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HIV Testing Uptake According to Opt-In, Opt-Out or Risk-Based Testing Approaches: a Systematic Review and Meta-Analysis

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Abstract

Purpose of Review Improving HIV testing uptake is essential to ending the HIV pandemic. HIV testing approaches can be opt-in, opt-out or risk-based. This systematic review examines and compares the uptake of HIV testing in opt-in, opt-out and risk-based testing approaches.

Recent Findings There remain missed opportunities for HIV testing in a variety of settings using different approaches: opt-in (a person actively accepts to be tested for HIV), opt-out (a person is informed that HIV testing is routine/standard of care, and they actively decline if they do not wish to be tested for HIV) or risk-based (using risk-based screening tools to focus testing on certain individuals or sub-populations at greater risk of HIV). It is not clear how the approach could impact HIV test uptake when adjusted for other factors (e.g. rapid testing, country-income level, test setting and population tested).

Summary We searched four databases for studies reporting on HIV test uptake. In total, 18,238 records were screened, and 150 studies were included in the review. Most studies described an opt-in approach (87 estimates), followed by opt-out (76) and risk-based (19). Opt-out testing was associated with 64.3% test uptake ($I^2 = 99.9\%$), opt-in testing with 59.8% ($I^2 = 99.9\%$) and risk-based testing with 54.4% ($I^2 = 99.9\%$). When adjusted for settings that offered rapid testing, country income level, setting and population tested, opt-out testing had a significantly higher uptake (+ 12% (95% confidence intervals: 3–21), $p = 0.007$) than opt-in testing. We also found that emergency department patients and hospital outpatients had significantly lower HIV test uptake than other populations.

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Introduction

Optimising HIV testing services is critical for ending the HIV/AIDS pandemic. Testing informs people living with HIV (PLHIV) of their status, preferably during the early stages of infection [1]. Earlier HIV detection and management have many benefits, including reducing morbidity and mortality, and preventing onward transmission [2]. It is more cost-effective to detect HIV infection early, as late presentations result in significantly higher medical costs and incur more public health expenditure [1]. Knowing one's HIV-negative status also enables use of effective biomedical prevention strategies like pre-exposure prophylaxis [3].

Despite the importance of HIV testing, many countries are not on track to meet the Joint United Nations Programme on HIV/AIDS 95–95-95 targets where 95% of PLHIV know their HIV status, 95% of people who know their status are receiving treatment and 95% of people on treatment have a supressed viral load [4]. Globally, it is estimated that 84% of PLHIV were aware of their HIV status, with 87% of these receiving treatment and 90% of these virologically

suppressed in 2020 [5]. HIV/AIDS-related deaths have only declined by 57.5%, from 1.9 million in 2010 to ~ 680,000 in 2020 [5]. Even in well-resourced health systems, a significant proportion of PLHIV are still diagnosed late [6]. In particular, the uptake of HIV testing services remains low in key populations, resulting from structural issues that limit access and fear of stigmatisation and breach of confidentiality [7]. Discriminatory attitudes towards PLHIV persist and negatively impact the use of HIV services [8]. Further, the fear of HIV-related stigma has led to PLHIV avoiding disclosure of HIV status and delaying or staying in treatment [9].

HIV testing services should always be voluntary and can take several approaches: opt-in (a person actively accepts to be tested for HIV), opt-out (a person is informed that HIV testing is routine/standard of care, and they actively decline if they do not wish to be tested for HIV) or risk-based (using risk-based screening tools to focus testing on certain individuals or sub-populations at greater risk of HIV) [10••]. Since 2006, the United States Centers for Disease Control and Prevention (CDC) has recommended an 'opt-out' approach, in which voluntary HIV testing is a part of routine health care for individuals between the ages of 13 and 64 [11]. Previous studies have suggested that this screening policy might reduce stigma by normalising HIV testing and making it a common behaviour [12–14]. Similarly, since 2007, the WHO recommends an opt-out approach to offer provider-initiated HIV testing service in health facilities for: (1) all patients, irrespective of epidemic setting, whose clinical presentation might result from underlying HIV infection; (2) as a standard part of medical care for all patients attending health facilities in high HIV prevalence settings; and (3) more selectively in low HIV prevalence settings [15]. Alternatively, a risk-based approach uses a set of criteria to either identify at-risk individuals for HIV testing who would not otherwise be offered a test ('screen in') or exclude people from a routine offer of a test ('screen out') [10••].

This systematic review examined the uptake of HIV testing by comparing opt-in, opt-out or risk-based testing approaches.

Methods

Search Strategy and Selection Criteria for the Systematic Literature Review

Ovid MEDLINE, Ovid EMBASE, Web of Science and Global Health were searched between 1st January 2010 and 9th July 2020. The search terminology revolved around two key aspects: 'HIV' and 'Risk assessments or screening'. Appendix 1 shows the full search strategy. The inclusion criteria were any study that contained primary data on the uptake of HIV testing amongst those offered testing; we then grouped this according to opt-in, opt-out and risk-based testing. Systematic literature reviews, editorials, duplicated results from the same study, laboratory studies about HIV diagnostic performance and studies restricting study populations by clinical outcomes (e.g. men with urethritis or women with cervicitis) were excluded. The primary outcome of interest was the uptake of HIV testing amongst those offered testing.

Titles and abstracts were independently assessed for eligibility by two reviewers (QS, LO). Another reviewer (JO) resolved any discrepancies. This systematic review has been registered at the International Prospective Register of Systematic Reviews (PROSPERO: CRD42020187838).

Data Analysis

An extraction file was created in Microsoft Excel, and the following information was collected: country income level, setting of the study, population tested, whether testing was opt-in/opt-out/risk-based and presence of rapid testing. Data extraction was conducted by two reviewers (QS, LO), and another reviewer (JO) resolved any discrepancies. The quality of each study was also assessed by two reviewers (QS, LO) using the relevant critical appraisal tool from Johanna Briggs Institute [16].

Statistical Analysis

We used descriptive analysis to summarise the characteristics of the studies included. We used the Fisher exact probability test to assess for statistically significant differences according to the testing approach. A country with a high HIV prevalence was defined as having a national prevalence above 5%, as reported by UNAIDS [17]. We used random effects meta-analysis to calculate the pooled proportion of people tested for HIV according to the type of HIV testing approach (opt-in, opt-out, risk-based). Inter-study heterogeneity was assessed using the I^2 statistic. We explored heterogeneity using subgroup analysis and meta-regression according to availability of rapid HIV testing, country-income level, study setting, population targeted and the latest study year. Publication bias was assessed using funnel plot and Egger's test. STATA version 16 (StataCorp. 2019. *Stata Statistical Software: Release 16*. College Station, TX: StataCorp LLC) was used to perform all statistical analyses. This review is reported per Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [18].

Role of the Funding Source

The funders did not have any role in the study design; collection, analysis or interpretation of the data; writing the report or decision to submit the paper for publication.

Results

The initial search identified 18,238 potential articles, and 150 were included in this systematic review (Fig. 1). Figure 2 summarises the country of origin of the studies. Majority of studies arose from North America ($n = 83$), followed by Africa ($n = 32$) and Europe ($n = 20$).

Table 1 summarises the characteristics of the included studies according to the country's HIV prevalence. Most studies were from high- (71%) and middle-income countries (22%), conducted in the emergency department (ED) (39%), for ED patients (41%) and involved settings with rapid testing (58%).

Table 2 compares the study characteristics of opt-in, opt-out and risk-based testing. We found that more studies from high-income countries used opt-out or risk-based approaches, and more studies from community-based settings and those targeting the general public used the opt-in approach.

Table 3 summarises the pooled proportion of people testing for HIV according to various settings. It demonstrates that opt-out testing had higher uptake of people testing for HIV compared with opt-in and risk-based testing (64.3% vs. 59.8%), although it was not statistically significantly different. However, in the meta-regression analysis (Table 4), when we adjusted for rapid HIV testing, country income level, test setting, population tested and the year of study, opt-out testing had a significantly higher HIV test uptake compared with opt-in and risk-based testing (additional 12% and 15%, respectively).

Supplementary Fig. 1 shows the funnel plot which demonstrates a possibility for publication bias with under-reporting of studies with lower HIV test uptake. The quality assessment for each paper is presented in Supplementary Tables 1–3.

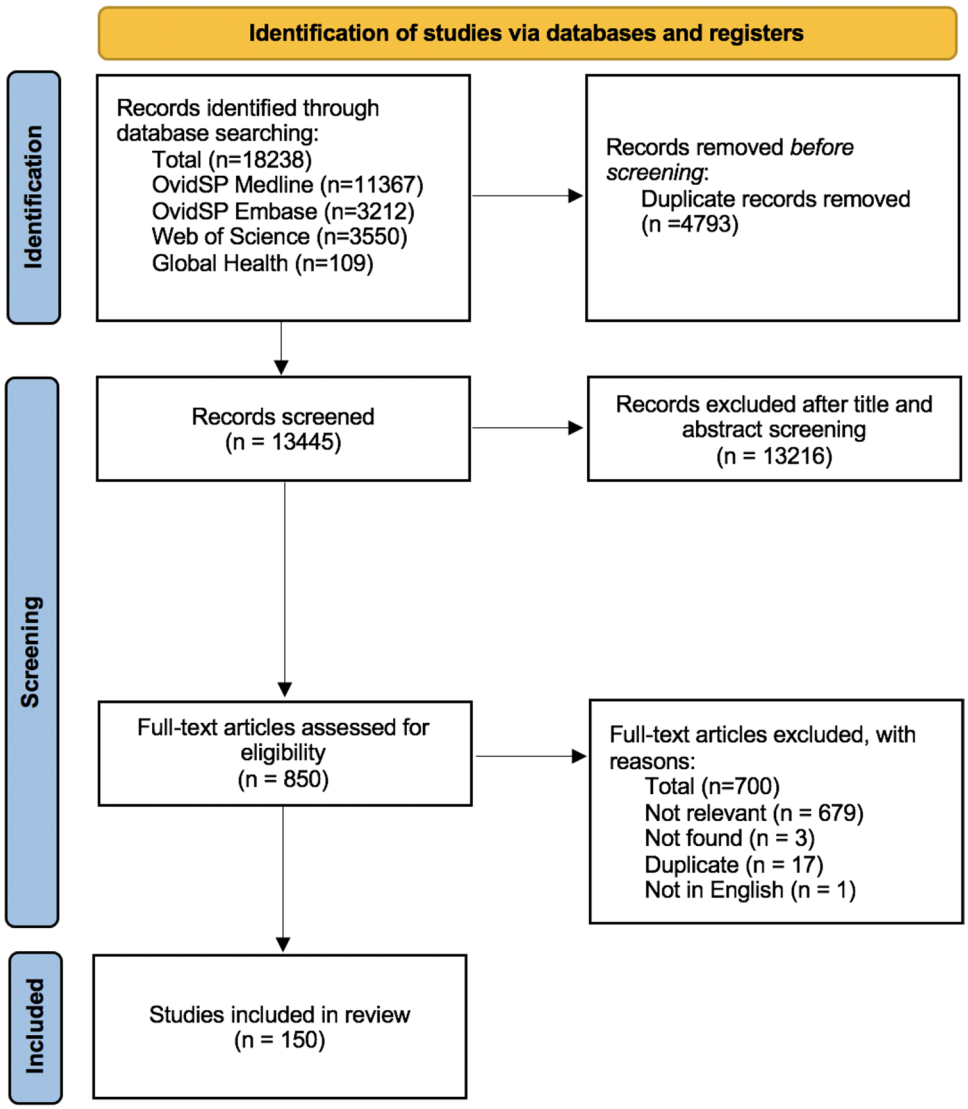

Fig. 1 PRISMA Flow diagram

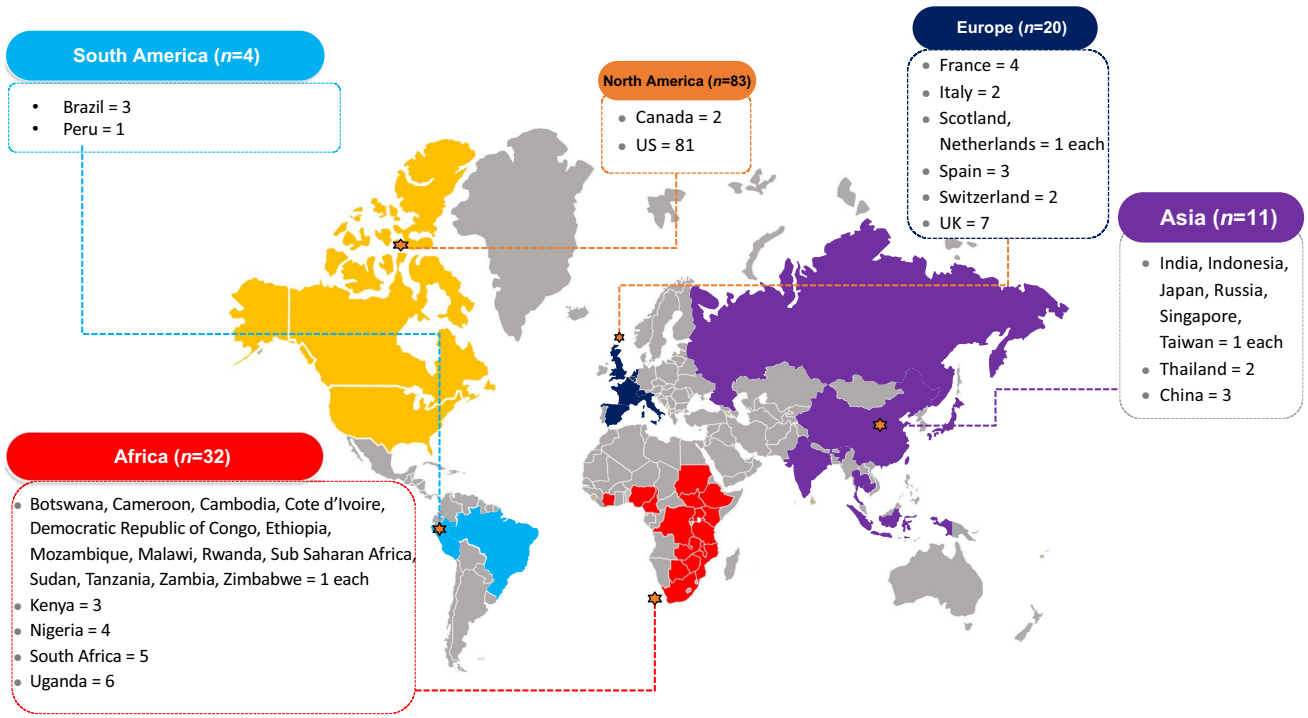

Fig. 2 Countries of included studies ($N = 150$)

Discussion

This systematic review aimed to understand the uptake of HIV testing by comparing opt-in, opt-out and risk-based testing approaches. This study adds to the evidence base regarding HIV testing approaches. We found that opt-out testing (when adjusted for rapid testing, country income level, setting and population tested) had higher uptake than opt-in and risk-based testing. We also found that the population of emergency department patients and hospital outpatients had significantly lower HIV test uptake than other populations.

Our finding that opt-out testing for HIV was associated with a higher proportion of people testing than opt-in testing is consistent with other studies. For example, a 2017 systematic review and meta-analysis comparing HIV opt-out testing and opt-in testing amongst patients attending emergency departments found that the opt-out strategies had higher uptake (44%) than the opt-in strategies (19%) [20••]. We extend the evidence base for the value of opt-out testing, as we included studies from various settings beyond emergency departments. The value of opt-out testing is exemplified by a 2021 study in Kenya that reported a 2.2-fold greater odds of new HIV diagnosis using opt-out point of care than opt-in testing [21]. The study reported higher refusal rates for opt-in testing, whilst a higher proportion of participants in the opt-out testing were willing to disclose risky sexual practices, suggesting that they were more likely to participate if testing were presented as part of standard care [21]. The study also reported that physicians were more likely to offer tests to patients who are at a higher risk of HIV (i.e. never tested, tested > 1 year ago, older men) and therefore were likely to miss a substantial proportion during opt-in testing [21].

Our review found that opt-out testing was mostly implemented in the emergency department setting. Yet, HIV test uptake was the lowest in emergency departments compared with other settings where opt-out testing was available. Whilst there could be value in HIV testing in emergency departments, studies have shown HIV testing in emergency departments could have poor linkage to care [22], low test acceptance rates amongst marginalised populations [23], high cost per positive diagnosis [24] and lack of cultural competency being integrated [25]. This could also be due to the transient nature of conditions and acute care needed in the emergency department, where the focus is on the patient's current issue and less on peripheral issues like HIV testing. Furthermore, HIV testing uptake could be higher when a physician offers the test [26–28] which may not always be the case in a busy emergency department. Nevertheless, an ED-based HIV screening program remains an integral component of the overall HIV screening strategy to reduce the current HIV testing gap and complement existing community-based HIV screening programs. Therefore, our study highlights the need for further improvements for HIV testing beyond

Table 1 Study characteristics, according to low and high (≥ 5%) HIV prevalence [19]

	Total ($N=150$)	Low HIVprevalence ($N=133$)	High-HIVprevalence ($N=17$)
Country income level	***n*** **(%)**	***n*** **(%)**	***n*** **(%)**
High	106 (71)	106 (80)	0 (0)
Middle	33 (22)	24 (18)	9 (53)
Low	11 (7)	3 (2)	8 (47)
Settings			
Primary care/GP	10 (7)	9 (6)	1 (6)
Pharmacy	1 (0.7)	1(1)	0 (0)
Hospital	20 (13)	15 (11)	5 (29)
Emergency department	58 (39)	58 (44)	0 (0)
Community	25 (16)	17 (13)	8 (47)
Dental/outpatient clinic	29 (19)	26 (19)	3 (18)
Prisons	7 (5)	7 (6)	0 (0)
Populations			
ED patients	60 (41)	60 (46)	0 (0)
Paediatrics	5 (3)	1 (1)	4 (23)
Outpatients	36 (24)	34 (25)	2 (12)
Hospital inpatients	14 (9)	11 (8)	3(18)
General public	28 (18)	20 (14)	8 (47)
Incarcerated persons	7 (5)	7 (6)	0 (0)
Availability of rapid HIV testing			
Yes	86 (58)	75 (57)	11 (65)
No	64 (42)	58 (43)	6 (35)
Study year			
2016–2020	27 (18)	21 (16)	6 (35)
2011–2015	64 (43)	57 (43)	7 (41)
2006–2010	54 (36)	50 (37)	4 (24)
2001–2005	5 (3)	5 (4)	0 (0)

ED emergency department, *GP* general practice

Table 2 Study characteristics according to opt-in testing, opt-out testing or risk-based testing approaches

	Opt-in ($N=87$)	Opt-out ($N=76$)	Risk-based ($N=19$)	*p* value
Country income level	*n* (%)	*n* (%)	*n* (%)	
High	52 (60)	62 (82)	15 (79)	0.007
Middle	25 (29)	11 (14)	4 (21)	0.083
Low	10 (11)	3 (4)	0 (0)	0.104
Settings				
Primary care/GP	4 (5)	6 (8)	4 (21)	0.050
Pharmacy	1 (1)	0 (0)	0 (0)	1.000
Hospital	7 (8)	12 (16)	4 (21)	0.131
Emergency department	29 (33)	34 (45)	7 (38)	0.311
Community	23 (26)	5 (6)	2 (10)	0.002
Dental/outpatient clinic	18 (20)	12 (16)	1 (5)	0.281
Prisons	5 (7)	7 (9)	1 (5)	0.769
Populations				
ED patients	30 (34)	33 (44)	6 (32)	0.432
Paediatrics	1 (1)	3 (4)	2 (10)	0.090
Outpatients	18 (20)	19 (25)	7 (38)	0.309
Hospital inpatients	5 (6)	10 (13)	1 (5)	0.218
General public	28 (32)	4 (5)	2 (10)	< 0.001
Incarcerated persons	5 (7)	7 (9)	1 (5)	0.769
Rapid HIV testing				
Yes	57 (65)	39 (52)	9 (47)	0.135
No	30 (35)	37 (48)	10 (53)	-

Of 150 unique studies, some evaluated more than one approach and thus will appear more than once in the columns

opt-out testing strategies for the emergency department setting.

These are missed opportunities for HIV testing in certain settings. Our review uncovered that pharmacies, followed by primary care clinics, had the lowest uptake of HIV testing. In many countries, the majority of the population sees a primary care practitioner at least once a year [29, 30]. The literature surrounding insights into GPs' current HIV testing practices reveal the barriers GPs face to routinely offering testing, including being worried about potentially harming patient relationships [31] and feeling incapable of offering HIV tests due to perceived poor knowledge [32]. Steps should be taken to address barriers around HIV testing in primary care to improve HIV detection rates [33, 34]. In addition, pharmacies can provide point-of-care HIV testing [35] and participate in HIV prevention related to pre-exposure prophylaxis and post-exposure prophylaxis [36].

One unexpected finding from our review was in settings where rapid testing was available, there was no significant difference in HIV test uptake compared to settings without rapid testing. This observation should be interpreted with caution. One possibility could be because the majority of studies with rapid testing were conducted in emergency department settings, a setting with the lowest testing uptake in this review. Another possibility is that unlike other studies which specifically assessed the impact of rapid testing compared with venepuncture, our systematic review examined the difference in HIV test uptake between settings where rapid testing was available compared with settings that did not have rapid testing uptake. Therefore, there could be other confounders related to sub-populations attending these settings [37, 38]. There is evidence of greater appeal of rapid testing compared with venepuncture. For example, a 2013 systematic review on rapid point-of-care HIV testing found that youth preferred rapid point-of-care tests compared to traditional testing methods [39]. Similarly, a study of adults attending general practices in France reported higher acceptability of a rapid test (92%) compared with venepuncture

Table 3 Pooled proportion of people testing for HIV

	Number of studies	Pooled proportion of people testing for HIV (%)	95% confidence interval	I^2 (p value)
Total ($N=182$)		61.2	57.4–64.9	99.9 (<0.001)
Type of HIV testing service				
Opt-in	87	59.8	52.2–67.3	99.9 (<0.001)
Opt-out	76	64.3	57.4–70.9	99.9 (<0.001)
Risk-based	19	54.4	41.2–67.4	99.9 (<0.001)
Rapid testing				
Available	86	62.2	56.1–68.0	100.0 (<0.001)
Not available	64	60.0	54.4–65.5	100.0 (<0.001)
Country income level				
High	106	53.7	49.5–57.8	100.0 (<0.001)
Middle	33	80.4	73.9–86.2	99.9 (<0.001)
Low	11	69.1	57.2–79.9	99.6 (<0.001)
Setting				
Hospital	22	72.0	56.4–85.2	100.0 (<0.001)
GP/primary care	14	81.4	72.0–89.3	98.5 (<0.001)
Pharmacy	1	39.5	33.2–46.1	-
Community-based	30	79.2	73.6–84.3	100.0 (<0.001)
Emergency department	71	46.6	40.1–53.3	100.0 (<0.001)
Prison	14	68.8	49.9–84.9	100.0 (<0.001)
Outpatients	29	55.9	44.9–66.7	100.0 (<0.001)
Mixed	3	46.9	16.1–79.1	-
Populations				
Inpatients	15	68.4	45.7–87.3	100.0 (<0.001)
Emergency patients	69	47.2	40.6–53.9	100.0 (<0.001)
Paediatrics	6	75.7	63.1–86.4	99.7 (<0.001)
General public	34	76.4	71.1–81.3	100.0 (<0.001)
Outpatients	41	64.8	50.1–78.2	100.0 (<0.001)
Incarcerated persons	11	68.8	49.9–84.9	100.0 (<0.001)
Mixed	3	46.9	16.1–79.1	-
Latest study year				
2016–2020	27	69.2	57.8–79.5	100.0 (<0.001)
2011–2015	64	59.8	54.7–64.8	100.0 (<0.001)
2006–2010	54	58.2	48.7–67.3	100.0 (<0.001)
2001–2005	5	63.2	49.7–75.7	99.8 (<0.001)

(64%) [40]. Studies report that patients prefer to receive their results quickly and would recommend rapid testing to their peers [41, 42]. Rapid testing can reach high-risk populations in clinical and community settings, which is critical in testing untested individuals [43, 44]. However, there is evidence that some patients may have concerns regarding the reliability of the rapid test and having their clinical visits prolonged [33]. Further research is warranted to understand how rapid testing (including HIV self-testing) could improve HIV testing rates using an opt-out approach.

Our findings have implications for policy and practice for HIV testing. First, congruent with WHO and US CDC recommendations, our review strengthens the evidence base that an opt out testing approach could further improve HIV testing. However, this should not be a one-size-fits all recommendation as evidenced by the high heterogeneity between studies. This underscores the importance to consider the type of clinical service and the unique socio-cultural contexts of different regions and countries. Nevertheless, our review provides a useful compendium of studies where opt-out testing has worked well and where it has not. Second, we highlight the settings where more work is needed to improve HIV testing rates, for example, in emergency departments and hospital outpatients. Whilst opt-out testing in these settings may reduce stigma associated with HIV by normalising testing, further implementation research is needed to understand ongoing barriers and focus on strategies to better integrate HIV testing into the clinical workflow.

There are a few limitations of this systematic review. First, many studies included were from high-income countries, specifically, more than half were from the USA. As such, the

Table 4 Meta-regression of HIV test uptake

Variable	Univariable			Multivariable[1]	
	β (95% CI)	P-value	Adjusted R^2	β (95% CI)	P-value
Type of HIV testing service approach			-0.15%		
Opt-in	Reference			Reference	
Opt-out	0.04 (-0.05 to 0.12)	0.413		0.12 (0.03 to 0.21)	0.007
Risk-based	-0.05 (-0.19 to 0.09)	0.506		-0.03 (-0.17 to 0.11)	0.685
Rapid testing			-0.51%		
Available	Reference			Reference	
Not available	-0.02 (-0.10 to 0.07)	0.674		-0.03 (-0.11 to 0.06)	0.542
Country income level			12.1%		
High	Reference			Reference	
Middle	0.24 (0.15 to 0.33)	<0.001		0.21 (0.09 to 0.32)	0.001
Low	0.14 (-0.01 to 0.30)	0.067		0.19 (0.00 to 0.38)	0.051
Mixed	0.28 (-0.23 to 0.79)	0.273		0.17 (-0.41 to 0.75)	0.560
Setting			17.9%		
Hospital	Reference			Reference	
GP/primary care	0.10 (-0.07 to 0.28)	0.251		0.04 (-0.22 to 0.29)	0.779
Pharmacy	-0.30 (-0.82 to 0.22)	0.256		-0.20 (-0.76 to 0.36)	0.487
Community-based	0.06 (-0.08 to 0.21)	0.371		0.03 (-0.22 to 0.29)	0.795
Emergency Department	-0.23 (-0.35 to -0.10)	<0.001		-0.35 (-0.68 to -0.03)	0.032
Prison	-0.03 (-0.20 to 14.4)	0.761		0.09 (-0.11 to 0.28)	0.373
Outpatients	-0.15 (-0.29 to 0.0)	0.044		-0.29 (-0.54 to -0.04)	0.021
Mixed	-0.23 (-0.54 to 0.08)	0.141		-0.32 (-0.67 to 0.03)	0.072
Populations			11.5%		
Inpatients	Reference			Reference	
Emergency patients	-0.18 (-0.33 to -0.03)	0.017		0.26 (-0.07 to 0.59)	0.124
Paediatrics	0.09 (-0.16 to 0.34)	0.495		-0.01 (-0.18 to 0.38)	0.958
General public	0.07 (-0.09 to 0.23)	0.383		0.10 (-0.18 to 0.38)	0.487
Outpatients	-0.03 (-0.19 to 0.13)	0.710		0.22 (-0.05 to 0.48)	0.108
Incarcerated persons	0.01 (-0.18 to 0.21)	0.900		*	
Mixed	-0.19 (-0.52 to 0.14)	0.251		*	
Latest study year			-0.16%		
2016–2020	Reference			Reference	
2011–2015	-0.07 (-0.19 to 0.04)	0.194		0.01 (-0.10 to 0.12)	0.818
2006–2010	-0.09 (-0.20 to 0.02)	0.114		0.04 (-0.08 to 0.15)	0.552
2001–2005	-0.03 (-0.29 to 0.23)	0.812		0.19 (-0.06 to 0.44)	0.135

*omitted because of collinearity

[1]Adjusted R^2 23.3%

results may not be easily generalisable to other settings and/or in lower-income settings. A large proportion (71 of 150) of studies were from an emergency department. Therefore, our findings could be skewed by the large proportion of studies from the USA, emergency department settings and/or high-income countries. Second, we found a low number of studies using the risk-based HIV testing approach (19 of 150 articles), thus exposing a gap in the literature for future studies to evaluate the value of this approach [10••]. Third, we found high heterogeneity between studies, highlighting the importance of the need for local, contextualised evidence when deciding between an opt-in, opt-out or risk-based testing approach. We explored this heterogeneity in our meta-regression analyses and found that country-income level, settings and type of population could explain some of this variability, but there remain unexplained confounders.

In conclusion, this review adds to the current literature that opt-out testing can significantly improve HIV test uptake compared to opt-in in various settings and across different populations. We also uncovered settings (emergency department, primary care, pharmacy) where HIV test uptake remains poor, highlighting the need to implement new strategies in those settings to improve HIV test uptake if we are to end the HIV/AIDS pandemic.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11904-022-00614-0.

Author Contribution JJO, CJ, MSJ conceptualised the idea. LO and QS performed the screening and extraction of data. JJO analysed the data. LO and QS wrote the original draft. All authors contributed to the writing of the manuscript and approved the final version for submission.

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Data Availability All relevant data are presented in the manuscript and online supplementary materials. Any further details can be obtained by contacting the corresponding author.

Code Availability Not applicable.

Declarations

Ethics Approval Not applicable.

Consent to Participate Not applicable.

Consent for Publication Not applicable.

Conflict of Interest The authors declare no competing interests. The contents in this article are those of the authors alone and do not necessarily reflect the view of the World Health Organization.

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•• Of major importance

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