to obtain insurance.

Interventions to overcome barriers and to increase testing

Various interventions to implement HIV testing have been assessed.

The most acceptable and effective example of routine HIV testing has been the adoption of universal HIV testing in antenatal clinics in the UK and Ireland. This is offered on a true opt-out basis as part of routine care. The uptake is near universal with over 99% coverage [1] and this together with appropriate management of the pregnant woman has directly led to the near elimination of vertical transmission of HIV in the UK [83].

Routine opt-out HIV testing as part of a sexual health screen for patients attending sexual health clinics has been similarly successful and is highly acceptable to patients and staff [83, 84].

Despite these examples, the role out of routine HIV testing in other clinical settings has been less successful [33, 65, 85]. Efforts to introduce HIV testing routinely in services for TB, lymphoma and hepatitis have had mixed results [86, 87].

Testing of patients attending medical services such as emergency departments and acute medical admissions units in areas of high prevalence have demonstrated that patients have few objections to the offer of a test and when offered the uptake is high [59, 86].

It was demonstrated that in an area of high prevalence in North London, for each additional general practitioner who attended a brief educational intervention, overall individual practice HIV testing rates increased by 16%, and that this increase was sustained over 8 years of observation [88]. However other studies have shown no effect [89,90].

Some studies employed extra staff to request consent from patients for testing. Although this was initially successful, as it addressed capacity, competence and confidence concerns, it was not sustainable in the longer term after the conclusion of the study [65].

A more robust approach has been to integrate HIV testing into routine investigations so that the offer of the test becomes normal practice with no additional resource required [59, 91]. This helps normalises HIV testing, making the test part of the routine work up for all patients with no special consent required beyond that required for any routine blood test.

9 Testing where the patient lacks capacity to consent

Legislation in England, Wales and Scotland provides a framework for decision-making on behalf of adults aged 16 and over who lack capacity to make decisions on their own behalf (including the unconscious patient). The Mental Capacity Act 2019 applies to England and Wales. In Scotland, the Adults with Incapacity (Scotland) Act 2000 applies, for which there is a separate British Medical Association (BMA) guidance note. In Northern Ireland, common law applies.

Persons lack capacity if, at the time the decision needs to be made, they are unable to make a decision because of a mental disorder or are unable to communicate their decision. Key points to consider when assessing capacity:

1) The assessment of capacity relates to the specific issue in question, in this case consent to HIV testing.

2) Start from the presumption that the patient has capacity to make this decision.

3) Consider whether patients understand what decision they are being asked to make and can assess the information relevant to the decision; do they understand the consequences of making a choice?

4) Take all possible steps to help patients make a decision for themselves (e.g. provide information in an accessible form such as drawings). If a patient is judged to lack capacity to consent to an HIV test, consider whether this is temporary or permanent. If temporary, testing should be deferred until the patient regains capacity, unless testing is immediately necessary to save the patient's life or prevent a serious deterioration of their condition.

5) If the lack of capacity is, or is likely to be, permanent a decision should be sought from any person with relevant powers of attorney or the requirements of any valid advance statements should be followed.

6) If the patient has not appointed an attorney nor left a valid advance statement, HIV testing may be undertaken where this is in the best interests of the patient (England and Wales) or is necessary and of benefit to the patient (Scotland).

Guidance on assessing capacity is published by the BMA and the GMC [92]. Advice on how to assess appropriate treatment of patients who lack capacity is available in the relevant statutory codes of

practice for England and Scotland [93].

If consciousness is regained the patient should be told of the test result as soon as practicable.

If a patient dies, a decision should be made on disclosure according to the circumstances (e.g. others at risk and previously disclosed wishes).

10 List of abbreviations

AIDS	Acquired immunodeficiency syndrome
ART	Antiretroviral therapy
BASHH	British Association for Sexual Health and HIV
BHIVA	British HIV Association
BIA	British Infection Association
BMA	British Medical Association
CI	Confidence interval
CrI	Credible interval
DBS	Dried blood spot
FDA	Food and Drug Administration
GBL	Gamma butyrolactone
GHB	Gamma hydroxybutyrate
GMC	General Medical Council
HIV	Human immunodeficiency virus
Ig	Immunoglobulin
IQR	Interquartile range
MSM	Men who have sex with men
MT	Mini-tube
PHE	Public Health England
POCT	Point-of-care test
PrEP	Pre-exposure prophylaxis
PWID	People who inject drugs
QALY	Quality-adjusted life year
STI	Sexually transmitted infection
TasP	Treatment as prevention

TB	Tuberculosis

Appendix 1. Indicator conditions

Table 1 AIDS-defining conditions in people living with HIV

Category	Condition
Neoplasms	Cervical cancer Non-Hodgkin lymphoma Kaposi's sarcoma
Bacterial infections	*Mycobacterium tuberculosis*, pulmonary or extrapulmonary *Mycobacterium avium* complex or *Mycobacterium kansasii*, disseminated or extrapulmonary Mycobacterium, other species or unidentified species, disseminated or extrapulmonary Pneumonia, recurrent (two or more episodes in 12 months) Salmonella septicaemia, recurrent
Viral infections	Cytomegalovirus retinitis Cytomegalovirus, other (except liver, spleen, glands) Herpes simplex, ulcer(s) >I month/bronchitis/pneumonitis Progressive multifocal leukoencephalopathy
Parasitic infections	Cerebral toxoplasmosis Cryptosporidiosis diarrhoea, >1 month Isosporiasis, >1 month Atypical disseminated leishmaniasis Reactivation of American trypanosomiasis (meningoencephalitis or myocarditis)
Fungal infections	*Pneumocystis carinii* pneumonia Candidiasis, oesophageal Candidiasis, bronchial/tracheal/pulmonary Cryptococcosis, extrapulmonary Histoplasmosis, disseminated/extrapulmonary Coccidioidomycosis, disseminated/extrapulmonary Penicilliosis, disseminated

Table 2 Evidence grading for HIV indicator conditions (where HIV test is recommended), defined by having an undiagnosed HIV prevalence of at least 1 per 1000

Indicator condition	**Strength of recommendation (1/2)**	**Grade of evidence (A–D)**	**Reference**
Sexually transmitted infections	1	C	[94-96]
Malignant lymphoma	1	C	[97-101]
Anal cancer/dysplasia	1	C	[96,100]
Cervical dysplasia	1	C	[96,100,102]
Herpes zoster	1	C	[96,101]
Hepatitis B or C (acute or chronic)	1	C	[100,101,103]
Unexplained lymphadenopathy	1	C	[100,104]
Mononucleosis-like illness	1	C	[100,101,105,106]
Community-acquired pneumonia	1	C	[96,100,101,107]
Unexplained leukocytopenia/ thrombocytopenia lasting >4 weeks	1	C	[96,100,101]
Seborrheic dermatitis/exanthema	1	C	[100,108,109]
Peripheral neuropathy	1	C	[100,101,104]
Severe or atypical psoriasis	1	C	[100]
Mononeuritis	1	D	[110]
Unexplained weight loss	1	D	[94,111-113]
Unexplained oral candidiasis	1	D	[101,111]

Hepatitis A	1	D	[101,111,114]
Unexplained fever	1	D	[111,115]
Candidaemia	2	D	
Visceral leishmaniasis	2	D	
Primary lung cancer	2	D	[100]
Invasive pneumococcal disease	2	D	
Oral hairy leukoplakia	2	D	
Guillain–Barré syndrome	2	D	
Subcortical dementia	2	D	
Multiple sclerosis-like disease	2	D	[110]
Unexplained chronic diarrhoea	2	D	
Unexplained chronic renal impairment	2	D	

Appendix 2. HIV tests: definition

First generation	Based on viral lysate antigens to detect HIV antibodies (e.g. western blot)
Second generation	Utilise synthetic peptide or recombinant protein antigens with/without viral lysates to detect HIV immunoglobulin (Ig)G antibodies
Third generation	Synthetic peptide or recombinant protein antigen-based tests detect IgM and IgG antibodies with increased sensitivity during early seroconversion
Fourth generation	Combination third-generation assays to detect IgM and IgG antibodies, and monoclonal antibodies to detect p24 antigen
Fifth generation	Detect and distinguish between HIV-1/2 antibodies and p24 antigen in the same sample

References

1. Public Health England. *HIV: annual data tables*. 2019. Available at: https://www.gov.uk/government/statistics/hiv-annual-data-tables (accessed November 2019).
2. Department of Health and Social Care. *Health Secretary announces goal to end HIV transmissions by 2030*. 2019. Available at: https://www.gov.uk/government/news/health-secretary-announces-goal-to-end-hiv-transmissions-by-2030 (accessed November 2019).
3. Walensky RP, Weinstein MC, Kimmel AD *et al*. Routine human immunodeficiency virus testing: an economic evaluation of current guidelines. *Am J Med* 2005; **118**: 292–300.
4. Graves N, Walker DG, McDonald AM *et al*. Would universal antenatal screening for HIV infection be cost-effective in a setting of very low prevalence? Modelling the data for Australia. *J Infect Dis* 2004; **190**: 166–174.
5. General Medical Council. *Consent: patients and doctors making decisions together* (under review). 2018. Available at: https://www.gmc-uk.org/ethical-guidance/ethical-guidance-for-doctors/consent (accessed November 2019).
6. GRADE Working Group. *Grading the quality of evidence and the strength of recommendations.* Available at: www.gradeworkinggroup.org/intro.htm (accessed November 2019).
7. Guyatt GH, Oxman AD, Kunz R *et al*. *Going from evidence to recommendations. BMJ* 2008; **336**: 1049–1051.
8. UNAIDS. *UNAIDS data 2018.* 2018. Available at: https://www.unaids.org/sites/default/files/media_asset/unaids-data-2018_en.pdf (accessed November 2019).
9. Public Health England. *Bloodborne infections in blood, tissue and organ donors (BIBD): guidance, data and analysis.* 2014. Available at: https://www.gov.uk/government/collections/bloodborne-infections-in-blood-and-tissue-donors-bibd-guidance-data-and-analysis (accessed November 2019).
10. Public Health England. *Prevalence of HIV infection in the UK in 2018.* 2019. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/843766/hpr3919_hiv18.pdf (accessed November 2019).
11. Public Health England. *Progress towards ending the HIV epidemic in the United Kingdom 2018 report.* 2019. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/821273/Progress_towards_ending_the_HIV_epidemic_in_the_UK.pdf (accessed November 2019).
12. Paltiel AD, Weinstein MC, Kimmel AD *et al*. Expanded screening for HIV in the United States--an analysis of cost-effectiveness. *N Engl J Med* 2005; **352**: 586–595.
13. National Institute for Health and Care Excellence. *HIV testing: increasing uptake among people who may have undiagnosed HIV. Clinical guideline [NG60].* 2016. Available at: https://www.nice.org.uk/guidance/ng60 (accessed November 2019).
14. Leber W, McMullen H, Anderson J *et al*. Promotion of rapid testing for HIV in primary care (RHIVA2): a cluster-randomised controlled trial. *Lancet HIV* 2015; **2**: e229–235.
15. Baggaley RF, Irvine MA, Leber W *et al*. Cost-effectiveness of screening for HIV in primary care: a health economics modelling analysis. *Lancet HIV* 2017; **4**: e465–e474.
16. Lucas A, Armbruster B. The cost-effectiveness of expanded HIV screening in the United States. *AIDS* 2013; **27**: 795–801.

17. Gray RT, Prestage GP, Down I *et al*. Increased HIV testing will modestly reduce HIV incidence among gay men in NSW and would be acceptable if HIV testing becomes convenient. *PLoS One* 2013; **8**: e55449.
18. Hutchinson AB, Farnham PG, Sansom SL *et al*. Cost-effectiveness of frequent HIV testing of high-risk populations in the United States. *J Acquir Immune Defic Syndr* 2016; **71**: 323–330.
19. Wilson DP, Heymer KJ, Anderson J *et al*. Sex workers can be screened too often: a cost-effectiveness analysis in Victoria, Australia. *Sex Transm Infect* 2010; **86**: 117–125.
20. Clutterbuck D, Asboe D, Barber T *et al*. 2016 United Kingdom national guideline on the sexual health care of men who have sex with men. *Int J STD AIDS* 2018: 956462417746897.
21. Centers for Disease Control and Prevention (CDC). *Preexposure prophylaxis for the prevention of HIV infection in the United States – 2014 clinical practice guideline.* 2014. Available at: https://www.cdc.gov/hiv/pdf/risk/prep/cdc-hiv-prep-guidelines-2017.pdf (accessed November 2019).
22. Read TR, Hocking JS, Bradshaw CS *et al.* Provision of rapid HIV tests within a health service and frequency of HIV testing among men who have sex with men: randomised controlled trial. *BMJ* 2013; **347**: f5086.
23. Solomon MM, Mayer KH, Glidden DV *et al*. Syphilis predicts HIV incidence among men and transgender women who have sex with men in a preexposure prophylaxis trial. *Clin Infect Dis* 2014; **59**: 1020–1026.
24. Harte D, Mercey D, Jarman J, Benn P. Is the recall of men who have sex with men (MSM) diagnosed as having bacterial sexually transmitted infections (STIs) for re-screening a feasible and effective strategy? *Sex Transm Infect* 2011; **87**: 577–582.
25. McCormack S, Dunn DT, Desai M *et al*. Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): effectiveness results from the pilot phase of a pragmatic open-label randomised trial. *Lancet* 2016; **387**: 53–60.
26. Molina J, Capitant C, Spire B *et al*. On-demand preexposure prophylaxis in men at high risk for HIV-1 infection. *N Engl J Med* 2015; **373**: 2237–2246.
27. 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**: e241–e250.
28. Whitlock G, Duke O, Nwokolo N, McOwan A. Active recall of high-risk msm by text message. *Sex Transm Infect* 2015; **91 Suppl 1**: A72.
29. Bourne C, Knight V, Guy R *et al*. Short message service reminder intervention doubles sexually transmitted infection/HIV re-testing rates among men who have sex with men. *Sex Transm Infect* 2011; **87**: 229–231.
30. Desai M, Woodhall SC, Nardone A *et al*. Active recall to increase HIV and STI testing: a systematic review. *Sex Transm Infect* 2015; **91**: 314–323.
31. Estem KS, Catania J, Klausner JD. HIV self-testing: a review of current implementation and fidelity. *Curr HIV/AIDS Rep* 2016; **13**: 107–115.
32. Brown AE, Mohammed H, Ogaz D *et al*. Fall in new HIV diagnoses among men who have sex with men (MSM) at selected London sexual health clinics since early 2015: testing or treatment or pre-exposure prophylaxis (PrEP)? *Euro Surveill* 2017; **22**: 30553.
33. Public Health England. *HIV testing in England: 2017 report.* 2017. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/659078/HIV_testing_in_England_report_2017.pdf (accessed November 2019).
34. Paul-Erlich-Institut. *HIV self-tests.* 2019. Available at: https://www.pei.de/EN/in-vitro-diagnostics/hiv-self-testing-content.html (accessed November 2019).
35. Public Health England. *HIV testing and self-testing information update November 2015.* 2015. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_

data/file/572798/HIV_Self-Testing_PHE_Position_v13_-_Nov_15_updated.pdf (accessed November 2019).
36. Carballo-Dieguez A, Frasca T, Dolezal C. *et al*. Will gay and bisexually active men at high risk of infection use over-the-counter rapid HIV tests to screen sexual partners? *J Sex Res* 2012; **49**: 379–387.
37. Witzel T, Weatherburn P, Burns A *et al*. What role does HIV self-testing (HIV-ST) have for men who have sex with men (MSM) in the UK? Testing needs, social norms & biological citizenship. *International AIDS Conference*. July 2016. Durban, South Africa.
38. World Health Organization. *Guidelines on HIV self-testing and partner notification.* 2016. Available at: http://apps.who.int/iris/bitstream/handle/10665/251655/9789241549868-eng.pdf;jsessionid=A05D4B56BBABED6DEFA72631A88C73FD?sequence=1 (accessed November 2019).
39. Figueroa C, Johnson C, Verster A, Baggaley R. Attitudes and acceptability on HIV self-testing among key populations: a literature review. *AIDS Behav* 2015; **19**: 1949–1965.
40. 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. *J Int AIDS Soc* 2017; **20**: 21594.
41. Frye V, Wilton L, Hirshfield S *et al*. *"Just* because it's out there, people aren't going to use it." HIV self-testing among young, black MSM, and transgender women. *AIDS Patient Care STDS* 2015; **29**: 617–624.
42. European Centre for Disease Prevention and Control. *Public health guidance on HIV, hepatitis B and C testing in the EU/EEA An integrated approach.* 2018. Avaialble at: https://www.ecdc.europa.eu/sites/portal/files/documents/hiv-hep-testing-guidance.pdf (accessed November 2019).
43. Brady M. *Self-testing for HIV: initial experience of the UK's first kit*. 2017. Available at: https://www.bhiva.org/file/DkypjlwQLInTc/MichaelBrady.pdf (accessed November 2019).
44. Patel AV, Abrams SM, Gaydos CA *et al*. Increasing HIV testing engagement through provision of home HIV self-testing kits for patients who decline testing in the emergency department: a pilot randomisation study. *Sex Transm Infect* 2019; **95**: 358–360.
45. Public Health England. *National HIV self-sampling service November 2017 to October 2018.* 2019. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/789793/national_HIV_self_sampling_service_november_2017_to_october_2018.pdf (accessed November 2019).
46. Elliot E, Rossi M, McCormack S, McOwan A. Identifying undiagnosed HIV in men who have sex with men (MSM) by offering HIV self-sampling via online gay social media: a service evaluation. *Sex Trans Infect* 2016; **92**: 470–473.
47. Page M, Atabani SF, Wood M *et al*. Dried blood spot and mini-tube blood sample collection kits for postal HIV testing services: a comparative review of successes in a real-world setting. *Sex Transm Infect* 2019; **95**: 43–45.
48. Sulat J, Prabandari Y, Sanusi R *et al*. The impacts of community-based HIV testing and counselling on testing uptake: a systematic review. *J Health Res* 2018; **32**: 152–163.
49. Reyes-Uruena J, Breveglieri M, Furegato M *et al.* Heterogeneity of community-based voluntary counselling and testing service for HIV in Europe: the HIV-COBATEST survey. *Int J STD AIDS* 2017; **28**: 28–38.
50. Qvist T, Cowan SA, Graugaards C, Helleberg M. High linkage to care in a community-based rapid HIV testing and counseling project among men who have sex with men in Copenhagen. *Sex Transm Dis* 2014; **41**: 209–214.
51. Choko AT, Nanfuka M, Birungi J *et al.* A pilot trial of peer-based distribution of HIV self-test kits among fishermen in Bulisa, Uganda. *PLoS One* 2018; **13**: e0208191.

52. Chan SY, Hill-Tout R, Rodgers M, Cormack I. Acceptance of HIV testing in medical inpatients: a local acceptability study. *Int J STD AIDS* 2011; **22**: 187–189.
53. Drayton R, Keane F, Prentice E. Patients' attitudes towards increasing the offer of HIV testing in primary and secondary care. *Int J STD AIDS* 2010; **21**: 563–566.
54. Ellis J, Hempling M, Zielicka-Hardy A *et al*. Routine opt-out HIV testing in the emergency department: feasible and acceptable. *HIV Med* 2015; **16 Suppl 2**: 12–77 (Abstract P120).
55. Gennotte AF, Semaille P, Ellis C *et al*. Feasibility and acceptability of HIV screening through the use of rapid tests by general practitioners in a Brussels area with a substantial African community. *HIV Med* 2013; **14 Suppl 3**: 57–60.
56. Henriquez-Camacho C, Villafuerte-Gutierrez P, Pérez-Molina JA *et al*. Opt out screening strategy for HIV infection among patients attending emergency departments; systematic review and meta-analysis. *HIV Med* 2017; **18**: 419–429.
57. Mody N, Perry N, Richardson D *et al*.; Brighton HIV Testing Steering Group. Routine HIV testing in acute hospital admissions. *HIV Med* 2016; **17**: 634.
58. Public Health England. *Progress towards ending the HIV epidemic in the United Kingdom 2018 report – appendix.* 2018. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/769001/HIV_annual_report_2018_-_Appendix_101218.pdf (accessed November 2019).
59. Palfreeman A, Nyatsanza F, Farn H *et al*. HIV testing for acute medical admissions: evaluation of a pilot study in Leicester, England. *Sex Transm Infect* 2013; **89**: 308–310.
60. Brady M, Howells W, James C *et al*. *HIV self-testing: feasibility and acceptability of a large scale national service. HIV Med* 2017; **18 Suppl S1**: 3–13 (Abstract 07).
61. d'Almeida KW, Kierzek G, de Truchis P *et al*.; Emergency Department HIV-Screening Group. Modest public health impact of non-targeted human immunodeficiency virus screening in 29 emergency departments. *Arch Intern Med* 2012; **172**: 12–20.
62. De Coster DA, Sivalokanathan S, Sornum A, Kegg S. *HIV testing of acute medical admissions – any sign of progress? HIV Med* 2015; **16 Suppl 2**: 12–77 (Abstract P148).
63. Cropp A. Is the acute medical unit (AMU) the right place for HIV testing? A real life look. *HIV Med* 2015; **16 Suppl 2**: 12–77 (Abstract P147).
64. Elgalib A, Fidler S, Sabapathy K. Hospital-based routine HIV testing in high-income countries: a systematic literature review. *HIV Med* 2018; **19**: 195–205.
65. Rayment M, Rae C, Ghooloo F *et al*. Routine HIV testing in the emergency department: tough lessons in sustainability. *HIV Med* 2013; **14 Suppl 3**: 6–9.
66. Rayment M, Rae C, Sullivan A *et al*. Routine HIV testing on an acute admissions unit (AAU) feasible and affordable but a challenge to sustain. *HIV Med* 2015; **16 Suppl 2**: 48 (Abstract P113).
67. Brady M, Nardone A, Buenaventura E *et al.* Acceptability of home HIV sampling and testing: a user survey. *HIV Med* 2014; **15 Suppl 3**: 89 (Abstract P230).
68. Ellis S, Graham L, Price D, Ong E. Offering HIV testing in an acute medical admissions unit. *HIV Med* 2011; **12 Suppl 1**: 14–86 (Abstract P137).
69. Delaney KP, Hanson DL, Masciotra S *et al*. Time until emergence of HIV test reactivity following infection with HIV-1: implications for interpreting test results and retesting after exposure. *Clin Infect Dis* 2017; **64**: 53–59.
70. Centers for Disease Control and Prevention. *Laboratory testing for the diagnosis of HIV infection: updated recommendations.* 2014. Available at: http://dx.doi.org/10.15620/cdc.23447 (accessed November 2019).
71. Gökengin D, Geretti AM, Begovac J *et al*. 2014 European Guideline on HIV testing. *Int J STD AIDS* 2014; 25: 695–704.

72. Public Health England. *HIV screening and confirmation. UK Standards for Microbiology Investigations.* 2017. Available at: https://www.gov.uk/government/publications/smi-v-11-anti-hiv-screening (accessed November 2019).
73. Taylor D, Durigon M, Davis H *et al*. Probability of a false-negative HIV antibody test result during the window period: a tool for pre- and post-test counselling. *Int J STD AIDS* 2015; **26**: 215–224.
74. British HIV Association/British Association for HIV and Sexual Health. *BHIVA/BASHH guidelines on the use of HIV pre-exposure prophylaxis (PrEP) 2018.* 2018. Available at: https://www.bhiva.org/file/5b729cd592060/2018-PrEP-Guidelines.pdf (accessed November 2019).
75. Alvarez-Del Arco D, Monge S *et al*. Implementing and expanding HIV testing in immigrant populations in Europe: comparing guideline's recommendations and expert's opinions. *Enferm Infecc Microbiol Clin* 2017; **35**: 47–51.
76. Flowers P, Knussen C, Li J, McDaid L. Has testing been normalized? An analysis of changes in barriers to HIV testing among men who have sex with men between 2000 and 2010 in Scotland, UK. *HIV Med* 2013; **14**: 92–98.
77. Hoyos J, Fernandez-Balbuena S, de la Fuente L *et al.* Never tested for HIV in Latin-American migrants and Spaniards: prevalence and perceived barriers. *J Int AIDS Soc* 2013; **16**: 18560.
78. Seedat F, Hargreaves S, Friedland JS. Engaging new migrants in infectious disease screening: a qualitative semi-structured interview study of UK migrant community health-care leads. *PLoS One* 2014; **9**: e108261.
79. Lazzarini Z, Galletly CL, Mykhalovskiy E *et al*. Criminalization of HIV transmission and exposure: research and policy agenda. *Am J Public Health* 2013; **103**: 1350–1353.
80. Scheim AI, Travers R. Barriers and facilitators to HIV and sexually transmitted infections testing for gay, bisexual, and other transgender men who have sex with men. *AIDS Care* 2017; **29**: 990–995.
81. Davies C, Gompels M, May M. Public and healthcare practitioner attitudes towards HIV testing: review of evidence from the United Kingdom (UK). *Int STD Res Rev* 2015; **3**: 91–112.
82. Public Health England. *HIV in the UK 2016 report.* 2016. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/602942/HIV_in_the_UK_report.pdf (accessed November 2019).
83. British HIV Association. *BHIVA guidelines for the management of HIV in pregnancy and postpartum 2018.* 2019. Available at: https://www.bhiva.org/pregnancy-guidelines (accessed November 2019).
84. Thornton AC, Rayment M, Elam G *et al*. Exploring staff attitudes to routine HIV testing in non-traditional settings: a qualitative study in four healthcare facilities *Sex Transm Infect* 2012; **88**: 601–606.
85. Ong K, Thornton A, Fisher M *et al*. Estimated cost per HIV infection diagnosed through routine HIV testing offered in acute general medical admission units and general practice settings in England. *HIV Med* 2016; **17**: 247–254.
86. Bath R, O'Connell R, Lascar M *et al*. TestMeEast: a campaign to increase HIV testing in hospitals and to reduce late diagnosis *AIDS Care* 2016; **28**: 608–611.
87. Roy A, Anaraki S, Hardelid P *et al*. Universal HIV testing in London tuberculosis clinics: a cluster randomised controlled trial. *Eur Respir J* 2013; **41**: 627–634.
88. Pillay K, Gardner M, Gould A *et al*. Long term effect of primary health care training on HIV testing: a quasi-experimental evaluation of the Sexual Health in Practice (SHIP) intervention. *PLoS One* 2018; **13**: e0199891.
89. Rayment M , Thornton A, Mandalia S *et al*.; HINTS Study Group. HIV testing in non-traditional settings – the HINTS study: a multi-centre observational study of feasibility and acceptability. *PLoS One* 2012; **7**: e39530.

90. Bailey AC, Dean G, Hankins M, Fisher M. Attending an STI Foundation course increases chlamydia testing in primary care, but not HIV testing. *Int J STD AIDS* 2008; **19**: 633–634.
91. Bath R, Ahmad K, Orkin C. Routine HIV testing within the emergency department of a major trauma centre: a pilot study. *HIV Med* 2015; **16**: 326–328.
92. British Medical Association. *6. Adults who lack capacity.* 2018. Available at: https://www.bma.org.uk/advice/employment/ethics/consent/consent-tool-kit/6-adults-who-lack-capacity (accessed November 2019).
93. British Medical Association. *Mental capacity for adults in Scotland and Northern Ireland.* 2018. Available at: https://www.bma.org.uk/advice/employment/ethics/mental-capacity/mental-capacity-scotland-and-ni (accessed November 2019).
94. Goulet JL, Martinello RA, Bathulapalli H *et al*. STI diagnosis and HIV testing among OEF/OIF/OND veterans. *Med Care* 2014; **52**: 1064–1067.
95. Harte D, Mercey D, Jarman J, Benn P. Is the recall of men who have sex with men (MSM) diagnosed as having bacterial sexually transmitted infections (STIs) for re-screening a feasible and effective strategy? *Sex Transm Infect* 2011; **87**: 577–582.
96. Sullivan AK, Raben D, Reekie J *et al*. Feasibility and effectiveness of indicator condition-guided testing for HIV: results from HIDES I (HIV indicator diseases across Europe study). *PLoS One* 2013; **8**: e52845.
97. D'Addario G, Dieterle A, Torhorst J *et al*. HIV-testing and newly-diagnosed malignant lymphomas. The SAKK 96/90 registration study. *Leuk Lymphoma* 2003; **44**: 133–138.
98. LeVoir H, Wexler S, Horn K. Audit of HIV testing in a lymphoma clinic. *Sex Transm Infect* 2015; **91 Suppl 1**: A42.
99. Mosimann V, Cavassini M, Hugli O *et al*. Patients with AIDS-defining cancers are not universally screened for HIV: a 10-year retrospective analysis of HIV-testing practices in a Swiss university hospital. *HIV Med* 2014; **15**: 631–634.
100. Raben D, Sullivan AK, Mocroft A *et al*. Improving the evidence for indicator condition guided HIV testing in Europe: results from the HIDES II Study - 2012 - 2015. *PLoS One* 2019; **14**: e0220108.
101. Søgaard OS, Lohse N, Østergaard L *et al*. Morbidity and risk of subsequent diagnosis of HIV: a population based case control study identifying indicator diseases for HIV infection. *PLoS One* 2012; **7**: e32538.
102. Qureshi NS, Manavi K. The prevalence of HIV among women with high-grade cervical smear abnormalities in Birmingham, United Kingdom: a prospective cohort study. *Eur J Obstet Gynecol Reprod Biol* 2017; **212**: 51–53.
103. Armed Forces Health Surveillance Center (AFHSC). Surveillance snapshot: service members with hepatitis B, hepatitis C, and HIV-1, active component, U.S. Armed Forces. *MSMR* 2011; **18**: 23.
104. Joore IK, Arts DL, Kruijer MJP *et al*. HIV indicator condition-guided testing to reduce the number of undiagnosed patients and prevent late presentation in a high-prevalence area: a case-control study in primary care. *Sex Transm Infect* 2015; **91**: 467–472.
105. Hsu DTS, Ruf M, O'Shea S *et al*. Diagnosing HIV infection in patients presenting with glandular fever-like illness in primary care: are we missing primary HIV infection? *HIV Med* 2013; **14**: 60–63.
106. Pyziak-Kowalska KA, Kowalska J, Horban A. Rationales for indicator condition-based HIV testing data from the Hospital for Infectious Diseases in Warsaw – one-year observation. *HIV AIDS Rev* 2017; **3**: 191–194.
107. Sharvill R, Fernandes A, Allen K, Astin J. Adopting universal testing for HIV in intensive care for patients admitted with severe pneumonia: results from our change in practice. *Int J STD AIDS* 2016; **28**: 88–90.

108. Menacho I, Sequeira E, Muns M *et al*. Comparison of two HIV testing strategies in primary care centres: indicator-condition-guided testing vs. testing of those with non-indicator conditions. *HIV Med* 2013; **14 Suppl 3**: 33–37.
109. Scognamiglio P, Chiaradia G, De Carli G *et al*. The potential impact of routine testing of individuals with HIV indicator diseases in order to prevent late HIV diagnosis. *BMC Infect Dis* 2013; 13: 473.
110. Omland LH, Legarth R, Ahlström MG *et al*. Five-year risk of HIV diagnosis subsequent to 147 hospital-based indicator diseases: a Danish nationwide population-based cohort study. *Clin Epidemiol* 2016; **8**: 333–340.
111. Damery S, Nichols L, Holder R *et al*. Assessing the predictive value of HIV indicator conditions in general practice: a case-control study using the THIN database. *Br J Gen Pract* 2013; **63**: e370–377.
112. Tominski D, Katchanov J, Driesch D *et al*. The late-presenting HIV-infected patient 30 years after the introduction of HIV testing: spectrum of opportunistic diseases and missed opportunities for early diagnosis. *HIV Med* 2017; **18**: 125–132.
113. Wood E, Kerr T, Rowell G *et al*. Does this adult patient have early HIV infection?: The Rational Clinical Examination systematic review. *JAMA* 2014; **312**: 278–285.
114. Girardi E, Scognamiglio P, Sciarrone MR *et al*. High HIV prevalence in male patients with acute hepatitis A in the Rome metropolitan area, Italy 2002–2008. *J Hepatol* 2011; **54**: 1102–1106.
115. Siikamäki HM, Kivelä PS, Sipilä PN *et al*. Fever in travellers returning from malaria-endemic areas: don't look for malaria only. *J Travel Med* 2011; **18**: 239–244.