





HIV testing strategies outside of health care settings in the European Union (EU)/European Economic Area (EEA): a systematic review to inform European Centre for Disease Prevention and Control guidance

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Objectives

In recent years, new technologies and new approaches to scale up HIV testing have emerged. The objective of this paper was to synthesize the body of recent evidence on strategies aimed at increasing the uptake and coverage of HIV testing outside of health care settings in the European Union (EU)/European Economic Area (EEA).

Methods

Systematic searches to identify studies describing effective HIV testing interventions and barriers to testing were run in five databases (2010–2017) with no language restrictions; the grey literature was searched for similar unpublished studies (2014–2017). Study selection, data extraction and critical appraisal were performed by two independent reviewers following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Results

Eighty studies on HIV testing in non-health care settings were identified, the majority set in Northern Europe. Testing was implemented in 65 studies, with men who have sex with men the risk group most often targeted. Testing coverage and positivity/reactivity rates varied widely by setting and population group. However, testing in community and outreach settings was effective at reaching people who had never previously been tested and acceptability of HIV testing, particularly rapid testing, outside of health care settings was found to be high. Other interventions aimed to increase HIV testing identified were: campaigns ($n = 8$), communication technologies ($n = 2$), education ($n = 3$) and community networking ($n = 1$).

Conclusions

This review has identified several strategies with potential to achieve high HIV testing coverage outside of health care settings. However, the geographical spread of studies was limited, and few intervention studies reported before and after data, making it difficult to evaluate the impact of interventions on test coverage.

Keywords: HIV, systematic review, Europe, HIV testing, adults

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Introduction

In 2010, the European Centre for Disease Prevention and Control (ECDC) produced guidance for HIV testing

with an aim to inform the development, monitoring and evaluation of national HIV testing strategies and programmes in the European Union (EU) and European Economic Area (EEA) member states [1]. This guidance

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recommended expanding HIV testing across a variety of settings across health care services and into the community, in an effort to reduce the high rates of late HIV diagnosis and the proportion of people unaware of their infection.

Despite the finding of a recent evaluation that the guidance has been widely used to develop HIV policies, guidelines, programmes and strategies in the EU/EEA [2], HIV testing among high-risk populations in Europe has remained low [3]. In 2016, an estimated 25% of people living with HIV were undiagnosed, equivalent to over 300 000 individuals in Europe (EU and non-EU countries) [4]. In addition, high rates of late diagnosis of HIV infection have continued in these countries; over half of people diagnosed in 2016 had a CD4 count of < 350 cells/ μ L [5]. Studies show that diagnosis of HIV infection promptly after infection is of substantial benefit to the individual, reducing both morbidity and mortality [6,7]. Furthermore, there is public health benefit, as effective HIV treatment after diagnosis reduces onward transmission [8].

As a consequence, in 2016, the ECDC launched a project to synthesize the evidence on HIV testing implementation in the EU/EEA, with the aim to document testing interventions, gather case studies of good testing practice and ultimately update the existing testing guidance. This paper focuses on one aspect of the evidence gathering process used to inform the new guidance, summarizing strategies that have been applied with an aim to increase HIV testing outside of health care settings in the EU/EEA and documenting barriers to testing in these settings. In this paper, HIV testing outside of health care settings includes testing occurring in fixed and mobile venues in the community and testing at home.

Testing outside of health care services is a particularly important approach to reach certain groups at higher risk of HIV infection, such as people who inject drugs (PWID), men who have sex with men (MSM), sex workers (SWs) and migrants [9]. These populations are disproportionately burdened by HIV and are often marginalized [5]. Furthermore, these vulnerable groups may not access traditional HIV testing and care services because of stigma and/or laws restricting service use (e.g. for undocumented migrants) [10,11]. Expanding HIV testing outside of health care settings provides a mechanism of improving testing coverage and identifying undiagnosed infection in at-risk populations [1]. Although previous studies have shown that community testing results in high HIV detection rates [9], there are challenges to implementation in the EU/EEA, such as service funding and laws restricting non-medical testing [11,12].

Methods

The systematic review of the literature, described below, was designed to gather studies that aimed to increase HIV testing or document barriers to testing in the EU/EEA, across all testing settings. It adheres to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [13].

Search strategy

Searches were carried out in OVID Medline, Embase, PsycINFO, Scopus and the Cochrane Library of Systematic Reviews on 17 March 2017. Specific search strings were built for HIV, the concept of testing, and EU/EEA geography (Tables S1–S5).

Conference abstracts from the International AIDS Conference, International AIDS Society Conference, European AIDS Clinical Society Conference, Conference on Retroviruses and Opportunistic Infections, HEPHIV and the HIV Drug Therapy Conference were also reviewed for relevance. References of HIV testing guidelines published by the World Health Organization (WHO) and HIV in Europe were also reviewed.

Study inclusion and exclusion

Studies from the database search were included if published between January 2010 and March 2017; this time restriction was applied to capture evidence since the publication of the previous ECDC HIV testing guidelines [1]. Conference proceedings identified through either the database search or the search of the grey literature were included if presented between 2014 and 2017; conference proceedings prior to 2014 were excluded as they were assumed to be published in peer-reviewed journals. Inclusion was restricted to studies of adults (aged ≥ 15 years) conducted in at least one of the 30 EU/EEA countries (Table S6) describing approaches to increase HIV testing and/or barriers to testing. Studies were excluded if they focussed on testing following occupational exposure. No language restrictions were applied.

Specific study designs of interest included: observational studies, randomized control trials, economic evaluations and qualitative studies. Systematic reviews were included and reviewed for relevant studies. Case reports, editorials and letters were also included if presenting original data not published elsewhere.

Study selection

A four-stage selection process was used to identify relevant studies, with two independent reviewers at all stages. Disagreement was resolved through consensus and, where

required, through independent adjudication by a third party.

Firstly, titles and abstracts were screened based on the inclusion/exclusion criteria. All remaining studies were assessed for eligibility based on the full text. For conference proceedings, authors were contacted for copies of the posters or slides. Where available, these were reviewed at the full-text stage; where not, study inclusion was based on the abstract alone. In the third phase, reference lists from relevant systematic reviews and recently published HIV testing guidance from the WHO and HIV in Europe were reviewed for any other relevant studies.

Finally, further scrutiny of the article was applied during data extraction; articles that made use of the same data set and presented identical outcome measures were de-duplicated, with the most recent or the most complete article included.

Data extraction

Two researchers independently extracted qualitative and quantitative data using a standardized data collection form designed using the Research Electronic Data Capture (REDCap) application [14]. All data were extracted in English. The following variables were collected for each included study: study authors, year, study design and type, country, study characteristics (demographics, population subgroups, setting, recruitment and data collection methods) and outcomes (e.g. barriers, coverage, uptake, positivity/reactivity, acceptability and cost-effectiveness). HIV testing intervention studies were categorized based on the strategy(ies) researchers applied in an effort to increase testing, including: testing provision, education programmes, campaigns, communication technologies, clinical decision-making tools and other interventions. Audit studies were considered if they presented evidence on gaps in testing. Non-intervention studies were categorized as economic evaluations, feasibility and/or acceptability studies or studies of barriers to HIV testing. For quantitative outcomes, data were extracted as presented in the study; values were not recalculated based on a predefined approach.

Critical appraisal

Critical appraisal of published studies was carried out at the same time as data extraction and based on National Institute for Health and Clinical Excellence (NICE) checklists [15] and the AXIS quality assessment tool [16]. Each study was assessed for quality and bias by two independent reviewers, except for economic modelling studies which were excluded from critical appraisal.

There were seven critical appraisal questions relevant to every study design and answers to these questions were used to generate a quality rating; studies were rated as being of low (score 0–4), medium (score 5–6) or high quality (score 7). A list of included questions can be found in Table S7.

A similar approach was used to assign a risk of bias rating to each study based on the four bias fields (selection, reporting, missing and other bias). Articles were rated as having low (score 0–1), medium (score 2–3) or high risk of bias (score 4).

Data analysis

Data were analysed based on the strategy the study applied to try and increase HIV testing, the study setting and the target population, using a descriptive approach. The analyses presented in this paper cover studies on HIV testing initiatives outside of health care settings, such as community and outreach testing. Evidence on HIV testing across health care settings has been published elsewhere [17].

Results

Study identification and overview

Of the 15 004 de-duplicated records retrieved from the searches, 894 were selected for full-text review following title and abstract screening; 455 underwent data extraction, and, ultimately, 368 studies were included (Figure 1). Overall, there were 80 studies on HIV testing outside of health care settings, including 41 peer-reviewed articles and 39 conference proceedings.

An overview of these 80 studies can be found in Table 1 [18–97]. Studies were from 14 of the 30 countries in the EU/EEA, with most set in Northern Europe ($n = 37$), followed by Southern Europe ($n = 27$) and Western Europe ($n = 12$). Four studies were set across multiple EU/EEA countries. There were no studies on HIV testing outside of health care settings from the East, although two of the studies set across Europe covered Eastern EU/EEA countries [55,95]. The most common country of study was the UK ($n = 34$), followed by Spain ($n = 16$) and France ($n = 7$).

There were a number of interventions carried out in an effort to increase HIV testing outside of health care settings, including: testing provision/implementation ($n = 65$), testing campaigns ($n = 8$), communication technologies ($n = 2$), education and training ($n = 4$) and other ($n = 1$) (Table 1). Ten studies applied strategies with multiple components to increase testing. The feasibility/

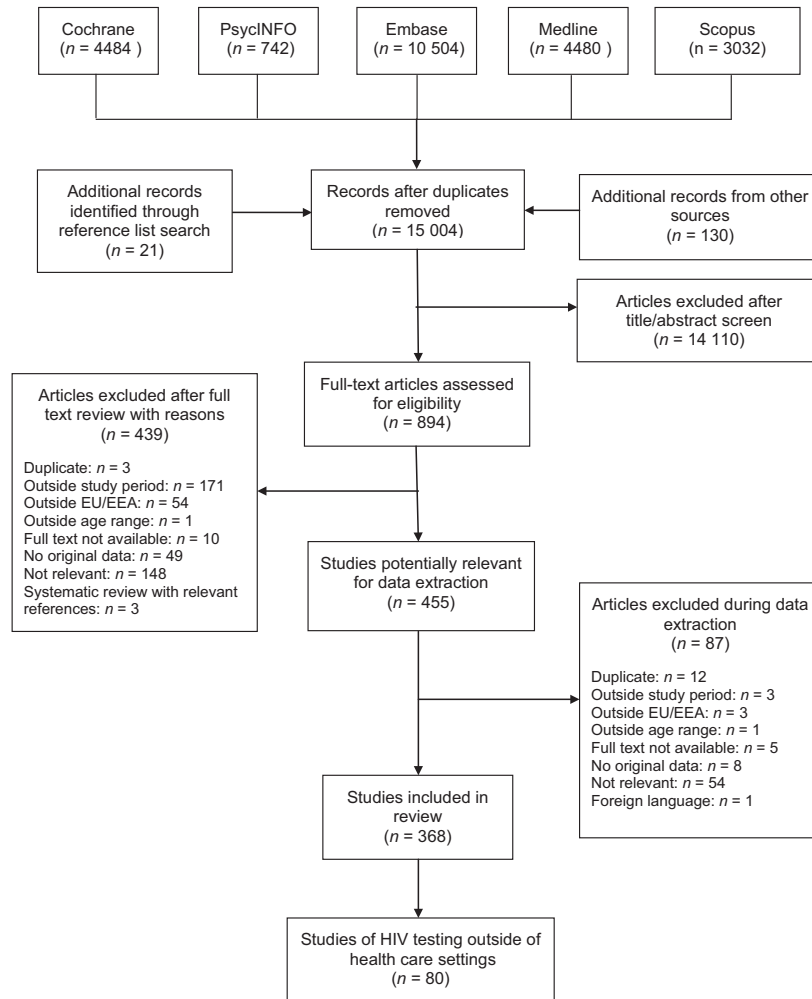


Fig. 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram. EU/EEA, European Union/European Economic Area.

acceptability of testing outside of health care settings was assessed by 48 studies. The searches captured one economic evaluation and six studies on barriers to testing. There were no audits or studies that used clinical decision-making tools set outside health care settings.

Testing provision outside of health care settings

Of the 65 studies that introduced HIV testing, 56 studies utilized novel HIV testing technologies to improve testing uptake [18,19,21–23,25–27,29,31–39,41–43,46,47,50–52,54,58–62,64–69,72–78,81,83,84,86–90,94,95,97], such as rapid testing ($n = 38$) [19,21,26,27,29,33–37,39,41,50–52,54,58,60–62,64–69,73,76,78,81,83,84,86–90,95]. Twelve studies provided HIV self-sampling (oral-fluid sample: $n = 7$ [32,38,46,59,72,74,77]; blood sample: $n = 6$ [18,25,32,43,47,94]) and six provided self-testing

(oral-fluid: $n = 3$ [23,42,97]; blood: $n = 3$ [22,31,75]). Twenty-six studies provided HIV testing as part of an integrated testing programme with: other blood-borne viruses ($n = 17$) [19,20,26,30,36,39,57,58,65,67,73,78,85–88,96], sexually transmitted infections (STIs) ($n = 19$) [20,26,30,54,56–58,62,63,65,73,76,78,85–88,90,96] or tuberculosis ($n = 1$) [67].

Twenty studies provided non-targeted testing to the general population, while 44 studies provided testing to one or more groups at higher risk of HIV infection. MSM were the group most frequently targeted ($n = 31$) [20,21,25–27,30,32,38,39,46,51,54,58,60,61,63–66,72–74,76,77,81,86,87,89,94,96,97], followed by: migrants ($n = 10$) [21,33,52,59,61,74,86,87,89,97], people who use/inject drugs (PWUD/PWID) ($n = 8$) [33,36,49,61,81,86,87,89], SWs ($n = 7$) [33,51,56,74,86,87,89], black and minority ethnic groups (BME) ($n = 5$) [24,39,63,83,89], young people

Table 1 Overview of included studies and their approach to increase HIV testing outside of health care settings

Author, year	Study location	Study period	Study description	Testing venue	Target population	Interventions				Barriers to testing	OA score	Risk of bias
						Testing provision	Campaign	Communication technology	Education			
Ahmed-Little et al., 2016 [18]	Manchester, UK	Jun 2011–Dec 2012	A project pilot, 'RUClear', to expand HIV testing outside traditional settings using home-sampling kits (dry-blood-spot testing) available online to people aged ≥ 16 years	Home	-	x					High	Medium
Appola et al., 2011 [19]	Derby, UK	Feb 2007–Dec 2008	Oral swab BBV testing for young people aged 13–19 years engaged with a young person's community substance misuse service	Drug services	Young people	x					High	Low
Beanland et al., 2015 [20]	Leeds, UK	Not specified	A weekly nurse-led clinic at a sauna for STI and BBV screening among MSM	Outreach	MSM	x					NA	NA
Betza et al., 2012 [22]	Madrid, Spain	Nov 2009–Jan 2010	An evaluation of a street-based programme of HIV self-testing under the supervision of a skilled counsellor in a neighbourhood with a large number of gay venues and in two campuses at a university	Outreach	-	x					High	Low
Betza et al., 2015 [21]	Madrid, Spain	May–Dec 2008 Jul 2009–Jul 2010 Nov 2010–Dec 2011	An evaluation of a multisite, street-based HIV rapid testing programme in a neighbourhood containing a high proportion of young people, a high proportion of gay residents or a high proportion of migrants	Outreach	MSM Migrants Young people	x					Low	Low
Brady et al., 2014 [24]	UK	Jan–Sep 2013	A survey of users of an HIV home-sampling service to assess their experience and to gauge acceptability of home testing	Home	-	x*					NA	NA
Brady et al., 2014 [25]	UK	Phase 1: Jan–Sep 2013 Phase 2: Nov 2013–Mar 2014	A national HIV home-sampling service using 4th generation dried-blood-spot HIV tests	Home	MSM BME Other risk groups	x					NA	NA
Brady et al., 2016 [23]	UK	Apr 2015–Feb 2016	An evaluation of the first 9 months of HIV self-testing in the UK	Home	-	x					NA	NA
Campos et al., 2016 [26]	Lisbon, Portugal	2011–2015	A peer-led, community-based voluntary counselling, testing and linkage to care centre tailored for MSM offering HIV, STI and BBV testing (Checkpoint)	Community testing sites	MSM	x					NA	NA
Champenois et al., 2012 [27]	Montpellier, Lille, Bordeaux and Paris, France	Feb 2009–Jun 2010	A community-based HIV testing and counselling service for MSM aged ≥ 18 years staffed by lay providers (ANRS-COMTEST)	Community testing sites	MSM	x					High	Low
Champenois et al., 2017 [28]	France and French overseas departments	Oct 2016	A survey of MSM aged ≥ 18 years examining their knowledge, interest and use of HIV self-tests	-	MSM	x					NA	NA
Chanos et al., 2014 [29]	Athens, Greece	Nov 2012–Sep 2014	A community-based HIV testing and counselling service (Checkpoint)	Community testing sites	-	x					NA	NA
Coll et al., 2015 [30]	Catalonia, Spain	Dec 2009–Oct 2012	A quarterly HIV screening programme for high-risk MSM in a community-based testing site (Checkpoint)	Community testing sites	MSM	x					NA	NA
de la Fuente et al., 2012 [31]	Madrid, Spain	Oct 2009–Feb 2010	A street-based programme of HIV testing using whole-blood rapid tests in a neighbourhood with a large number of gay venues, two campuses and two railway stations	Outreach	-	x					High	Low
Elliott et al., 2016 [32]	London, UK	Nov 2008–Nov 2010	A service evaluation of the Dean Street at Home' online risk assessment and home HIV sampling service for MSM	Home	MSM	x					High	Low
Fernández-Balbuena et al., 2014 [34]	Madrid, Canary Islands, Spain	2008–2011	A highly visible street-based mobile unit promoting and offering rapid HIV testing, anonymously and free of charge	Outreach	-	x					High	Low
Fernández-Balbuena et al., 2015 [33]	Spain	2008–2012	A community-based rapid HIV testing and counselling programme free of charge	Community testing sites	Migrants SWS PWID	x					High	Low

Table 1 (Continued)

Author, year	Study location	Study period	Study description	Testing venue	Target population	Interventions					Barriers to testing	OA score	Risk of bias
						Testing provision	Campaign	Communication technology	Education	Other			
						Feasibility/acceptability	Economic evaluation						
Fernández Balbuena et al., 2016 [35]	Spain	2007–2012	A rapid HIV testing programme in an outreach mobile unit	Outreach	-	x						High	Medium
Fernandez-Lopez et al., 2010 [37]	Catalonia, Spain	2006–2007	A rapid HIV testing programme in a network of eight community-based testing sites	Community testing sites	-	x						Medium	Medium
Fernandez-Lopez et al., 2016 [36]	Catalonia, Spain	Apr–Dec 2011	A rapid HIV and HCV testing programme for PWID within harm reduction services offered at facility-based centres or mobile or street outreach units	Drug services	PWID	x						High	Medium
Fisher et al., 2015 [38]	Brighton, UK	Feb–Sep 2008	A comparison of an STI/HIV home-sampling service for MSM aged ≥ 18 years run from a GUM clinic, an outpatient service and a community-based rapid testing service	Community testing sites	MSM	x						High	Medium
Flavell et al., 2014 [39]	Birmingham/Handsworth, UK	Not specified	A pilot of offering HIV dried-blood-spot sampling at Birmingham PRIDE (MSM), Handsworth Carnival (BME community) and pubs and clubs; also involving training of local health promotion workers on DBS testing and a promotion campaign in local magazines, on Twitter and on the radio	Outreach	MSM BME	x	x		x			NA	NA
Fonkes et al., 2014 [40]	UK	Apr 2012–Mar 2013	A feasibility study for testing MSM for STIs in community-based contraception and sexual health clinics (CASH)	Outreach	MSM					x		NA	NA
Freeman-Romilly et al., 2017 [41]	UK	2008–2012	An evaluation of a community-based point-of-care HIV testing service	Community testing sites	-	x						High	Low
Gibson et al., 2016 [42]	UK	May 2015–May 2016	A pilot project providing oral-fluid HIV self-tests online and a service evaluation feedback survey	Home	-	x					x	NA	NA
Gillespie, 2014 [43]	UK	Feb–Mar 2014	A national online self-sampling service for HIV testing offering dried-blood-spot kits to communities with the highest prevalence of undiagnosed HIV infection	Home	-	x						NA	NA
Greacen et al., 2012 [45]	France	Feb–Apr 2009	A survey of French-speaking MSM aged ≥ 18 years recruited from sex, dating and chat sites, gay community websites and HIV community information websites examining the acceptability of and interest in accessing HIV home-tests if reliable and authorized tests were available	-	MSM							High	Medium
Greacen et al., 2013 [44]	France	Feb–Apr 2009	An online survey of MSM aged ≥ 18 years recruited from sex, dating and chat sites, gay community websites and HIV community information websites examining the acceptability of and interest in accessing HIV home-tests if reliable and authorized tests were available	-	MSM						x	High	Medium
Greaves et al., 2014 [46]	London, UK	Not specified	A pilot sauna-based, self-sampling STI screening service for MSM	Outreach Home	MSM	x						NA	NA
Guerra et al., 2016 [47]	UK	Nov 2015–Jan 2016	A nationwide HIV self-sampling service free for populations most at risk of HIV acquisition commissioned by participating local authorities	Home	Key HIV risk populations not specified	x						NA	NA
Hatzakis et al., 2014 [48]	Athens, Greece	Aug 2012–Dec 2013	A survey of acceptability of a seek-test-treat-retain intervention implemented in response to an HIV outbreak among people who inject drugs (ARISTOLE programme)	Outreach	PWID	x*						NA	NA

Table 1 (Continued)

Author, year	Study location	Study period	Study description	Testing venue	Target population	Interventions				Barriers to testing	OA score	Risk of bias
						Testing provision	Campaign	Communication technology	Education			
Hatzakis <i>et al.</i> , 2015 [49]	Athens, Greece	Aug 2012–Dec 2013	A large-scale seek-test-retain intervention implemented among people who had injected drugs without a prescription in the last 12 months in response to an HIV outbreak (ARISTOLE programme)	Outreach	PWID	x					Medium	Medium
Hovav <i>et al.</i> , 2012 [50]	Madrid, Malaga and Salamanca, Spain	Oct 2008–Dec 2009	An evaluation of a rapid HIV testing programme in a mobile unit located in university campuses	Outreach	-	x					High	Medium
Hurtado <i>et al.</i> , 2010 [51]	Valencia, Spain	Jan–Jun 2008	A project offering community-based rapid HIV testing of MSM in three saunas and male sex workers in four brothels aged ≥ 25 years	Outreach	MSM SWS	x		x			Medium	Medium
Illaria <i>et al.</i> , 2015 [52]	Rome, Italy	2010–2014	A comparison of rapid and venous HIV testing strategies among vulnerable migrant populations at the National Institute for Health, Migration and Poverty	Outreach	Migrants	x					NA	NA
James <i>et al.</i> , 2014 [53]	UK	23–30 Nov 2012	A National HIV Testing Week campaign to increase awareness of HIV testing among MSM and black African populations	Variety of testing venues including community testing sites	MSM BME		x				NA	NA
Jeffrey <i>et al.</i> , 2014 [54]	Newcastle upon Tyne, UK	May 2013–Apr 2014	A pilot project for outreach work offering testing for HIV and STIs in two city centre saunas; staff from the local sexual health service and MESMAC offered full STI and HIV screening and sexual health promotion advice	Outreach	MSM	x		x			NA	NA
Klaus <i>et al.</i> , 2017 [55]	Multiple countries	Jan–Jun 2015	A European network of community-based services offering rapid HIV testing (COBATES)	Community testing sites	-	x					NA	NA
Klingenberg <i>et al.</i> , 2016 [56]	Bochum, Germany	Oct 2013–Jan 2014	A medical outreach service provided for the diagnosis of STIs among sex workers in brothels free of charge	Outreach	SWS	x					High	Low
Legoupil <i>et al.</i> , 2016 [57]	France	Jan–Dec 2014	An HIV screening programme for vulnerable populations run in nine out-of-hospital centres	Community testing sites	Key HIV risk populations not specified	x					Low	Medium
Lenart <i>et al.</i> , 2015 [58]	Ljubljana, Slovenia	2009–2014	A community-based voluntary counselling and testing centre that offers free testing for HIV, syphilis, hepatitis B and oral gonorrhoea and free hepatitis A and B vaccinations for MSM	Community testing sites	MSM	x					NA	NA
Loos <i>et al.</i> , 2016 [59]	Antwerp, Belgium	2012–2013	A community-based outreach HIV testing intervention using oral-fluid collection devices and web-based HIV test result collection among sub-Saharan African migrants aged 17–73 years (Swab2know)	Community testing sites Outreach	Migrants	x		x			Medium	Medium
Lorente <i>et al.</i> , 2013 [60]	Paris, Marseille, Nice, France	Mar 2010–Apr 2011	An evaluation of a community-based, nonmedicalized rapid HIV testing offer (CBOffer) for MSM implemented in four voluntary counselling and testing centres outside of opening hours in parallel with the standard medicalized HIV testing offer for MSM (SMOffer) provided during opening hours (ANRS-DRAG Study). The study was promoted through a communication campaign	Community testing sites	MSM	x		x			Medium	Medium

Table 1 (Continued)

Author, year	Study location	Study period	Study description	Testing venue	Target population	Interventions				Barriers to testing	OA score	Risk of bias	
						Testing provision	Campaign	Communication technology	Education				Other
MacPherson et al., 2011 [61]	Liverpool, UK	Sep 2009–Jun 2010	A programmatic evaluation of point-of-care HIV testing in five community outreach settings (a drug-users support group; an asylum-seekers health programme; an MSM health and support programme; a travel clinic; and a support programme for homeless people) and six GUM drop-in services, publicized through the Liverpool Gets Tested campaign.	Outreach	MSM Migrants PWUD Homeless	x	x				x	High	Low
Manavi et al., 2012 [62]	Birmingham, UK	2009–2010	A nurse-delivered service offering oral-fluid HIV testing during Birmingham Pride events, publicized in regional gay and lesbian magazines and websites for eight weeks before the Pride events.	Outreach	Men	x	x					Medium	Medium
McMillan et al., 2014 [63]	London, UK	22–29 Nov 2013	An evaluation of a health bus outreach HIV/STI testing service designed to target BME, MSM and younger populations during National HIV Testing Week.	Outreach	MSM BME Young people	x						NA	NA
Meulbroeck et al., 2013 [66]	Barcelona, Spain	2007–2012	A community-based voluntary counselling and testing service for MSM, offering free testing for HIV, syphilis and other STIs, and free hepatitis A and B vaccinations (Checkpoint).	Community testing sites	MSM	x						Medium	Low
Meulbroeck et al., 2017 [64]	Barcelona, Spain	Mar 2015–Sep 2016	An evaluation of a point-of-care PCR HIV testing programme for same-day confirmation in a community-based HIV testing centre for MSM (Checkpoint).	Community testing sites	MSM	x						NA	NA
Meulbroeck, 2017 [65]	Barcelona, Spain	2006–2015	An evaluation of a community-based voluntary counselling and testing service for MSM (Checkpoint).	Community testing sites	MSM	x						NA	NA
Okpo et al., 2015 [67]	Barcelona, Spain	2013	A pilot project offering dried-blood-spot testing for BBVs to new students in a university setting during freshmen's week.	Outreach	Young people	x						High	Low
Parisi et al., 2013 [68]	Barcelona, Spain	Dec 2008–Dec 2012	An HIV prevention programme called 'EASY Test Project', offering a new oral-fluid rapid HIV test to people aged ≥ 18 years, to evaluate the acceptability of an alternative, free and anonymous test available in different settings (on board a motor home at public events, points of care, STI outpatient prevention units and GP surgeries).	Outreach	-	x						High	Low
Parisi et al., 2015 [68]	Barcelona, Spain	Dec 2008–Feb 2015	An evaluation of the EASY test project which involved point-of-care oral-fluid HIV testing for MSM in community-based organizations.	Outreach	-	x						Low	Medium
Pretiman et al., 2016 [70]	Multiple countries	2014	An economic evaluation of HIV testing for chlamydia, gonorrhoea, HIV and syphilis and the 'GetTested' randomized controlled trial evaluating its effectiveness.	-	-						x	-	-
Pitaway et al., 2016 [71]	London, UK	Not specified	A free, anonymous counselling and testing service for HIV, syphilis, chlamydia and hepatitis B/C offered to visitors in two selected gay venues aged ≥ 18 years with STI test results communicated by cell phone using standardized text messages.	Outreach	MSM	x		x				High	Low

Table 1 (Continued)

Author, year	Study location	Study period	Study description	Testing venue	Target population	Interventions					Risk of bias		
						Testing provision	Campaign	Communication technology	Education	Other		Feasibility/acceptability	Economic evaluation
Platteau et al., 2015 [72]	Antwerp, Belgium	Dec 2012–Apr 2014	An HIV testing strategy using oral-fluid samples and online communication of test results for MSM aged ≥ 18 years (Swab2know)	Outreach Home	MSM	x	x	x			x	High	High
Platteau et al., 2017 [74]	Multiple countries	Jan–Sep 2016	An assessment of the acceptability and feasibility of outreach and online HIV testing of oral-fluid samples, and web-based delivery of test results among HIV risk groups (Swab2know)	Outreach Home	MSM Migrants SVs	x					x	NA	NA
Prazuck et al., 2016 [75]	Paris, France	Apr–Jul 2014	An evaluation of an HIV screening programme for adults aged ≥ 18 years using finger-stick whole-blood HIV tests in outreach sites (commercial centres and mobile screening units in urban centres) and in a hospital	Outreach	-	x					x	High	Medium
Ovist et al., 2014 [76]	Copenhagen, Denmark	2008–2012	A community-based rapid HIV testing and counselling project among MSM aged ≥ 16 years (Checkpoint)	Community testing sites	MSM	x					x	High	Low
Reeves et al., 2014 [77]	London, UK	Dec 2012–Nov 2013	An internet-based HIV home sampling project in which gay or bisexual men could order a free HIV saliva sampling kit	Home	MSM	x					x	NA	NA
Roberts et al., 2014 [78]	London, UK	2013	An asymptomatic STI and BBV screening outreach service held on a bus at an adult (≥ 18 years) lifestyle event ('Erotica') with self-sampling for chlamydia and gonorrhoea, and collection of blood for HIV, hepatitis and syphilis testing, with the offer of HIV point-of-care testing	Outreach	-	x					x	NA	NA
Rosales-Starkus et al., 2014 [79]	Madrid, Spain	Oct 2009–Feb 2010	A survey of HIV self-testing feasibility among Spanish-speaking attendees of a street-based HIV testing programme	-	-	x*					x	Medium	Low
Rosales-Starkus et al., 2015 [80]	Madrid, Spain	Nov 2010–Jun 2012	A survey of HIV self-testing acceptability among Spanish-speaking attendees of a street-based HIV testing programme located in urban neighbourhoods include a well-known gay neighbourhood and one with a large number of migrant residents	Outreach	MSM Migrants General population	x*					x	High	Medium
Ruutel et al., 2012 [81]	Tallinn, Estonia	Feb–Apr 2008	A pilot of HIV rapid finger-prick testing in gay venues for MSM aged ≥ 18 years and syringe exchange programmes for PWID aged ≥ 18 years	Outreach	MSM PWID	x					x	High	Medium
Standers et al., 2012 [82]	UK	Jan–Oct 2010	A survey of the acceptability of various medical, recreational and sports venues as settings to access self-collected testing kits for STIs and HIV among men in the general population aged 18–35 years	-	Men						x	High	Low
Skelton et al., 2014 [83]	London, UK	Jun 2013–Mar 2014	An HIV testing programme by NAZ Project London, which provides social health and HIV prevention and support services to BAME communities. The programme was promoted through various testing campaigns and initiatives including the 'Let's Stop HIV' campaign, National HIV Testing Week and health and wellbeing fairs	Community testing sites Outreach	BME	x	x				x	NA	NA

Table 1 (Continued)

Author, year	Study location	Study period	Study description	Testing venue	Target population	Interventions				Feasibility/acceptability	Economic evaluation	Barriers to testing	QA score	Risk of bias
						Testing provision	Campaign	Communication technology	Education					
Šibarova et al, 2017 [84]	Lithuania	2011–2016	An evaluation of the AIDS Healthcare Foundation project 'Test and Treat' offering rapid, anonymous and free HIV testing through community-based organizations	Community testing sites	-	x						NA	NA	
Slawie et al, 2014 [85]	London, UK	Jun 2012–May 2013	An evaluation of a nurse-led satellite outreach sexual health service established in hostels for homeless people	Outreach	Homeless	x			x			NA	NA	
Simões et al, 2016 [87]	Portugal	Aug 2015–Apr 2016	A national community screening network working with key populations and providing community-based counselling and HIV, hepatitis and syphilis testing	Community testing sites	MSM Migrants SWS	x		x				NA	NA	
Simões et al, 2017 [86]	Portugal	Jan–Dec 2016	An evaluation of a community-based national HIV, HCV, HBV and syphilis screening programme for key populations which involved training of medical and nonmedical staff on how to carry out testing	Community testing sites	MSM Migrants SWS PWUD	x		x				NA	NA	
Stockwell et al, 2015 [88]	Brighton, UK	Jun–Dec 2014	A weekly outreach HIV, STI and BBV testing project organized by the THF for asymptomatic people accessing a local homeless service using rapid testing	Outreach	Homeless	x						NA	NA	
Taatsprey et al, 2011 [89]	Liverpool, UK	Sep 2009–Jul 2010	An evaluation of the use of a combined antigen and antibody test for rapid HIV diagnosis in community testing services for high-risk groups and sexual health clinics	Community testing sites	MSM Migrants SWS PWUD BME	x				x		NA	NA	
Turner et al, 2016 [90]	London, UK	Nov 2015	A health bus stationed inside the 'Scopio' exhibition where attendees and exhibitors aged ≥ 19 years received a sexual health consultation and free STI testing (including HIV point-of-care tests), condoms and contraceptive information	Outreach	-	x						NA	NA	
Warriner et al, 2014 [91]	UK	Not specified	A major media campaign during National HIV Testing Week supporting HIV prevention within clinical, statutory and community organizations	Variety of testing venues including community testing sites	MSM BME		x					NA	NA	
Wayal et al, 2011 [92]	Brighton, UK	Feb–Oct 2006	An exploration of the preferred venues and mechanisms for offering HIV/STI home-sampling kits among MSM aged ≥ 18 years attending GUM clinics	-	MSM						x	High	Low	
Witzel et al, 2016 [98]	London, Manchester, Plymouth, UK	Jul–Nov 2015	An exploration of the acceptability of HIV self-testing and barriers to self-testing among MSM aged 18–64 years recruited through gay location-based social networking applications as well as community-based organizations	-	MSM				x			High	Low	

Table 1 (Continued)

Author, year	Study location	Study period	Study description	Testing venue	Target population	Interventions				Barriers to testing	Risk of bias		
						Testing provision	Campaign	Communication technology	Education			Feasibility/acceptability	Economic evaluation
Wood <i>et al.</i> , 2014 [94]	UK	Not specified	A nurse-delivered outreach STI and BBV screening service was established for asymptomatic MSM at a local sauna, alongside constantly available 'do it yourself' postal self-sampling packs	Outreach Home	MSM	x					NA	NA	
Zakowicz <i>et al.</i> , 2015 [95]	Multiple countries	Nov 2014	A community-based rapid HIV testing programme for key populations run during European HIV Testing Week	Community testing sites	Key HIV risk populations not specified	x						NA	NA
Zéjan <i>et al.</i> , 2015 [96]	Croatia	Oct 2014–Jul 2015	A pilot 'one stop shop' STI service for MSM providing free, easy access to STI testing and treatment	Community testing sites	MSM	x						NA	NA
Zuure <i>et al.</i> , 2016 [97]	Netherlands	Aug 2014–Dec 2015	An online HIV self-testing service providing reliable oral-fluid HIV self-tests in combination with internet counselling for individuals at risk for HIV infection, especially MSM and migrants from HIV-endemic countries. A campaign promoting the service and a user acceptability survey were also conducted	Home	MSM Migrants	x	x					NA	NA

($n = 4$) [19,21,63,67], homeless people ($n = 3$) [61,85,88], and other key risk populations not specified ($n = 3$) [47,57,95].

HIV testing was conducted in a number of non-health care settings, including: fixed community testing venues ($n = 23$) [26,27,29,30,33,37,38,41,55,57,58,60,64–66,76,83,84,86,87,89,95,96], outreach sites ($n = 32$) [20–22,31,34,35,39,46,49–52,54,56,59,61–63,67–69,72–75,78,81,83,85,88,90,94], at home through self-sampling ($n = 10$) [18,25,32,43,46,47,72,74,77,94] and self-testing ($n = 3$) [23,42,97] and community drug services ($n = 2$) [19,36]. Outreach testing activities were run through community mobile units [street-based ($n = 9$) [21,22,31,34,35,49,68,69,75], event-based ($n = 6$) [39,59,62,63,78,90] and university-based ($n = 2$) [50,67]] and in saunas ($n = 6$) [20,46,51,54,72,94], gay venues ($n = 3$) [72,73,81], brothels ($n = 2$) [51,56] and homeless services/hostels ($n = 2$) [85,88]. One study provided HIV testing to vulnerable migrant populations in a migrant centre [52] and one study provided HIV self-sampling to African migrants in churches and community groups [59].

As seen in Table 2, where reported, testing coverage and HIV positivity/reactivity varied within and between population groups targeted and test settings. Very few studies provided data on the proportion of individuals who were offered and/or accepted a test. HIV positivity/reactivity ranged widely by population: MSM: 0.0–11%; BME and migrant groups: 0.0–6.2%; PWID: 1.9–32%; SWs: 0.9–2.1%, and the general population: 0.2–3.2%. Across the studies captured in this review, HIV positivity/reactivity was lowest among homeless people (0.0%) and young people (0.0%). Where studies targeted multiple risk groups, positivity/reactivity ranged from 0.0 to 3.9%. Overall, there were eight studies from this review that reported 0.0% HIV positivity/reactivity [39,54,67,81,85,88,90,94]; the numbers of people tested were relatively small [MSM: $n = 16$ –126 [54,81,94]; BME/migrant groups: 26 [39]; general population: 188 [90]; homeless people: 58–110 [85,88]; young people (students): 512 [67]].

This review identified a limited number of testing initiatives that demonstrated an increase in HIV testing, as a consequence of a lack of reporting of baseline data or control data. Only two comparative studies presented data documenting changes to the number tested over time [37,66]. One study, describing a community-based voluntary counselling and testing service for MSM, showed a scale-up from 951 tests carried out in 2009 to more than 4049 in 2012; reactivity over this period remained stable (3.9% in 2007; 3.4% in 2012) [66]. Another study from Catalonia evaluated the impact of introducing a rapid HIV testing programme in a community testing site network and found that, 1 year

after implementation, a 103% increase had been observed in the number of tests performed; again, reactivity remained stable (2.4% in 2006; 2.2% in 2007) [37].

There were three studies that compared HIV testing in community-based settings to that in health care settings, with varied findings [38,60,94]. One study, from France, showed that a higher proportion of MSM accepted a non-medicalized community-based rapid test compared to a standard medicalized test; this non-medicalized test strategy also reached MSM at higher risk of HIV infection [60]. In contrast, the other two studies found that the proportions of people who accepted a test in the community and in sexual health clinics were similar [38,94], with one study finding overall lower uptake in community settings [38].

Other interventions

Campaigns aimed at the public to improve testing outside of health care settings ranged from small campaigns promoting local testing interventions in magazines, on websites, on social media and/or on the radio ($n = 5$) [39,60–62,97] to major media campaigns supporting HIV Testing Week ($n = 3$) [53,83,91]. A variety of indicators were used to measure the success of campaigns in increasing testing, such as the additional hours of HIV testing carried out, volume of leaflets/posters distributed, views on social media, editorial coverage, website visits and the number of people accessing the promoted services. However, no studies reported on the change in testing coverage following the campaigns.

Two studies used communication technologies to improve HIV testing rates [72,73]. One study provided the participants with their results by text message following testing in gay venues [73] and one communicated participant test results online following HIV self-sampling through the Swab2Know project [72]. In both studies, the vast majority of people had received/accessed their test results through these technologies when followed up (99% in both studies).

Three studies incorporated training of medical and non-medical staff on how to perform HIV testing as part of their testing intervention [39,86,87]. In one study, health promotion workers were trained in dried-blood spot HIV testing with a one-day education and assessment programme supported by creating a training video available on YouTube [39]. The other two studies provided training to doctors, nurses, psychologists, social workers and peer educators in community testing sites [86,87]. One study trained people recruited to a mobile outreach unit to perform HIV self-testing under the supervision of a skilled counsellor and 99% received a valid result [22]. None of these interventions documented how education or training increased testing, but

Table 2 HIV testing and positivity/reactivity rates by target population and testing venue outside health care settings

Target population	Testing venue	Number of tests performed	% offered a test	% or number that accepted a test	Testing coverage	Positivity/reactivity rate (%)	References
MSM	Community testing sites	9–14 453	100**	66–89%	16–74%	0.9–4.3	[26,27,30,38,58,60,64,66,76,86,96]
	Outreach	7–2955	100**	78–83%	10–78%	0.0–11	[20,21,39,46,51,54,72,73,81,94]
	Home	Kits returned: 8–5696		Ordered kit: 53–69%	Returned kit: 10–67%	0.0–2.1	[25,32,46,72,77,94]
BME/migrants	Community testing sites	302*–4219				2.1–3.6	[33,83,86]
	Outreach	26–5676*			18%**	0.0–6.2	[21,39,52,59]
PWID	Home	Kits returned: 10 410**			Returned kit: 60%**	1.4** (BME: 3.3)	[25]
	Community testing sites	323**				1.9**	[86]
Sex workers	Outreach	141–7113	100**	83–97%	97%**	2.5–32	[21,36,49,81]
	Community testing sites	923–1969				0.9–2.1	[33,86]
Homeless	Outreach	112**				0.9**	[56]
	Outreach	58–110			45%**	0.0**	[85,88]
Young people	Outreach	27–512		37%**	19–100%	0.0	[19,67]
	Community testing sites	341–12 261*				0.6–3.9	[33,57,86,87,89,95]
Multiple high-risk groups	Outreach	186–8923			42–95%	0.0–19	[21,39,61,63,74,81]
	Home	Kits returned: 122–10 410			Returned kit: 51–64%	1.4–2.5	[25,74,97]
	Community testing sites	1849*–71 465				1.3–3.2	[29,37,41,55,84]
General population†	Outreach	188–95 575*	100**	78–95%	5.8–98%	0.0–2.2	[22,31,34,35,50,62,68,69,75,78,90]
	Home	Kits returned: 3020*,**		Ordered kit: 629–27 917	Returned kit: 3020*,**	0.2–0.3	[18,23,42,43]

The percentage of people offered a test was calculated as the number of people offered a test divided by the number of people eligible for testing. The percentage of people that accepted a test was calculated as the number of people that accepted a test divided by the number of people who were offered a test. Testing coverage was calculated as the number of people tested divided by the number of people eligible for testing. Positivity/reactivity was calculated as the number of people with a positive/reactive test divided by the number of people tested. The percentage newly diagnosed was calculated as the number of people who were newly diagnosed with HIV divided by the number of people tested.

BME, black and minority ethnic groups; MSM, men who have sex with men; PWID, people who inject drugs.

*More than one test per person.

**Only one study presents these data.

†Includes studies set in services that are more often accessed by risk groups but do not restrict testing based on risk.

following training, 17 801 tests were delivered in community testing sites and outreach settings.

The other intervention implemented with an aim to increase HIV testing was the creation of a national testing network of community organizations working with key risk groups. This network promoted testing at a local level and supported people with reactive test results to link to care [87]. Network members received training in counselling and testing, and were offered information leaflets, rapid testing kits and a standard monitoring questionnaire. In 2016, over 6000 HIV tests were delivered.

Feasibility and acceptability of testing for HIV

The feasibility/acceptability of testing outside of health care settings was assessed by 48 studies (Table 3) [18,20–24,27–29,31–34,36,37,40,42–44,46–48,51,54,59,61,63,65,67,69,71–83,85,87,90,93,97]. Overall, HIV testing was found to be

acceptable to people offered testing across community (65–99%) [27,37,40,61] and outreach settings (90–100%) [48,63,85]. Both outreach settings and community testing sites seemed to be effective in capturing first-time testers (12–95%) [20–22,29,33,34,36,46,51,54,59,63,69,76,78,82,87,90]. HIV testing outside of health care settings was also acceptable to the staff offering the tests [67,85].

HIV self-sampling was highly acceptable (87–97%) [18,24,72,77,82], with people finding the instructions easy to understand [18] and the kits easy to use [18]. The evidence gathered suggests that self-sampling at home is useful in reaching groups at higher risk of HIV infection, such as MSM and black African populations [43,46,47]. Self-testing was also considered highly acceptable (71–98%) [23,28,31,42,97] and easy to do (92–98%) [23,42,75,97] and the results easy to interpret (97–99%), [23,28,31,75] although there was evidence to suggest that acceptability may be dependent on test price and location.[79,80,82]

Table 3 Feasibility/acceptability measures of HIV testing outside of health care settings

Testing venue	Sample size	Selection of feasibility/acceptability indicators*	References
Community testing sites	124–6046	Community testing acceptable: 65–70% Rapid testing in the community acceptable: 90–96% Same-day confirmatory testing in the community comparable to lab confirmatory results: 96% Same-day confirmatory testing results in 90 min: 91% First time testers: 12–43% First time accessing any health service: 55%	[27,29,33,37,40,61,64,76,83,87]
Outreach services	Sauna	79–231 Sauna outreach clinics were well attended and feedback from users was positive; they particularly valued the convenience and confidentiality of the service First time testers: 13–37%	[20,46,51,54]
	Mobile unit	22–8923 Outreach service acceptable: 90–99% Self-testing in outreach acceptable: 82% Ability to interpret self-test results correctly: positive result: 96%; invalid result: 94%; negative result: 95% First time testers: 18–95% First time testers who would not otherwise have tested: 40%	[21,22,31,34,48,59,63,67,69,78,90]
	Hostels	42 Testing in hostels acceptable: 100%	[85]
	Drug services	12 Testing in harm reduction services easy or very easy to do (staff): 100% Confidence in test results from tests performed in harm reduction services (staff): 60% First time testers: 18%	[36]
Other	264–411 632 Self-tests in pharmacies acceptable: 88% Self-collected testing kits acceptable in: post, 52%; college/university, 42%; school, 28%; workplace, 22%; youth club, 21%; gym, 19%; bar/pub/night-club, 17%; leisure centre, 13%; sports club, 12%; café, 7% Self-collected testing kits from outreach settings: first time testers: 80% Self-sampling cost effective in outreach settings (positivity rate > 0.1%) First time testers in brothels: 25%	[51,74,75,80,82]	
Home	HIV self-sampling	150–411 632 Self-sampling acceptable: 66–97% Self-sampling instructions easy to understand (finger-prick): 94% Self-sampling kit easy to use: 80% Preference for self-sampling: 69% Ability of self-sampling to reach risk groups: samples ordered by: MSM, 82–94%; black Africans, 3.4–42% Home self-sampling cost effective (positivity rate > 0.1%) First time testers: 10–45%	[18,24,32,43,46,47,71,72,74,77,82]
	HIV self-testing	47–5908 Self-testing acceptable: 71–98% Self-testing easy to do: 92–99% Self-test result easy to interpret: 97–99% Self-testing recommendation to a friend or family member: 89% Ability to interpret self-test results correctly: 99% Purchasing the self-test if the price was: ≥ €30, 18%; ≥ €20, 40% First time testers: 26–51%	[23,28,42,44,71,79,93,97]

MSM, men who have sex with men.

*Feasibility/acceptability among people testing unless otherwise specified.

Both self-sampling and self-testing reached a high proportion of people who had never previously tested for HIV (10–51%) [18,24,42,43,47,72,79,97]. Perceived benefits of HIV self-testing included privacy, convenience and immediacy [93].

There were two studies that measured feasibility/acceptability that were not included in Table 3, as they were not context specific. However, findings suggest a preference for oral-fluid over blood samples for rapid testing [81] and that text-messaging of test results is highly acceptable [73].

Economic evaluation of HIV testing

There was only one economic evaluation captured in this review. Perelman *et al.* carried out an economic evaluation of HIV testing for MSM across six community testing services in six European cities (Copenhagen, Paris, Lyon, Athens, Lisbon and Ljubljana) [70]. The cost per HIV test ranged from €41 to €113 and the cost per reactive test from €1966 to €9065, which were among the lowest costs quoted in the literature [70].

Barriers to HIV testing

There were six studies on barriers to HIV testing outside of health care settings [28,45,71,79,92,93]. However, in this systematic review, there were no barriers reported specific to testing in community settings. Five studies described barriers to HIV self-testing [28,45,71,79,93] from the perspective of the potential tester, including a lack of awareness of self-tests [28,45], concern about the capacity to perform self-testing [71,93], fear of a reactive result without any support [93] and cost [79]. One study explored barriers to home-sampling among MSM and found men worried about stigma, confidentiality, privacy, the accuracy of the self-sampling test and the lack of opportunity to discuss the results with a health care professional [92].

Quality assessment

Quality among the 40 peer-reviewed articles that were assessed was variable; 29 (73%) studies were of high quality, eight (20%) were of medium quality and three (7%) were assessed as being of low quality (Table 1). Risk of bias was low in 20 studies (50%), medium in 19 studies (48%) and high in one study (2%) (Table 1).

Discussion

This comprehensive systematic review presents the evidence from the EU/EEA on HIV testing outside of health care settings. Overall, the review highlights that, although HIV testing in community sites and through outreach services is highly feasible, it has been predominantly implemented in a small number of countries. Where reported, uptake and positivity/reactivity rates varied widely, but these outcome measures were generally highest among hard-to-reach groups at higher risk of infection, such as MSM, PWID, SWs and migrants. This review identifies several promising strategies for HIV testing; however, the ability to assess the effectiveness of different initiatives to increase testing was limited by a lack of comparison data. The body of evidence does suggest that testing outside of health care settings is useful in attracting people who have not tested for HIV previously and in re-engaging people previously diagnosed back into care [9].

In addition, this review demonstrates that testing in community and outreach settings is highly acceptable, not only to the people who undergo testing, but also to the people carrying out the tests. Rapid HIV testing outside of health care settings is also highly acceptable and same-day confirmatory testing in community settings is

feasible. An economic evaluation of testing MSM in community testing sites suggests that the associated costs are low. Community-based rapid testing may also have the potential to increase HIV test uptake among migrants [98].

No studies in this review measured the acceptability of lay providers offering HIV testing, although one study found that non-medicalized testing was effective at reaching high-risk MSM who were infrequent testers [60]. Furthermore, existing literature not captured in the review supports utilizing trained lay providers to carry out rapid HIV testing, which was found to be highly effective and acceptable [99]. Encouragingly, there were no studies gathered in the review that documented barriers to HIV testing in the community or by lay providers. It is unclear, however, whether this was because of a lack of research on this topic. In one study, published prior to 2010 and thus not captured in this review, African participants voiced concerns about HIV-related stigma and confidentiality, and doubts about the ability of community-based services to maintain professional standards of care [100]. More research is needed to explore barriers to testing outside of health care settings, as community and outreach testing provides key opportunities to reach highly vulnerable individuals not accessing formal health care services.

Home-sampling and home-testing are strategies that have been implemented in several studies to reach people not accessing traditional HIV testing services. Both strategies have been found to be highly acceptable, easy to use and successful in reaching populations at higher risk for HIV infection. Although, in some studies, people raised concerns about their capacity to perform self-tests, the ability to correctly interpret self-test results was found to be high. For both HIV self-testing and self-sampling, there were concerns about not having sufficient support following a reactive result. The WHO recommends that those with a reactive self-test result should be sign-posted to services for confirmatory testing and peer support [101]. Although the majority of home-sampling and home-testing interventions captured in this review were targeted to MSM, there is evidence that these strategies could be of benefit to other key populations, such as BME groups [43,47,101]. Increased HIV testing coverage could be achieved through reduction of the price of self-testing and self-sampling kits and removal of legal and regulatory barriers to use.

Despite evidence for the potential benefits to testing outside of health care settings identified in this review, as of 2016, only one in three countries in Europe had authorized delivery of community-based testing by non-medical staff and use of home-sampling or self-testing

kits was authorized in very few countries [3]. Data from the most recent Dublin Declaration implementation survey indicate that one of the main barriers to effective provision of HIV testing services in the WHO European Region is the availability of community-based services [3]. National guidance should promote the scale-up of testing outside of health care settings to improve testing coverage and reach groups at highest risk of acquiring HIV infection. In addition, legal and regulatory barriers to home-testing and home-sampling should be removed, as well as restrictions on who can offer an HIV test.

It is also essential that testing across non-traditional settings be accompanied by well-defined referral pathways into HIV care for anyone testing positive or with a reactive result. Close coordination between community testing sites and health care facilities is important to ensure successful linkage. Evidence shows that transfer to care was rarely reported in studies of testing outside of health care settings [9], but, where it was, linkage rates were comparable to linkage from medical settings [102]. Monitoring of linkage to care after HIV diagnosis in community testing sites can often be difficult because of issues with patient confidentiality; only some sites receive information about the result of the confirmatory test and care access and this information is often informal [103,104].

This systematic review is comprehensive and used a robust methodology, adherent to PRISMA guidelines, to bring together the evidence on HIV testing outside of health care settings in the EU/EEA. No language restrictions were applied; studies were included in a number of European languages and from a number of countries. Search terms were broad, minimizing the possibility that key studies were missed and minimizing any publication bias. Studies that were critically appraised were of high quality with minimal bias. However, a limitation of this review is that half (49%) of the evidence included had not been peer-reviewed (i.e. conferences or reports), making quality assessment impossible. Synthesizing the evidence was challenging given the difficulty in comparing the findings across studies. HIV testing outcome measures were reported inconsistently, using a variety of definitions; many studies failed to report even the number of people tested and positivity/reactivity. Only one study described the prolonged impact and sustainability of the intervention over time and none presented the impact of testing on HIV incidence/prevalence. Few studies measured baseline testing rates, making it impossible to assess the extent to which the interventions were effective at increasing HIV testing. One limitation to applying the lessons from this review more widely is the limited evidence from Eastern Europe, as strategies to increase

testing in one setting may not be valid in other health systems.

Conclusions

This review highlights that testing outside of traditional health care settings plays a key role in diagnosing HIV infection, particularly among people at higher risk of infection and people who have not been tested previously. Testing outside of health care settings is also highly acceptable to both providers and users, making it an essential component of a well-designed, comprehensive HIV testing strategy. Public health professionals, policy advisors and programme managers should consider adapting their national guidelines and programmes to incorporate testing outside health care settings, not only to diversify the test offer, but to reach population groups at higher risk and with potentially poorer access to health care services. Furthermore, effective testing programmes/strategies should include robust monitoring and evaluation to allow for assessment of programme impact. The evidence from this systematic review was used to inform the ECDC guidance for integrated testing for hepatitis B virus, hepatitis C virus and HIV in Europe [105].

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Author contributions

All authors were involved in the evidence synthesis and contributed important intellectual content to this manuscript. SC drafted the manuscript and was responsible for submission; all authors commented on the manuscript and approved the final draft. SC and SD coordinated the systematic review process: developed the protocol and

search terms (with VD, DR and LT), ran the searches and compiled the results. SC, SD, LT, AKS, LC, DR, SFJ and VD contributed to systematic review study screening, data extraction and quality assessment along with the wider review working group (as listed in the Acknowledgements). AJAG and LT provided ECDC quality control and directed the ECDC-PHE-CHIP collaboration.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1 Search terms for OVID Medline – (17/03/2017)

Table S2 Search terms for OVID Embase (20/03/2017)

Table S3 Search terms for OVID PsycINFO (20/03/2017)

Table S4 Search terms for the Cochrane library (17/03/2017)

Table S5 Search terms for Scopus (20/03//2017)

Table S6 List of the 30 EU/EEA countries included in the systematic review

Table S7 Systematic review quality assessment