

LONDON  
SCHOOL of  
HYGIENE  
& TROPICAL  
MEDICINE



LSHTM Research Online

Elgalib, A; Fidler, S; Sabapathy, K; (2017) Hospital-based routine HIV testing in high-income countries: a systematic literature review. HIV medicine. ISSN 1464-2662 DOI: <https://doi.org/10.1111/hiv.12568>

Downloaded from: <http://researchonline.lshtm.ac.uk/4645825/>

DOI: <https://doi.org/10.1111/hiv.12568>

**Usage Guidelines:**

Please refer to usage guidelines at <https://researchonline.lshtm.ac.uk/policies.html> or alternatively contact [researchonline@lshtm.ac.uk](mailto:researchonline@lshtm.ac.uk).

Available under license: <http://creativecommons.org/licenses/by-nc-nd/2.5/>

<https://researchonline.lshtm.ac.uk>

**Title:** Hospital-Based Routine HIV Testing In High-Income Countries:

A Systematic Literature Review

**Running head:** Routine HIV Testing In High-Income Countries

A Elgalib<sup>1</sup>, S Fidler<sup>2</sup>, K Sabapathy<sup>3</sup>

1- Directorate General for Disease Surveillance and Control, Ministry of Health, Post Box 393, Postal Code 10, Muscat, Sultanate of Oman. Tel: 00968 22347507 Fax: 0096824690001  
Email: [alielgalib@yahoo.co.uk](mailto:alielgalib@yahoo.co.uk)

2- Department of HIV Medicine, Imperial College NHS Trust, London, UK

3- Department of Infectious Disease Epidemiology, London School of Hygiene & Tropical Medicine, London, UK

**Key words:** Routine, HIV, testing, high-income, hospital

## ABSTRACT

**Objectives:** To produce a summary of the published evidence of the barriers and facilitators for hospital-based routine HIV testing in high-income countries.

**Methods:** Electronic databases were searched for studies, which described the offer of HIV testing to adults attending emergency departments (EDs) and acute medical units (AMUs) in the UK and US, published between 2006-15. Other high-income countries were not included, as their guidelines do not recommend routine testing for HIV. The main outcomes of interest were HIV testing uptake, HIV testing coverage, factors facilitating HIV screening and barriers to HIV testing. Fourteen studies met the pre-defined inclusion criteria and critically appraised using mixed methods appraisal tool (MMAT).

**Results:** HIV testing coverage ranged from 9.7%-38.3% and 18.7%-26% while uptake levels were high (70.1-84% and 53%-75.4%) in the UK and US, respectively. Operational barriers such as lack of time, the need for training and concerns about giving results and follow up of HIV-positive results, were reported. Patient-specific factors including female sex, old age and low risk perception correlated with refusal of HIV testing. Factors that facilitated the offer of HIV testing were venous sampling (vs. point-of-care tests), commitment of medical staff to HIV testing policy and support from local HIV specialist providers.

**Conclusions:** There are several barriers to routine HIV testing in EDs and AMUs. Many of these stem from staff fears about offering HIV testing due to the perceived lack of knowledge about HIV. Our systematic review highlights areas which can be targeted to increase coverage of routine HIV testing.

## **INTRODUCTION:**

HIV infection is a major global public health threat and is responsible for significant morbidity and mortality (1), despite recent progress in treatment and care. (2) Public Health England reports that 13% (13,500) of the 101,200 people who were estimated, to be living with HIV in the UK in 2015 were unaware of their HIV infection. (3) Similarly, the Centres for Disease Control and Prevention (CDC) surveillance data shows that 13% of the 1.2 million people living with HIV in the United States (US) in 2013 were undiagnosed. (4) Furthermore, 39 % of those diagnosed with HIV in the United Kingdom (UK) in 2015 were diagnosed with CD4 counts < 350 cells/mm<sup>3</sup>, (3) and 46 % of people diagnosed with HIV infection in the US in 2015 were diagnosed with CD4 counts < 200 cells/mm<sup>3</sup> (4) Late-stage HIV diagnosis is associated with increased morbidity and mortality, (5) greater onward transmission (6,7) and high cost of treatment and care. (8)

Historically HIV testing was targeted - based on clinical suspicion and risk assessment. There is now evidence to suggest that targeted strategies result in missed HIV cases, sometimes even when patients present with HIV-associated conditions. (9-14) A recent randomised trial comparing universal testing with targeted testing in an emergency department (ED) in the US, showed that routine testing, defined as testing regardless of risk or clinical condition, identified more HIV cases than targeted testing. (15)

In recognition of the benefits of early HIV diagnosis the CDC published its revised HIV testing guidelines in September 2006 recommending routine opt-out HIV screening for all people aged 13-64 attending any healthcare setting, including the ED, in areas where the prevalence of diagnosed HIV infection in the population exceeds 0.1%. (16) The UK national HIV testing guidelines, (released in 2008) recommended HIV screening in various healthcare settings including all medical admissions in patients aged 16-59 in areas of HIV prevalence of more than 2 in 1000 population. (17-19) Despite the recommendations for routine offer of HIV testing a systematic review showed that the HIV testing coverage in settings where routine testing is recommended was just 29.5%. (20)

We aim to systematically review the literature to identify the facilitators and barriers to HIV screening in emergency departments (EDs) in the US and in acute medical units (AMUs) and EDs in the UK; other high-income countries were not included, as their guidelines do not recommend routine testing for HIV (21-23) Acute medical units serve as extensions of EDs in many hospitals in the UK, where patients are transferred directly from EDs, pending full admission to wards or discharge. We focused on EDs and AMUs as they are attended by a large number of patients a proportion of whom may not have access to other healthcare facilities, especially in the US. They are also the point of entry into health services for many. We hope to produce a summary of existing evidence that will help stakeholders and policy makers implement routine HIV testing and translate into practice what is already recommended.

## **METHODS**

This review was conducted and presented in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendation (24) (Supplementary Material 1).

We searched for publications which report on at least one of the following primary outcomes:

1. Coverage of HIV testing (proportion of people tested for HIV out of those eligible for testing, as per the guidelines) and/or HIV testing uptake (proportion of patients accepted the HIV test offer out of those offered a routine HIV test) in EDs/AMUs or
2. Facilitators (factors helping in increasing the offer of HIV testing and/or uptake) and /or Barriers (factors hindering the offer of HIV testing and/or uptake) of HIV testing in EDs/AMUs.

Electronic databases (MEDLINE and EMBASE) were searched for studies reporting on routine HIV screening (defined as the offer of HIV testing regardless of clinical presentation or HIV risk) as per CDC or UK HIV testing guidelines. We searched for terms, which referred to “facilitators”, “barriers”, “coverage”, “uptake”, “routine HIV testing”, “UK” and “US” (Supplementary Material 2)

Only studies including adults aged  $\geq 13$  years old (US) and  $\geq 16$  years old (UK) as per UK and CDC guidelines, attending EDs in the US or AMUs/EDs in the UK were included. Studies exploring the attitudes of providers of routine HIV screening for the above populations were also included.

No restriction on study design was applied. Only articles published in English language and in peer-reviewed journals in the period from 2006 and 2008 for American and British studies (reflecting the years when relevant recommendations were introduced in each country) respectively, up to 2015 were included. Grey literature and studies reporting on targeted, HIV tests based on clinical suspicion and/or risk assessment, HIV testing were excluded. We also manually searched the bibliographies of relevant articles. If more than one article reported on the same study population, only the article that provided most completed data was included. Review articles were also excluded to avoid over-lap.

The primary investigator (AE) conducted all searches, and reviewed all relevant abstracts and full-length articles and extracted data using a standardised form (Supplementary Material 3). A second independent investigator (KS) verified all the steps. Disagreements were resolved by consensus.

The mixed methods appraisal tool (MMAT) (25) was used to look for sources of bias in the studies.

We did not perform a meta-analysis, as included studies were heterogeneous,. Hence, narrative synthesis and summary of the evidence was carried out. We carried out a thematic analysis for facilitators and barriers to HIV testing. After thorough review of the selected studies, we deduced the themes and categorised the findings according to whether they represented factors that helped or hindered HIV testing.

## **RESULTS**

### **Study selection**

The process of study selection for inclusion is described in Figure 1. Fourteen papers, 7 British and 7 American, were included in the review (Table 1).

### **Study characteristics:**

Seven UK-based studies were included. (26-32) Six of them were quantitative studies (26, 28-32) and one was a qualitative study. (27) Three studies were pilots of 3-month duration (26, 31, 32) whilst the other three studies reported on experience of implementing policies of routine HIV testing for the duration of 12 months, (29) 21 months, (30) and 30 months. (28) The qualitative study (27) examined staff views about HIV testing before and after the implementation of the HIV testing programme. (27) (26, 27)

Seven American studies were also included in the review (33-39). Most of them were quantitative (33-38) and one was a mixed-methods study. (39) Three studies described implementation of policies, for HIV screening in EDs of 9-months, (35) 56-months (36) and 60-months (39) durations, and reported on HIV testing coverage, uptake, barriers and facilitators. Further 3 studies explored staff and patients' views about HIV screening (33, 37, 38) and the seventh was a pilot study reporting on HIV testing uptake and coverage. (34)

### **Risk of bias within studies**

A summary of risk of bias assessment in each quantitative study (12 in total; 6 British and 6 American) included in the review using MMAT is shown in Supplementary Material 4. All but 2 (26, 38) of the 12 reports did not compare patient characteristics between all patients eligible for HIV screening and those approached for testing. In the absence of such data, selection bias and targeting of high-risk groups of patients could not be ruled out. Patients approached for testing may be different from the overall population eligible for routine screening. Studies, which used surveys, focus group and in-depth interviews, selected participants via a convenience sample or non-systematic approach for selection. (26, 37, 38) This may have resulted in selection bias and participants may not be representative of all patients attending EDs.

The qualitative study (27) scored 100% on the MMAT score whereas the mixed-methods study (39) scored 75%. In the latter study, there was no data about the representativeness of the sample in relation to the population, in the quantitative component. The qualitative component did not give consideration to the influence the researchers may have had on study findings.

### **Results of individual studies**

#### **HIV testing uptake, coverage and linkage to care**

As shown in table 1, the HIV testing uptake ranged from 53% to 84%. In the UK, HIV test uptake in EDs (62-63%), (26, 28) was lower than AMUs (70-84%), (26, 30, 32). In the US, the uptake levels in EDs ranged from 53% to 75%. (37, 36) Despite high levels of uptake, the HIV testing coverage in the UK and US was (10% to 38%)(26, 29-32) and 19% to 26% (34, 35), respectively. Among those diagnosed, 88% to 100% in the UK and 74% to 100% in the US were linked into care.

## **Barriers to HIV testing**

### *Stigma, and confidentiality and privacy concerns*

In a study by Thorton et al (27), staff identified HIV as an “exceptional” condition and suggested that this was a barrier to the offer and uptake of HIV testing in settings other than sexual health and antenatal clinics. However, they also felt that HIV testing in medical settings would help in normalising and reducing the stigma attached to HIV. (27) Staff also raised confidentiality and privacy concerns as an obstacle to offering HIV testing in their settings, particularly in EDs. (27) Lack of privacy was also reported as a hurdle to HIV test offer by 58% of ED staff and 44% of AMU staff (26). In another study, 35% of patients and 38% of staff expressed similar concerns regarding confidentiality and privacy of HIV testing in a setting like ED. (38)

### *Staff fears about offering HIV tests*

Staff expressed concern that they did not have the specialist knowledge needed to offer an HIV test. (27)

During semi-structured interviews with 8 staff members working in an ED, Knapp et al reported that participants identified lack of training as a factor that hindered offer of HIV testing. (39)

Similarly another study found that 82% and 65% of staff members in ED and AMU, respectively, reported that they would require additional training prior to offering an HIV test. (26)

### *Operational barriers*

Several operational barriers such as lack of time, concerns over results’ handling and provision of follow up were identified as obstacles to HIV testing offer in both the UK and US. (26, 27, 32, 33, 38) In the UK, more than 50% of staff in an ED and 40% of an AMU staff identified insufficient time as a hurdle to the offer of HIV testing. (26) Staff from both settings also reiterated this concern during focus groups. (27)

In the same focus groups in the UK, staff raised concerns about giving an HIV-positive result and referring HIV-positive patients for care. (27)

In an American study, clinical staff in ED were asked about the perceived barriers to HIV testing in ED before and after implementing a 6-month routine HIV testing project in ED (33) At the study, more staff members identified time constraints (62% versus 51% at baseline) and concerns regarding follow-up (59% versus 50% at baseline) as obstacles for HIV test offer in ED. Conversely, concerns about other resources being inadequate, decreased from 70% to 60% over the study period. (33) Another American study showed that 60% and 35% of staff identified lack of time and concerns about provision of follow up, respectively as two factors that impeded offer of HIV testing in ED. (34)

Semi-structured interviews with staff identified other barriers to the sustainability of the offer of HIV testing such as lack of senior leadership engagement; insufficient involvement of frontline staff in

the planning process; and inadequate systems of monitoring of and feedback about the offer and uptake of HIV testing to staff in the frontline. (39)

The short average length of stay in AMUs was been identified as a hindering factor to HIV testing in 3 UK-based studies. (26, 29, 30)

## **Facilitators of HIV testing**

### *Partnership between ED/AMU medical staff and local specialist units*

Eight studies reported partnership between the ED/AMU staff and local HIV (26-28, 30, 31) or infectious diseases units (32, 35, 39). The ED/AMU staff offered the HIV tests and the specialist HIV teams prepared patient information sheets, trained medical teams on how to offer an HIV test and handled results and referral for care. Three of these studies described prelaunch meetings attended by all relevant stakeholders to define testing pathways and model of delivery as beneficial. (30-32)

### *Operational facilitators*

Operational factors that were recognised as facilitators for the offer of HIV testing included non-written consent, non-targeted testing, simple results' system and not using point of care tests (POCT). In all UK testing projects verbal consent documented in medical notes was sufficient. (26-32) In 4 studies, venous sampling was used (rather than POCT which would require immediate provision of results and post-test counselling etc.) (29-32). In three studies, results were handled via a 'no news is good news' policy and only patients with a positive test result or those requiring repeat testing for any reason were contacted. (30-32) Staff in AMU recognised that importance of routine offer of testing to all patients in facilitating HIV testing (as opposed to targeted testing). (27)

In the US, Lin X *et al* (35) reported that operational changes to their HIV testing pathway impacted on the offer of HIV testing. Initially, selected staff dedicated only to HIV testing carried out opt-in HIV testing with POCT in their ED. Training all existing ED staff to offer HIV testing, using the electronic health record to prompt HIV testing for eligible patients, and switching from POCT to venous sampling for laboratory testing resulted in increased testing levels from 17% to 26%. (35) Another study also identified lack of written consent and removing lengthy pre-test counselling requirements as a factor which favoured the offer of HIV testing. (34)

### *Commitment and enthusiasm of medical staff offering the HIV test*

The high-level commitment and motivation of medical staff (especially nurses) offering HIV tests was identified in two UK-based studies as a facilitator of offering HIV testing. (30, 31) Moreover, Rayment *et al* showed that involvement of nurses in HIV testing together with adding blood sampling based HIV testing to oral fluid testing, resulted in an increase in HIV testing level from 11% to 29%. (28) An American study evaluating a 5-year sustainability of HIV rapid testing in ED identified that success was dependant on the enthusiasm of 2 clinical champions in ED. (39)



## **Patient-specific factors**

As described above uptake of HIV testing when offered was high in most of the studies reviewed. Four studies (26, 32, 34, 36) showed that uptake of HIV testing was higher in younger age groups. Male sex was also associated with increased uptake of testing in two studies which reported this. (26, 36) As shown in table 1, perception of low HIV risk among patients was reported in 3 studies as a reason for declining an offer of HIV testing. (32, 37, 38)

## **DISCUSSION**

Routine HIV testing has already been shown to be feasible, acceptable by both patients and staff, effective in identifying new HIV cases and cost-effective. (40-44) Despite this, studies have shown that routine HIV testing in non-specialist settings remains low (20, 45).

We found that uptake among those offered was high suggesting that the barriers lie more with providers rather than patients. Medical staff identified some operational barriers to offering HIV testing such as time constraints and the need for more training. They expressed concerns about giving positive results and worried about what follow up patients would receive, despite the existence of referral pathways. A recent report from the UK showed how these barriers were successfully addressed in ED using 'notional' consent where staff ordered an HIV test for all patients requiring a blood test. Patients could decline testing after they had read a comprehensive leaflet. This innovative approach raised testing rates from 2.9% to 61%. (46) In addition, it had identified 40% of the newly diagnosed patients compared to 25% diagnosed in Sexual Health clinics. (47) 'Notional' consent may not be a fully informed consent, however, diagnosing new infections earlier might outweigh any loss in patients' autonomy. Our review also identified some patient-specific factors that correlated with refusal of HIV test offer such as female gender, old age and low risk perception. The higher rates of HIV test uptake among younger age groups and males might be explained, in part, by the high HIV risk-perception due to multiple sexual partners among young people and same-sex relationships among men.

We identified factors which seem to promote the offer of HIV testing. Several studies reported that blood sampling was preferred over POCT, which compelled immediate provision of results. The rationale seems to be that waiting for the return of the blood sample result would give staff time to prepare for the giving of the result. Staff also emphasised securing organisational buy-in for the testing policy. Another important facilitating factor from both countries that helped increase the number of HIV tests offered was the involvement of nurses and their ownership of the HIV testing initiative.

The less than optimal coverage of HIV testing in EDs and AMUs is due to low offer of testing rather than low uptake. If medical teams were to engage better with the offer of HIV testing, it is likely the reservations and anxieties currently experienced will be alleviated. In turn, this might result in even higher levels of HIV test uptake by patients. This is supported by the fact that the HIV test uptake levels in antenatal clinics in both UK and US have been consistently over 90% in recent years after initial low offer and uptake levels in the first few years after policy implementation. (3, 4) Furthermore, normalising HIV as a condition and embedding HIV testing within standard clinical care

may overcome some of the operational barriers commonly reported by medical facilities providers. However, targeted HIV testing may still be needed to complement routine HIV testing strategies considering the low coverage of the latter.

As described above the integration of a non-rapid HIV test, which requires a verbal consent only (as for other investigations), within the normal clinical duties for ED/AMU staff may well reduce provider related barriers to offering HIV tests. They would simply have to take another sample (for HIV) when taking blood for other tests. However, close cooperation with local HIV specialist teams is paramount for sustaining such initiatives. Local specialist HIV teams could provide on-going training for general medical staff about HIV testing and the rationale for testing guidelines, and help handle the results and linkage to care. On-going support from and collaboration with specialist teams would also help to alleviate fears about HIV result giving and therefore the offer of HIV testing in the first place. In the longer term healthcare workers' fears should not be a barrier to offering more rapid HIV testing.

### **Limitations**

Our review has some limitations to be considered. Methodological limitations of individual studies could result in mis-leading overall conclusions. Some of the included studies lacked data on important outcomes such as uptake and coverage of HIV testing and so our summaries on these outcomes are based on very few studies. Moreover, some of the UK studies were in two different clinical settings i.e. AMUs and EDs. This may affect the validity of the thematic analysis as some of the facilitators and/or barriers were only identified in two or three studies. Furthermore, studies were a mixture of proof-of-concept studies and effective sustainable implementation initiatives. Finally, it is not possible to extrapolate the conclusions of this review to other international healthcare settings.

### **Recommendations and conclusions**

Providers considering the introduction of routine HIV screening in medical settings, as per CDC and UK guidelines, would need to ensure adequate funding, training, retraining as staff changes, clinical support and clear referral pathways as well as prior engagement with stakeholders to encourage motivation to change practice. Models of delivery and specific roles should be identified in advance. For instance, decisions should be made about the target population and setting (ED or AMU), staff offering the test (doctors or nurses or both) and type of HIV test (POCT or standard serology). Also, the supportive role of local HIV team should be clarified. Based on published papers successful approaches included training of ED/AMU staff, creating patient and staff information leaflets, and taking a leading role in handling positive results and linkage to care. Furthermore, senior leadership of organisations need to show commitment funding and support of the policy for routine HIV testing. Creation of a system for monitoring, audit and feedback to frontline staff would also be beneficial. Other important stakeholders to involve would be local public health officials. Of concern, despite the fact that American and British HIV testing guidelines have recommended routine testing since 2006 and 2008 respectively, the adherence to these recommendations has not been high. Our systematic review has identified areas which providers may target to improve this which if

successfully implemented could help to normalise HIV, dramatically increase knowledge of HIV status, promote HIV prevention and ultimately avert unnecessary morbidity.

## REFERENCES:

1. UNAIDS 2016. AIDS DATA. [http://www.unaids.org/sites/default/files/media\\_asset/2016-AIDS-data\\_en.pdf](http://www.unaids.org/sites/default/files/media_asset/2016-AIDS-data_en.pdf). Accessed 05 May 2017
2. Gueler A, Moser A, Calmy A, et al. Swiss HIV Cohort Study, Swiss National Cohort. Life expectancy in HIV-positive persons in Switzerland: matched comparison with general population. *AIDS* 2017 Jan 28;31(3):427-436
3. Public Health England. HIV in the United Kingdom: 2016 report. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/602942/HIV\\_in\\_the\\_UK\\_report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/602942/HIV_in_the_UK_report.pdf). Accessed 05 May 2017
4. HIV in the United States: At A Glance. <https://www.cdc.gov/hiv/statistics/overview/ataglance.html>. Accessed 06 May 2017.
5. Lucas SB, Curtis H, Johnson MA. National review of deaths among HIV-infected adults. *Clin Med* 2008 Jun;8(3):250-252.
6. Marks G, Crepaz N, Senterfitt JW, Janssen RS. Meta-analysis of high-risk sexual behavior in persons aware and unaware they are infected with HIV in the United States: implications for HIV prevention programs. *JAIDS J Acquired Immune Defic Syndromes* 2005;39(4):446-453.
7. Marks G, Crepaz N, Janssen RS. Estimating sexual transmission of HIV from persons aware and unaware that they are infected with the virus in the USA. *AIDS* 2006 Jun 26;20(10):1447-1450.
8. Krentz H, Auld M, Gill M. The high cost of medical care for patients who present late (CD4< 200 cells/ $\mu$ L) with HIV infection. *HIV medicine* 2004;5(2):93-98.
9. Kennedy LA, Gordin FM, Kan VL. Assessing targeted screening and low rates of HIV testing. *Am J Public Health* 2010 Sep;100(9):1765-1768.
10. Duffus WA, Weis K, Kettinger L, Stephens T, Albrecht H, Gibson JJ. Risk-based HIV testing in South Carolina health care settings failed to identify the majority of infected individuals. *AIDS Patient Care STDS* 2009;23(5):339-345.
11. Jenkins TC, Gardner EM, Thrun MW, Cohn DL, Burman WJ. Risk-based human immunodeficiency virus (HIV) testing fails to detect the majority of HIV-infected persons in medical care Settings. *Sex Transm Dis* 2006 May;33(5):329-333.
12. Centers for Disease Control and Prevention (CDC). Missed opportunities for earlier diagnosis of HIV infection--South Carolina, 1997-2005. *MMWR Morb Mortal Wkly Rep* 2006 Dec 1;55(47):1269-1272.
13. Read P, Armstrong-James D, Tong CY, Fox J. Missed opportunities for HIV testing--a costly oversight. *QJM* 2011 May;104(5):421-424.
14. Burns FM, Johnson AM, Nazroo J, et al. Missed opportunities for earlier HIV diagnosis within primary and secondary healthcare settings in the UK. *AIDS* 2008 Jan 2;22(1):115-122.
15. Lyons MS, Lindsell CJ, Ruffner AH, et al. Randomized comparison of universal and targeted HIV screening in the emergency department. *J Acquir Immune Defic Syndr* 2013 Nov 1;64(3):315-323.
16. Centers for Disease Control and Prevention. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. *Ann Emerg Med* 2007;49(5):575-577.
17. BHIVA. UK National Guidelines for HIV Testing 2008. British HIV Association, 2008
18. NICE. Increasing the uptake of HIV testing to reduce undiagnosed infection and prevent transmission among men who have sex with men. National Institute for Health and Care Excellence, Public Health Guidance, 34, 2011.
19. NICE. Increasing the uptake of HIV testing to reduce undiagnosed infection and prevent transmission among black African communities living in England. National Institute for Health

- and Care Excellence, Public Health Guidance, 33, 2011.
20. Elmahdi R, Gerver SM, Gomez Guillen G, Fidler S, Cooke G, Ward H. Low levels of HIV test coverage in clinical settings in the U.K.: a systematic review of adherence to 2008 guidelines. *Sex Transm Infect* 2014 Mar;90(2):119-124.
  21. Gökengin D, Geretti AM, Begovac J, et al. 2014 European Guidelines on HIV testing. *Int J STD AIDS*. 2014 Sep;25(10):695-704
  22. Australian National HIV Testing Policy. <http://testingportal.ashm.org.au/hiv>. Accessed 7 March 2016
  23. HIV Testing and Screening Guide in Canada. [http://www.catie.ca/sites/default/files/EN\\_HIV-Screening-Guide-2013.pdf](http://www.catie.ca/sites/default/files/EN_HIV-Screening-Guide-2013.pdf). Accessed 7 March 2016
  24. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Ann Intern Med* 2009;151(4):W-65-W-94.
  25. Pluye P, Robert E, Cargo M, Bartlett G, O’Cathain A, Griffiths F. Proposal: A Mixed Methods Appraisal Tool for Systematic Mixed Studies Reviews.: McGill University; 2011 .
  26. Rayment M, Thornton A, Mandalia S, et al. HIV testing in non-traditional settings--the HINTS study: a multi-centre observational study of feasibility and acceptability. *PLoS One* 2012;7(6):e39530.
  27. 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 Dec;88(8):601-606.
  28. Rayment M, Rae C, Ghooloo F, et al. Routine HIV testing in the emergency department: tough lessons in sustainability. *HIV medicine* 2013;14(S3):6-9.
  29. Palfreeman A, Nyatsanza F, Farn H, McKinnon G, Schober P, McNally P. HIV testing for acute medical admissions: evaluation of a pilot study in Leicester, England. *Sex Transm Infect* 2013 Jun;89(4):308-310.
  30. Phillips D, Barbour A, Stevenson J, Draper S, Motazed R, Elgalib A. Implementation of a routine HIV testing policy in an acute medical setting in a UK general hospital: a cross-sectional study. *Sex Transm Infect* 2014 May;90(3):185-187.
  31. Bath R, Ahmad K, Orkin C. Routine HIV testing within the emergency department of a major trauma centre: a pilot study. *HIV medicine* 2015;16(5):326-328.
  32. Ellis S, Graham L, Price DA, Ong EL. Offering HIV testing in an acute medical admissions unit in Newcastle upon Tyne. *Clin Med* 2011 Dec;11(6):541-543.
  33. Arbelaez C, Wright EA, Losina E, et al. Emergency provider attitudes and barriers to universal HIV testing in the emergency department. *J Emerg Med* 2012;42(1):7-14.
  34. Brown J, Shesser R, Simon G, et al. Routine HIV screening in the emergency department using the new US Centers for Disease Control and Prevention Guidelines: results from a high-prevalence area. *JAIDS J Acquired Immune Defic Syndromes* 2007;46(4):395-401.
  35. Lin X, Dietz PM, Rodriguez V, et al. Routine HIV screening in two health-care settings--New York City and New Orleans, 2011-2013. *MMWR Morb Mortal Wkly Rep* 2014;63(25):537-541.
  36. Setse RW, Maxwell CJ. Correlates of HIV Testing Refusal Among Emergency Department Patients in the Opt-Out Testing Era. *AIDS and Behavior* 2014;18(5):966-971.
  37. Brown J, Kuo I, Bellows J, et al. Patient perceptions and acceptance of routine emergency department HIV testing. *Public Health Rep* 2008 Nov-Dec;123 Suppl 3:21-26.
  38. Hecht CR, Smith MD, Radonich K, Kozlovskaya O, Totten VY. A comparison of patient and staff attitudes about emergency department--based HIV testing in 2 Urban Hospitals. *Ann Emerg Med* 2011;58(1):S28-S32. e4.
  39. Knapp H, Hagedorn H, Anaya HD. HIV rapid testing in a Veterans Affairs hospital ED setting: a 5-year sustainability evaluation. *Am J Emerg Med* 2014;32(8):878-883.

40. Haukoos JS, Hopkins E, Byyny RL, Denver Emergency Department HIV Testing Study Group. Patient acceptance of rapid HIV testing practices in an urban emergency department: assessment of the 2006 CDC recommendations for HIV screening in health care settings. *Ann Emerg Med* 2008;51(3):303-309. e1.
41. Brown J, Kuo I, Bellows J, et al. Patient perceptions and acceptance of routine emergency department HIV testing. *Public Health Rep.* 2008;123(suppl 3):21-26.
42. 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 Apr;22(4):187-189.
43. Sanders GD, Bayoumi AM, Sundaram V, et al. Cost-effectiveness of screening for HIV in the era of highly active antiretroviral therapy. *N Engl J Med* 2005;352(6):570-585.
44. Stone PW, Teutsch S, Chapman RH, Bell C, Goldie SJ, Neumann PJ. Cost-utility analyses of clinical preventive services: published ratios, 1976–1997. *Am J Prev Med* 2000;19(1):15-23.
45. Hoover JB, Tao G, Heffelfinger JD. Monitoring HIV testing at visits to emergency departments in the United States: very-low rate of HIV testing. *J Acquir Immune Defic Syndr* 2013 Jan 1;62(1):90-94.
46. Paparello J, Hunter L, Betournay R, Craven M, LARBalestier N. Reducing the barriers to HIV testing – a simplified consent pathway increases the uptake of HIV testing in a high prevalence population. *HIV Medicine* 2016;17(Suppl 1):9
47. Paparello J, Lee M, Hunter L, Betournay R, LARBalestier N . HIV testing in the emergency department: an important and distinct target population . *HIV Medicine* 2017;18(Suppl 1):48

**Figure1: The process of study selection for inclusion in the review based on PRISMA guidance (46)**

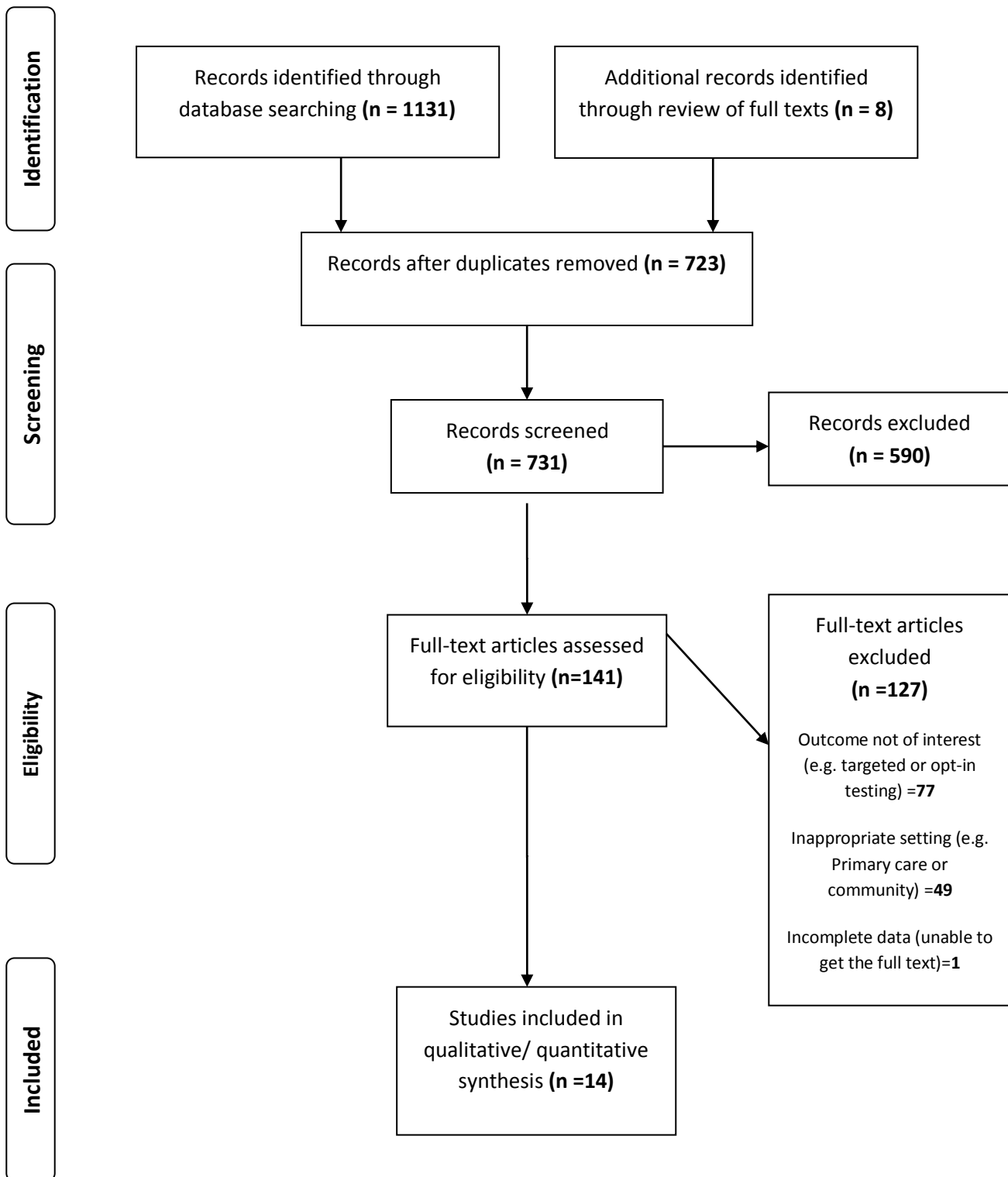


Table1. Summary of included British and American studies results

1st author, country (year) Citation	Type of study	Setting and population	Duration of study (months)	Type of HIV test & staff offering test	HIV test offer ¶	HIV test uptake §	HIV testing coverage I	Number of new HIV diagnoses	Proportion of new cases linked to care ¶¶	Barriers to HIV testing §§	Facilitators of HIV testing Ø
Rayment UK (2013) (28)	Quantitative (policy report)	Patients aged <b>16-65</b> attending <b>ED</b>	30	Non-rapid oral fluid (Serology added later); Existing ED staff	15.4% 6868/ 44582	<b>63%</b> 4327/ 6868	<b>9.7%</b> 4327/ 44582	13	100%	1- Competing priorities, as the result of increasing working pressure.	1-Introduction of serology testing in addition to the oral fluid 2-Involvement of nursing staff 3- Partnership with local sexual health service
Phillips UK (2013) (30)	Quantitative (policy report)	Patients aged <b>16-79</b> attending <b>AMU</b>	21	Standard serology Existing AMU staff	No data	<b>84%</b> 154/183	<b>32.5%</b> 4122/ 12682	14	93%	1- Short length of stay on AMU	1- High level of commitment from and ownership by the AMU staff, especially nurses. 2- Partnership with
Palfreeman UK (2013) (29)	Quantitative (policy report)	Patients aged <b>15-59</b> attending <b>AMU</b>	12	Standard serology Existing AMU staff	No data	No data	<b>22.5%</b> 1399/6225	15	100%	1- Short length of stay on AMU	1- Senior leadership support 2- Partnership with HIV unit
Rayment UK (2012) (26)	Quantitative (pilot) Staff filled in Questionnaires (71 in ED, 41 in AMU)	Patient aged <b>16-65</b> ; and staff in <b>ED</b> and <b>AMU</b>	3	Non-rapid oral fluid in ED standard serology in AMU Research team	<b>62.3%</b> 3433/ 5505 ED <b>42.2%</b> 548/12 98AMU	<b>61.8%</b> 2121/ 3433 ED <b>70.1%</b> 384/ 548 AMU	<b>38.3 %</b> 2121/ 5505 ED <b>29.6%</b> 384/1298 AMU	4 in ED 4 in AMU	100% ED 100% AMU	1- Lack of privacy (58% in ED & 44% in AMU) 2- Lack of time (53% in ED- 40% in AMU) 3- Short stay on AMU 4- Need for additional training (82% in ED; and 65% in AMU)	1- Not using a point of care tests 2- Partnership with local sexual health service



1st author, country (year) Citation	Type of study	Setting and population	Duration of study (months)	Type of HIV test & staff offering test	HIV test offer	HIV test uptake	HIV testing coverage	Number of new HIV diagnoses	Proportion of new cases linked to care	Barriers to HIV testing	Facilitators of HIV testing
Ellis UK (2011) (32)	Quantitative (pilot)	Patients aged >18 years attending AMU	3	Standard serology Existing AMU staff	13.1% 478/3645	82.8% 396/478	10.9% 396/3645	2	100%	1- Low risk perception was the main reason for refusal 2- Lack of time	1- Partnership with local infectious diseases unit (training and results/linkage to care handling)
Bath UK (2015) (31)	Quantitative (pilot)	Patients aged >16 years attending ED	3	Standard serology Existing ED staff	No data	No data	30% 2828/9297	8	87.5%		1- Partnership with local HIV unit (training and results/linkage to care handling) 2- Highly motivated and committed ED staff
Thornton UK (2012) (27)	Qualitative (focus groups before and after a testing pilot)	Staff in ED and AMU	3	n/a	n/a	n/a	n/a	n/a	n/a	1- Exceptionalism of HIV as a medical condition 2- lack of time 3- Confidentiality and privacy concerns, 4- Results' governance and follow up concerns 5- Perception of the need for specialist knowledge to offer an HIV test	1- Lack of targeted testing
Lin X US (2014) (35)	Quantitative (policy report)	Patients aged ≥ 13 years old attending ED	9	Standard serology Existing ED staff	No data	No data	26% 12568/48338	77	74%		1- Electronic health record prompts HIV test offer for all eligible patients. 2- Change from rapid testing to venous sampling 3- Staff education

1 <sup>st</sup> author, country (year)	Type of study	Setting and population	Duration of study (months)	Type of HIV test & staff offering test	Offer of HIV testing	Uptake of HIV testing offer	HIV testing coverage	Number of new HIV diagnoses	Proportion of new cases linked to care	Barriers to HIV testing	Facilitators of HIV testing
Knapp US (2014) (39)	Mixed (policy report) (in-depth interviews for staff)	Patients aged 13-64 attending & Staff working in ED	60	Rapid oral fluid test  Existing ED staff	No data	No data	2055 tests over 5 years	No data	No data	1- Lack of senior leadership engagement 2- Lack of frontline staff involvement in the planning process 3- Inadequate training 4- Lack of adequate system of monitoring and feedback to staff in the frontline	1- The enthusiasm of two clinical champions
Setse, US (2014) (36)	Quantitative (supported policy)	Patients aged ≥ 13 attending ED	56	Rapid oral fluid test Research team	No data	75.4% 24596/32633	No data	335	100%	1- Female sex 2- Old age	1- Research team support in offering and conducting HIV testing
Brown C US (2007) (34)	Quantitative (pilot)	Patient aged 13-64 attending ED	3	Rapid oral fluid test  Research team	31.4% 4187/ 13240	59.4% 2486/ 4187	18.7 % 2486/ 13240	9	88.9%	1- Old age	1- Lack of written consent and pre-test counselling requirement
Brown US (2008) (37)	Quantitative (Survey)	Patients aged 13-64 attending ED	9	Rapid oral fluid test Research team	No data	53% 5232/9826	No data	No data	No data	1- Low risk perception was the main reason for refusal	

1 <sup>st</sup> author, country (year)	Type of study	Setting and population	Duration of study (months)	Type of HIV test & staff offering test	HIV test offer	HIV test uptake	HIV testing coverage	Number of new HIV diagnoses	Proportion of new cases linked to care	Barriers to HIV testing	Facilitators of HIV testing
Hecht US (2011) (38)	Quantitative <b>(Survey for staff and patients)</b>	Patients aged <b>18-65</b> attending & staff working in <b>2EDs</b>	18	n/a	n/a	n/a	n/a	n/a	n/a	<b>Patients' views:</b> 1-Privacy/confidentiality concerns 2-Perception of low risk  <b>Staff views:</b> 1- Lack of time 2-Privacy/confidentiality concerns 3- Fear of influx of patients to ED	
Arbelaez US (2012) (33)	Quantitative <b>(Survey of staff before and after a testing pilot)</b>	Medical staff in <b>ED</b>	6	Rapid oral fluid  Existing ED staff	n/a	n/a	n/a	n/a	n/a	<b>Pre-programme:</b> 1-Lack of resources; 70% 2-Time constraints; 51% 3-Follow-up worries; 50%  <b>Post-programme:</b> 1-Inadequate time; 62% 2-lack of resources; 60% 3-Follow-up worries; 59%	

¶¶ HIV test offer refers to proportion of patients offered an HIV out of those eligible for HIV testing.

§ HIV offer uptake refers to proportion of patients accepted an HIV test offer out of those offered a test.

I HIV test coverage refers to number of patients tested for HIV out of those eligible for testing.

¶¶ Linkage of patients tested positive for HIV to care refers to percentage of patients tested positive who were informed of their positive results and seen by an HIV care provider out of those diagnosed with new HIV infection.

§§ Factors facilitating HIV testing refer to factors helping in increasing the HIV testing offer and/or uptake.

⊖ Barriers to HIV testing refer to factors hindering the HIV testing offer and/or uptake.

## Supplementary Material 1: PRISMA Checklist

Section/topic	#	Checklist item
<b>TITLE</b>		
Title	1	Identify the report as a systematic review, meta-analysis, or both.
<b>ABSTRACT</b>		
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.
<b>INTRODUCTION</b>		
Rationale	3	Describe the rationale for the review in the context of what is already known.
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).
<b>METHODS</b>		
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$ ) for each meta-analysis.

Section/topic	#	Checklist item
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.
<b>RESULTS</b>		
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).
<b>DISCUSSION</b>		
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.
<b>FUNDING</b>		
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.

## Supplementary Material 2: Search plan

### 1- Search question:

What are the facilitators and barriers for routine HIV testing in British and American hospitals?

### 2-Search concepts:

Facilitators and barriers  
Routine HIV testing  
American and British hospitals

### 3- Databases:

MEDLINE  
EMBASE

### 4- choosing search terms (subject headings are also used):

#### Facilitators and barriers:

Facilitate, enable, barrier, obstacle, hurdle, hinder, uptake, coverage, sustain

#### Routine HIV testing:

Opt-out, screening, universal, testing, HIV, human immunodeficiency virus,

#### America and UK :

United Kingdom, UK, Britain, Great Britain, GB, GBR, England, Wales, Scotland, North Ireland, British, English, Welsh, Scottish, Northern Irish, America, American, North America, Northern American, United States, US, United States of America and USA

### 5- compiling search strategy and running the search:

(facilitat\* or enable or barrier or obstacle or hurdle or hinder or uptake or coverage or sustain\*)

And

(routine HIV test\* or routine human immunodeficiency virus test\* or routine HIV screen\* or routine human immunodeficiency virus screen\* or opt-out HIV test\* or opt-out human immunodeficiency test\* or opt-out HIV screen\* or opt-out human immunodeficiency screen\* or universal HIV screen\* or universal human immunodeficiency virus screen\* or universal HIV test\* or universal human immunodeficiency virus test\*)

And

(United Kingdom or UK or Britain or England or Wales or Scotland or North Ireland or British or English or Welsh or Scottish or Northern Irish or America or American or North America or Northern American or United States or US or United States of America or NY or New York or London or USA)

### 6-Search limit:

The search was limited to 2006 to current and 2008 to current for American and British literature, respectively (Since the publication of HIV testing guidelines)

### Supplementary Material 3: Data extraction tool

Author (s):

Year of publication:

Country:

Setting (ED (US) vs AMU or A &E (UK)):

Study design:

Population:

Age group:

Duration of reported period:

Type of HIV test used (rapid vs non-rapid):

Staff group offering the HIV test (existing staff vs HIV screening staff):

Number of subjects eligible for screening:

HIV test offer rate (number of patients offered / number of eligible patients):

Uptake rate (number of patients tested / number of patients offered):

HIV test coverage (number of patients tested/ number of eligible patients):

Positivity rate (number of patients tested positive / number of patients tested):

Number of new HIV diagnoses:

Proportion of patients newly diagnosed who were linked to care:

Factors facilitating testing

Barriers to testing

Comments

**Supplementary Material 4: Risk of bias assessment in the quantitative studies included in the review**

Author  (Country, year)	Is the sampling strategy relevant to address the quantitative research question?	Is the sample representative of the population understudy?	Are measurements appropriate	Is there an acceptable response rate	Overall score
Rayment M (UK, 2013)	Yes	Can't tell	Yes	Yes	75%
Phillips D	Yes	Can't tell	Yes	Yes	75%
Palfreeman A (UK, 2013)	Yes	Can't tell	Yes	Yes	75%
Rayment M (UK, 2012)	Yes	No	Yes	Yes	75%
Ellis S	Yes	Can't tell	Yes	Yes	75%
Bath R	Yes	Can't tell	Yes	Yes	75%
Lin X	Yes	Can't tell	Yes	Yes	75%
Setse RW (US, 2014)	Yes	Can't tell	Yes	Yes	75%
Brown J	Yes	Can't tell	Yes	Yes	75%
Brown J	Yes	Can't tell	Yes	Can't tell	50%
Hecht CR (US, 2011)	Yes	Yes	Yes	Can't tell	75%
Arbelaez C (US, 2012)	Yes	Can't tell	Yes	Yes	75%