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Economic evaluation in implementation initiatives to improve HIV prevention, screening and treatment: a systematic review

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Systematic Review

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Abstract

Background

The global response to HIV has achieved major advances, while the uptake of proven prevention, screening, and treatment technologies remains uneven, particularly in resource-limited settings. Implementation initiatives are essential to bridge this gap, but their economic implications are less systematically understood.

Methods

We conducted a systematic review to synthesize evidence on the implementation costs and economic evaluations of global initiatives designed to improve uptake of HIV-related technologies. We systematically searched MEDLINE, Embase, LILACS, PsycINFO, EconLit, and Web of Science for peer-reviewed studies published between 1981 and December 2024. We included studies that reported economic evaluations of implementation strategies aiming to enhance the uptake of HIV prevention, screening, or treatment technologies in low-, middle-, and high-income countries. We excluded studies based on hypothetical scenarios, technology-only evaluations, or non-HIV interventions. We extracted data on study characteristics, implementation strategies, outcomes, and costs using the ERIC and RE-AIM frameworks. We standardised costs to 2024 USD and synthesised economic findings narratively. We assessed study quality using the Drummond checklist.

Results

We screened 4,387 records and included 25 eligible studies. The interventions focused on prevention (n = 6), treatment (n = 5), screening (n = 12), or combined aims (n = 2). The most frequent implementation strategies involved engaging patients and communities, modifying infrastructure, and training providers. Implementation costs ranged from $2 to $11,979 per person reached, with lower averages in low- and middle-income countries ($108; range $3–660) than in high- and upper-middle-income settings ($1,694; range $2–11,979). We identified 16 studies that conducted full economic evaluations. Prevention and screening initiatives more frequently reported cost-effective or cost-saving results, while treatment studies showed greater variability, partly due to methodological and contextual differences.

Conclusions

Implementation costs and cost-effectiveness outcomes varied widely across settings and intervention types. Our findings highlight the need to standardise cost classification, reporting, and analytic methods to strengthen the integration of economic evidence within implementation science. We discussed how to improve methodological consistency to enhance comparability and policy relevance, supporting efficient and equitable progress toward global HIV targets.

Registration:

Protocol published on PROSPERO international database (CRD42024565223).

Contributions to the literature

- We systematically synthesized how economic evaluations are conducted within implementation initiatives aimed at strengthening the HIV response.
- Economic evidence was more frequently available for prevention and screening initiatives than treatment-focused studies.
- There is substantial heterogeneity in how implementation costs are defined, classified, and reported, limiting cross-study comparability.
- Our findings highlight the need for standardised methods for economic evaluation of implementation initiatives for the HIV-response.
- The review emphasizes equity as a core dimension of economic evaluation, reinforcing its relevance to the UNAIDS 95-95-95 targets.

Background

The global response to Human Immunodeficiency Virus (HIV) has driven decades of scientific and clinical progress, resulting in the development of effective and cost-effective HIV prevention, screening, and treatment technologies (1). However, their use in routine healthcare remains inconsistent (2, 3). This persistent gap between evidence and practice is further exacerbated by declining global investment in public health programmes, including those targeting HIV, posing serious risks to the sustainability of recent progress (4).

In response to the global HIV epidemic, the Joint United Nations Programme on HIV/AIDS (UNAIDS) introduced the 95-95-95 targets: the goal for 2030 is for 95% of people living with HIV to (i) know their status, (ii) receive treatment, and (iii) achieve viral suppression (5) . These targets are now embedded within a broader equity-focused framework that emphasises community-led responses and seeks to dismantle structural barriers. Additional goals include 95% coverage of services to eliminate vertical transmission, 95% access to sexual and reproductive health services for women, and integrated care reaching 90% of people at risk (5). As of 2024, approximately 40.8 million people were living with HIV worldwide, of whom only 87% were aware of their serological status, and around 77% had access to antiretroviral therapy (ART) (6). Achieving the 2030 targets will require the effective implementation and scale-up of both

existing and emerging HIV-related health technologies, especially in the context of increasingly constrained global health budgets, with particular attention to underserved communities and priority populations.

Implementation science has emerged as a critical field aimed at improving the adoption, delivery, and sustainability of interventions in real-world settings (7–9). Implementation strategies are designed to enhance the practical uptake of health technologies and interventions, such as provider training, community engagement, and service restructuring (8, 9). These strategies often require substantial resources, making consideration of their economic implications an essential component of evaluation (7, 8, 10). Within implementation science, economic evaluation aims to assess not only the resource implications and consequences of clinical treatments, but also the resource use and outcomes associated with the strategies used to implement those treatments (10). For instance, an evaluation might examine the cost-effectiveness of a community outreach strategy designed to increase HIV testing uptake among a specific population, such as the approach adopted by Common Ambition Bristol (11). Economic evaluations in implementation science aim to combine the trade-offs between the treatment and the implementation strategy, informing decisions about the value for money of translating research into practice (10, 12, 13).

Previous reviews indicate economic evaluations of implementation strategies remain limited and often methodologically inconsistent (7, 14). In the context of HIV, economic evaluations have increasingly been reported alongside assessment of implementation strategies for HIV initiatives (2, 7). However, to our knowledge, no review has systematically assessed the use of economic evaluations for implementation strategies for HIV initiatives. Salomon (2) emphasized that bridging the gap between implementation science and economic evaluation in the context of HIV global response is a priority area for an effective response. Moreover, existing studies are often concentrated in high-income settings (2, 15); while there is also growing interest in understanding how contextual differences across high-, middle-, and low-income countries influence the resource implication and effectiveness of implementation strategies (16).

This study aims to systematically review implementation costs and economic outcomes in studies evaluating strategies designed to enhance the uptake of interventions for HIV prevention, screening, and treatment in high-, middle-, and low-income countries. The review focused on interventions targeting either the general population, key population (e.g., men who have sex with men, sex workers), or groups particularly vulnerable to HIV infection (e.g., young people, pregnant women). With this review, we aim to contribute to bring the gap between implementation science and economic evaluation in the context of HIV global response.

Methods

Study design

This systematic review critically examines the use of economic evaluations reported within implementation initiatives for the HIV response. The study protocol was registered on the PROSPERO database (CRD42024565223).

Eligibility criteria, search and screening strategies

We included published peer-reviewed studies that conducted economic evaluations of implementation strategies aimed at increasing the uptake of evidence-based technologies for HIV prevention, screening, or treatment. Eligible study designs included randomised controlled trials, natural experiments, quasi-experiments, and observational studies.

Interventions could target either universal or specific populations (e.g., adolescents, young adults, pregnant women, or sero-discordant couples) vulnerable to, or living with HIV. We excluded studies focusing on individuals with acquired immune deficiency syndrome (AIDS), as these typically involve additional efforts to manage opportunistic infections and malignancies. We also excluded studies based on hypothetical scenarios or health technology assessments, those that did not report costs related to implementation strategies, or those that presented mixed outcomes without a specific focus on the HIV response. Reviews, commentaries, protocols, and grey literature were not considered.

We searched for studies published from the first global reports of HIV in 1981 to December 2024 (17). The search was restricted to English, Spanish, and Portuguese, and applied to the following databases: MEDLINE, Embase, LILACS, PsycINFO, EconLit, and Web of Science. The search strategy combined terms related to implementation science, economic evaluation, and HIV care (Appendix 1).

We exported the search results to Zotero and removed duplicates. We conducted study selection on the Rayyan online platform. One reviewer (VKA) screened all titles and abstracts, while two co-authors (CSR and YH) together independently screened 20% to ensure consistency. We resolved discrepancies through discussion with a third reviewer (CSR or YH). Two reviewers (VKA and CSR, or VKA and YH) screened all full-text papers. We documented and justified all exclusions at this stage.

Data extraction

We extracted data on study characteristics, target HIV interventions, implementation strategies, implementation outcomes, and costs. Information on study and intervention characteristics included geographic location, study design, intervention aim, the health technology implemented, the implementation strategy employed, setting, and target population. We also extracted data related to economic evaluation, including perspective (societal, health system), time horizon, cost components, type of economic evaluation, outcome measures, and additional analyses.

We categorised implementation strategies using the Expert Recommendations for Implementing Change (ERIC) framework to ensure consistency across studies (9). One researcher (VKA) performed data extraction with a standardised Excel template. A second reviewer (CSR or YH) independently checked all

extracted data, and a third reviewer (CSR or YH) resolved any discrepancies.

We classified implementation outcomes according to the RE-AIM framework (18). Box 1 presents definitions and practical examples of these categories, including cost subtypes.

Box 1 - Definitions and examples of implementation strategies, implementation outcomes (RE-AIM), and cost categories used in this review

Domain	Category	Definition	Example
Implementation strategies (9)	Educational strategies	Approaches to increase knowledge or skills to improve adoption or fidelity of an intervention.	Provider training to support PrEP initiation.
	Infrastructure changes	Modifications to physical or organisational structures that support implementation.	Task-shifting ART delivery from doctors to nurses.
	Community engagement	Activities that involve stakeholders and beneficiaries in the implementation process.	Peer-led outreach to increase HIV self-testing uptake.
Implementation outcomes (18)	Reach	Number, proportion, and representativeness of individuals exposed to or receiving the intervention.	Number of men reached through secondary distribution of self-test kits.
	Adoption	Number or proportion of settings or staff initiating the intervention.	Percentage of clinics adopting HIV testing via lay providers.
	Implementation	Fidelity, consistency, quality, and adaptations during delivery, including associated costs.	Number of counselling sessions delivered as planned; cost per person reached.
	→ Start-up costs	One-time expenses to prepare for implementation.	Initial training of providers; development of materials.
	→ Delivery costs	Recurring operational expenses for delivering the strategy.	Salaries, transportation for outreach workers, ongoing supervision.
	→ Treatment costs	Direct clinical costs.	HIV test kits, PrEP medication.
	Effectiveness	Impact of the intervention on clinical or behavioural outcomes.	Increase in HIV testing rates or ART adherence.
	Maintenance	Sustainability of the intervention over time post-implementation.	Continued use of PrEP delivery model after donor funding ends.

For economic evaluations, we extracted details on context (e.g., perspective, time horizon), costing methods, cost data sources, analytic methods, reported uncertainties, results, and conclusions drawn by the authors.

Quality assessment

We assessed the quality of the included studies according to the type of economic evaluation performed. For studies reporting full economic evaluations (i.e., cost-effectiveness, cost-utility, or cost-benefit analyses), we applied the 10-item Drummond checklist (19). Each study received a score from 1 to 10, with 1–3 considered poor, 4–7 average, and 8–10 good quality (20). For studies reporting cost analysis only, considered partial economic evaluations, we adopted a differentiated approach. When cost analyses included outputs or proxy effectiveness measures (e.g., number of clients reached or tests performed), we applied the Drummond checklist where relevant. For purely descriptive cost analyses without effectiveness data, we did not apply the checklist. Instead, we described these studies narratively in terms of costing approach, level of detail, and reporting transparency.

One researcher (VKA) conducted the quality assessment, and a second reviewer (CSR) independently checked all assessments. A third reviewer (YH) resolved any disagreements through discussion.

Data analysis

Given the heterogeneity of settings, populations, and methodologies among the included studies, we adopted a narrative synthesis approach without meta-analysis (21). We conducted subgroup analyses based on the primary aim of the intervention (i.e., prevention, screening, or treatment).

We extracted and reported implementation costs using the typology “start-up, delivery, or treatment costs” from the ImpRes guideline (8). Start-up costs referred to one-time investments required to prepare for implementation (e.g., initial training, adaptation); delivery costs referred to ongoing operational expenses (e.g., salaries, outreach, supervision); and treatment costs referred to direct clinical care costs, such as medications and medical tests (8). For comparability, we excluded treatment costs (e.g., HIV medicines) from implementation cost estimates when reported.

We adjusted all costs to 2024 United States Dollars (USD) using the CCEMG–EPPI-Centre Cost Converter online tool (22). In this study, we defined the implementation outcome “reach” as the number of individuals who received, accessed, or were exposed to the intervention (8). This allowed us to estimate cost per person reached by dividing total implementation costs by the reported reach number. For studies involving multiple settings or regions, we also calculated average, minimum, and maximum costs per reach where applicable.

We summarized economic evaluation results in tables and expressed them in the base year reported by each study. This systematic review followed PRISMA 2020 reporting guidelines.

Results

Studies included

We identified 4,387 papers after removing duplicates. After screening, we excluded 4,174 papers (95%) for not meeting the eligibility criteria. We then assessed 213 full-text articles (5%) for eligibility, and excluded 190. Most common reason for exclusion were implementation costs were not detailed (n = 80, 37%), the study was based on a hypothetical scenario (n = 31, 14%), or no economic evaluation was performed (n = 22, 10%). Other reasons included absence of implementation cost reporting (n = 17, 9%), ineligible publication type (n = 15, 8%), technology cost assessment (n = 12, 6%), interventions not HIV-related (n = 12, 6%), or ineligible population (n = 1, 1%).

In total, we included 25 studies in the synthesis, of which 22 were identified through database searches and 3 via other methods, such as scanning reference lists of relevant reviews. The full selection process is summarised in the PRISMA flow diagram (Fig. 1).

Figure 1 – PRISMA 2020 chart flow of identification of new studies via databases and other methods

[Insert Fig. 1]

Characteristics of studies

Table 1 and Fig. 2 provide an overview of the characteristics of the included studies. We included 25 studies published between 2006 and 2024. Eight studies (32%) were conducted in lower-middle-income countries (Kenya, India, Indonesia, Senegal, and Côte d'Ivoire), eight (32%) in high-income countries (United States and Switzerland), seven (28%) in low-income countries (Tanzania, Uganda, Zambia, Eswatini, and Mali), and four (16%) in an upper-middle-income country (South Africa) (Fig. 2A). Two studies reported initiatives implemented in more than one country.

Table 1
– Characteristics, context and implementation aspects of the included studies

Intervention aim	Study	Country	Setting	Population	Design	Treatment	Implementation Strategies	Comparator(s
Prevention	Holmes *et al.* (24)	South Africa	MMVC clinic, community outreach	Men (25–49 years old)	Quasi-experimental (pre-post)	MMVC	• Tailor strategies • Distribute educational materials • Change physical structure and equipment • Intervene with patients/consumers to enhance uptake and adherence	Standard care routine MMVC services
	Torres-Rueda *et al.* (25)	Tanzania	MMVC clinic, community outreach	Men (20–34 years old)	Cluster randomised controlled trial	MMVC	• Identify and prepare champions • Intervene with patients/ consumers to enhance uptake and adherence • Involve patients/ consumers and family members • Use mass media • Change physical structure and equipment.	Standard care routine MMVC services
	Terris-Prestholt *et al.* (26)	Tanzania	Healthcare clinic, school, community centre	Scholars (adolescents)	Cluster randomised controlled trial	Condoms	• Build a coalition • Intervene with patients/ consumers to enhance uptake and adherence • Conduct educational outreach visits	No intervention
	Wall *et al.* (30)	Zambia	Healthcare clinic	Heterosexual couples (HIV status independent)	Quasi-experimental (prospective)	MMVC, Condoms, HIVRT, ART	• Conduct ongoing training • Use mass media • Intervene with patients/ consumers to enhance uptake and adherence	Standard care individual HIVTC
	Roberts *et al*. (35)	Kenya	Hospital, Healthcare clinic, Dispensaries	Young Women and Adolescents	Quasi-experimental (prospective)	PrEP	• Mandate change	No comparator
	Chandrashekar *et al.* (29)	India	Community-based	FSW, MSM, and transgender people	Observational	Condom	• Access new funding • Audit and provide feedback • Change service sites • Develop a formal implementation blueprint • Develop resource sharing agreements • Involve patients/consumers and family members	No comparator

Intervention aim	Study	Country	Setting	Population	Design	Treatment	Implementation Strategies	Comparator(s
							• Obtain formal commitments • Stage implementation scale up • Tailor strategies • Use advisory boards and workgroups	
Treatment	Page *et al*. (41)	USA	Remote	People living with HIV	Quasi-experimental (prospective)	ART	• Stage implementation scale-up • Intervene with patients/ consumers to enhance uptake and adherence	No comparator
	Lightner *et al.* (42)	USA	Healthcare clinic, Health Department	People living with HIV in social vulnerability that are non-adherent to the treatment	Quasi-experimental (prospective)	ART	• Fund and contract for the clinical innovation • Conduct ongoing training	Standard care no patient navigation service
	Rasu *et al.* (43)	USA	Community HIV clinic	People living with HIV	Natural experiment (prospective)	ART	• Stage implementation scale-up • Intervene with patients/ consumers to enhance uptake and adherence	Standard care
	Barton *et al.* (44)	South Africa	Primary Healthcare clinic	People living with HIV who have not initiated ART yet	Cluster randomised controlled trial	ART	• Revise professional roles • Conduct educational outreach visits • Develop educational materials • Work with educational institutions	Standard care doctor-led ART
	Barnabas *et al.* (45)	Uganda and South Africa	Community-based, hybrid (community and healthcare clinic)	People living with HIV not diagnosed with AIDS (> 18 years-old)	Randomised control trial	ART	• Change service sites • Conduct ongoing training	Standard care Healthcare clinic
Prevention, Screening	Frey *et al.* (46)	Switzerland	HIVTC clinics, community-based (outreach in target venues)	MSM	Quasi-experimental (prospective)	HIVRT, Condom, PrEP	• Alter patient/ consumer fees • Distribute educational materials • Intervene with patients/ consumers to enhance uptake and adherence • Use mass media	No intervention

Intervention aim	Study	Country	Setting	Population	Design	Treatment	Implementation Strategies	Comparator(s
Prevention, Treatment	Ying *et al.* (47)	Uganda	Healthcare clinic	Sero-discordant couples	Quasi-experimental (prospective)	PrEP, ART	• Stage implementation scale-up • Intervene with patients/ consumers to enhance uptake and adherence	Standard care not target services
Screening	Skaathun *et al.* (36)	USA	Emergency department, Inpatient care, Healthcare clinic	Strategy 1&2: Universal Strategy 3: Young Black MSM	Natural experiment (prospective)	HIVRT, confirmatory exam	Strategy 1: Mandate change Strategy 2&3: • Intervene with patients/ consumers to enhance uptake and adherence • Involve patients/ consumers and family members • Promote network weaving • Use capitated payments	Standard care routine hospital-based HIVTC
	Wamuti *et al.* (27)	Kenya	HIVTC clinics	Men's sexual partners of clinic attendants	Quasi-experimental (prospective)	HIVRT	• Intervene with patients/ consumers to enhance uptake and adherence • Involve patients/ consumers and family members • Promote network weaving	Standard care no service integration
	Phillips *et al.* (37)	USA	Community HIV clinic	Young MSM	Randomised controlled trial	HIVRT	• Audit and provide feedback • Change accreditation or membership requirements	No intervention
	Shrestha *et al.* (28)	USA	Community-based organisations	Universal	Quasi-experimental (retrospective)	HIVRT, confirmatory exam	• Intervene with patients/ consumers to enhance uptake and adherence • Involve patients/ consumers and family members • Promote network weaving • Use capitated payments	No intervention
	Putri *et al.* (23)	Indonesia	Community-based (outreach)	FSW and MSM	Quasi-experimental (prospective)	HIVST	• Identify and prepare champions • Centralize technical assistance	No comparator
	McGee *et al.* (38)	Eswatini	Community-based (outreach), workplace	Universal (with additional efforts to reach SW, MSM, PWUD and men populations)	Quasi-experimental (prospective)	HIVST	• Change service sites • Conduct ongoing training • Create new clinical teams • Recruit, designate, and train for	No comparator

Intervention aim	Study	Country	Setting	Population	Design	Treatment	Implementation Strategies	Comparator(s
							leadership • Intervene with patients/ consumers to enhance uptake and adherence	
	Bulterys *et al.* (39)	Uganda	ANC clinic	Men partners of seropositive pregnant woman	Randomised controlled trial	HIVST	• Facilitation • Intervene with patients/ consumers to enhance uptake and adherence • Stage implementation scale-up	No intervention
	Traore *et al.* (31)	Senegal, Mali, Côte d'Ivoire	Healthcare clinic and mobile clinic	FSW, MSM, PWUD, partners of PLHIV/STI patients.	Quasi-experimental (prospective)	HIVST	• Change service sites • Centralise technical assistance • Start a dissemination organisation • Build a coalition • Capture and share local knowledge	Alternative intervention: Facility-based test and councilling
	Shrestha *et al.* (32)	USA	Community-based (outreach)	MSM	Randomised controlled trial	HIVST	• Create new clinical teams • Distribute educational materials • Involve patients/ consumers and family member • Start a dissemination organisation • Stage implementation scale-up • Use mass media	Alternative intervention: information provision only
	Zishiri *et al.* (33)	South Africa	ANC clinic	Men partners of seropositive pregnant women, Sexual partners of seropositive patients	Quasi-experimental (prospective)	HIVST	• Facilitation • Intervene with patients/ consumers to enhance uptake and adherence • Build a coalition	No comparator
	Thomas *et al*. (40)	Kenya	Family planning clinic	Couples in family planning services	Cluster randomised controlled trial	HIVRT	• Change service sites • Develop and organise quality monitoring systems • Develop a formal implementation blueprint	No comparator
	Tabana *et al.* (34)	South Africa	Community-based	Universal (> 18 years-old)	Cluster randomised controlled trial	HIVRT	• Change service sites • Conduct educational meetings	Standard care Healthcare clinic

Intervention aim	Study	Country	Setting	Population	Design	Treatment	Implementation Strategies	Comparator(s
							• Conduct ongoing training • Distribute educational materials • Stage implementation scale up • Use advisory boards and workgroups	

ANC – Antenatal Care. ART – Antiretroviral Therapy. FSW – Female Sex Worker. HIV – Human Immunodeficiency Virus. HIVRT – HIV Rapid Test. HIVST – HIV Self-Testing. HIVTC – HIV Testing Center. MMVC – Medical Male Voluntary Circumcision. MSM – Men who have sex with men. PLHIV – People Living with HIV. PrEP – Pre-exposition Prophylaxis. PWUD – People Who Use Drugs. STI – Sexually Transmissible Infections. SW – Sex Workers

Of the study designs, 13 (52%) were quasi-experimental, while nine (36%) were randomised controlled trials, including five cluster-randomised control trials. Two studies (8%) were natural experiments, and one was observational (4%) (Fig. 2B).

Twelve initiatives aimed to increase the uptake of HIV screening (48%), six focused on prevention (24%), and five on treatment (20%). Two initiatives (8%) combined more than one aim (Fig. 2C). Considering that one initiative could include efforts to increase the uptake of more than one technology, eight studies reported HIV rapid testing mediated by a health professional (31%), seven reported ART (27%), six HIV self-testing kits (HIVST) (23%), and four condom promotion (15%), three pre-exposure prophylaxis (PrEP) (12%), and three voluntary medical male circumcision (12%) (Fig. 2D).

We identified 35 distinct implementation strategies based on the ERIC framework (9), reflecting the diverse approaches taken to enhance the uptake of HIV technologies. The most frequently reported strategy category was engaging patients, described in 16 studies (64%). Fourteen of these studies involved direct patient interaction to encourage adherence (56%). In contrast, six targeted patients' families in the implementation process (24%) (Fig. 2E). Appendix 2 describes the complete list of implementation strategies.

Fourteen studies (56%) described community-based interventions, alone or in combination with other settings, while the remaining were conducted in varied settings (44%). The interventions targeted diverse populations: nine (36%) were not restricted to high-risk groups, such as couples in family planning services, scholars, or the general population. Sixteen studies (64%) targeted high-risk populations, such as men who have sex with men (MSM) (32%) (Fig. 2F).

Table 1 **– Characteristics, context and implementation aspects of the included studies**

[Insert Table 1]

Figure 2 - Characteristics of included studies

[Insert Fig. 2]

Economic evaluations

Table 2 presents the effectiveness outcomes and the economic evaluation results. Eleven studies (44%) conducted full cost-effectiveness analyses, and one additionally performed a cost-benefit analysis. Infections averted were the most frequent effectiveness outcome (45%), especially in prevention initiatives (80%). Screening studies more often reported HIV test uptake as the outcome (67%). In most cases, studies assessed cost-effectiveness by comparing interventions with standard care rather than against a formal willingness-to-pay threshold.

All studies analysed costs from a healthcare provider's perspective. Only one screening study also included individual and societal perspectives (23).

Across the 25 studies, the most common costing methods were micro-costing (52%) and the ingredients approach (28%) (19). The ingredients approach, which applies standardised unit costs from existing sources, was more common in prevention studies. Micro-costing, which directly measures all inputs, predominated in treatment (60%) and screening (50%) initiatives.

Reporting of cost analysis outcomes was inconsistent. About two-thirds of studies reported costs per patient, more than half reported total programme costs, and six (24%) reported annual operating costs. Table 3 reports results as presented in the original studies, without adjusting for base year or excluding treatment costs.

Table 3
– Reach and detailed cost (USD 2024) results

Aim	Study citation	Reach (N)	Time frame (years)	Start-up		Delivery		Total		Cost per reach
				Total	Average (min, max)	Total	Average (min, max)	Total	Average (min, max)	Average (min, max)
Prevention	(24)	722	1.08	659	N/A	11,632	N/A	12,291	N/A	17
	(25)	6,191	0.33	8,453	4,226 (4,226; 4,226)	34,131	17,065 (16,346; 17,784)	42,583	21,292 (20,572; 22,010)	3 (3; 3)
	(26)	15,000	5	312,829	N/A	1,064,693	N/A	1,377,522	N/A	92
	(30)	136,680	2.5	1,195,550	N/A	2,844,585	N/A	4,040,135	N/A	30
	(35)	4,198	1	5,338	N/A	150,430	N/A	155,768	N/A	37
	(29)	134,391	2	1,149,944	N/A	20,964,010	N/A	22,113,955	N/A	165
Treatment	(41)	61	0.17	717,819	N/A	12,925	N/A	730,744	N/A	11,979
	(42)	195	3	1,940	970 (0; 1,940)	1,706,676	853,338 (619,904; 1,086,771)	1,708,616	854,308 (619,904; 1,088,712)	4,381 (3,179; 5,583)
	(43)	139	5	72,289	36,144 (36,144; 36,144)	49,998	24,999 (24,857; 25,141)	122,287	61,144 (61,002; 61,286)	440 (439; 441)
	(44)	8,419	1	469,847	234,923 (234,923; 234,923)	1,305,774	652,887 (432,270; 873,504)	1,775,621	887,810 (667,193; 1,108,427)	105 (79; 132)
	(45)	1,017	1	66,366	33,183 (16,674; 49,691	1,275,205	637,602 (374,918; 900,287)	1,341,571	670,786 (391,593; 949,978)	660 (385; 934)
Prevention, Screening	(46)	17,145	0.17	179,250	N/A	309,646	N/A	488,897	N/A	29
Prevention, Treatment	(47)	769	1	9,994	N/A	59,655	N/A	69,649	N/A	91
Screening	(36)	58,062	5	551,369	183,789 (30,384; 305,233)	3,505,397	1,168,466 (400,812; 2,612,735)	4,056,766	1,352,255 (431,196; 2,917,969)	23 (7; 50)
	(27)	2,075	1	2,288	1,144 (1,038; 1,249)	13,996	6,998 (4,000; 9,996)	16,284	8,142 (5,039; 11,245)	4 (2; 5)
	(37)	NI	1	31,810	10,603 (10,561; 10,661)	31,791	10,596 (8,300; 14,348)	63,601	21,200 (18,861; 25,009)	N/A
	(28)	817	2	3,403	851 (428; 1,175)	945,424	236,356 (193,729; 275,663)	948,827	237,207 (194,157; 276,838)	290 (238; 339)
	(23)	3,675	1	15,025	3,756 (424; 7,221)	148,946	37,236 (6,959; 54,388)	163,971	40,993 (7,384; 61,609)	11 (2; 17)
	(38)	13,023	1	1,632	816 (627; 1,005)	266,024	133,012 (46,159; 219,865)	267,657	133,828 (46,787; 220,870)	10 (4; 17)
	(39)	660	1	1,997	N/A	119,112	N/A	121,109	N/A	183

N/A - Non-Applicable.

Aim	Study citation	Reach (N)	Time frame (years)	Start-up		Delivery		Total		Cost per reach
				Total	Average (min, max)	Total	Average (min, max)	Total	Average (min, max)	Average (min, max)
	(31)	NI	1.5	140,272	10,790 (1,742; 40,220)	271,733	20,903 (3,791; 99,576)	412,005	31,693 (5,534; 139,796)	N/A
	(32)	1,325	1	1,011,954	N/A	2,155,435	N/A	3,167,389	N/A	2,390
	(33)	14,473	1	3,299	550 (66; 2,030)	184,611	30,769 (1,050; 71,390)	187,911	31,319 (1,117; 73,420)	2 (0; 5)
	(40)	10,852	1	3,368	N/A	73,362	N/A	76,730	N/A	7
	(34)	22,099	1	11,129	N/A	302,722	N/A	313,851	N/A	14
N/A - Non-Applicable.										

Table 2 **– Evidence of the effectiveness and economic evaluation**

[Insert Table 3]

Implementation outcomes and cost component

The reach of interventions varied widely across studies, depending on the type of initiative and study design. Because these values are already presented in detail in Table 2, we focus here on the costs per reach, which are more informative. Adoption outcomes, defined as the number or proportion of sites or agents that initiated the intervention (Box 1), were reported in 24 studies (96%). Other implementation outcomes reported were feasibility and fidelity (24–28). None of the studies reported long-term maintenance outcomes, as interventions did not measure effects beyond program completion.

The average cost per reach was $911, ranging from $2 to $11,979. Cost per reach was higher for treatment initiatives (average $4,226) compared with prevention ($57) and screening ($294). Table 3 summarises the results of the implementation cost analysis.

Overall, implementation costs varied widely, with an average of $1,924,697, ranging from $12,291 to $22,113,955. Stratified by context, studies from high- and upper-middle-income countries reported median costs of $1,131,400 (range $12,291–4,056,766), while those from low- and lower-middle-income countries had higher median costs of $2,585,942 (range $16,284–22,113,955). In the latter group, results were heavily influenced by one study conducted in India, reporting unusually high personnel-related delivery costs exceeding $22 million, despite similar reach and duration to other interventions (29, 30). When excluding this outlier, the average cost in LIC/LMIC settings dropped to $633,140, considerably lower than the mean in HIC/UMIC studies. No clear patterns in costs emerged across implementation strategies.

Definitions and classifications of implementation costs were inconsistent across studies. Eleven papers (44%) distinguished one-time from recurrent costs in addition to start-up and delivery (23–29, 31–34). Most studies (88%) also reported treatment-related expenditures (e.g. HIV test kits, ART medication, PrEP acquisition) together with implementation costs, although not always explicitly classified as treatment costs. Building and facilities (e.g., infrastructure adaptation), equipment (e.g., utilities), and personnel costs (e.g., salaries) were variably treated as start-up or delivery. For analysis, we applied the RE-AIM framework (18) to standardise these categories, as described in the Methods session.

Table 3 **– Reach and detailed cost (USD 2024) results**

[Insert Table 2]

HIV prevention interventions

Six of the selected studies focused on implementation initiatives for HIV prevention (24–26, 29, 30, 35). These were conducted in diverse settings, including South Africa (UMIC), Kenya and India (LMICs), Tanzania and Zambia (LICs). Most interventions employed universal rather than targeted approaches, with four incorporating community settings. The most frequent implementation strategies were engaging patients and communities (n = 5) and modifying infrastructure (n = 4). Tailoring strategies to context was reported exclusively in prevention-focused initiatives (n = 2). Across studies, strategies typically combined multiple components such as outreach activities, education, counselling, and staff training.

Implementation costs among prevention-focused initiatives also varied by context. In the single UMIC study, the average cost per person reached was $17. In LICs/LMICs, costs ranged from $3 to $165 per person reached. Recent interventions promoting VMMC and PrEP reported lower costs per reach ($3–37) than the large-scale condom promotion programmes from the 2000s ($92–165). No clear pattern was observed linking implementation strategies to cost per reach.

Three studies conducted full economic evaluations, all of which reported favourable cost-effectiveness outcomes (24, 25, 30). Two of them evaluated interventions to promote VMMC in community settings. Holmes et al. found VMMC outreach in South Africa to be cost-saving, reporting substantial HIV

treatment costs averted and a positive cost–benefit ratio of $40 to $57.40 (24). Torres-Rueda et al. reported cost-saving results for VMMC outreach in Tanzania, with cost per DALY averted ranging from $71 to $143 and cost per infection averted between –$806 and –$493, compared to standard care (25). Wall et al. evaluating CVCT in Zambia, demonstrated that the intervention was more cost-effective than ART-based prevention scenarios, with an incremental cost per HIV infection averted of $659 (30).

HIV screening interventions

Twelve studies evaluated implementation strategies for HIV screening (23, 27, 28, 31–34, 36–40). Most were set in Sub-Saharan Africa (n = 7) and North America (n = 4), with one study conducted in Southeast Asia. Nine employed targeted approaches or universal approaches with additional efforts to reach high-risk groups, such as MSM (23, 31, 32, 36–38), sex workers (23, 31, 38), or people who inject drugs (31, 38). Interventions were implemented across healthcare clinics (n = 6) and community-based settings (n = 6), including outreach, workplace, and home-based models.

The most frequent implementation strategies included modifying infrastructure (n = 7), developing stakeholder interrelationships (n = 7), and engaging service users (n = 7). Activities frequently involved distributing HIV self-test kits (n = 6) and contact tracing (n = 4).

Implementation costs ranged from $2 to $2,390 per person reached (2024 USD), with an overall average of $293. When stratified by context, average costs were lower in LICs/LMICs ($43; range $4–183) than in HICs/UMICs ($545; range $2–2,390). This higher mean in HICs/UMICs was driven by one outlier, an US community-based outreach programme targeting MSM that reported a cost of $2,390 per person reached (32). Excluding this study, the average cost for HICs/UMICs dropped to $82 (range $2–290). The least costly interventions were community-based programmes in LMICs, while the most expensive were online or outreach campaigns implemented in high-income settings.

Five studies conducted full economic evaluations (28, 32, 34, 36, 38). These were primarily community-based and assessed cost-effectiveness by comparing programme costs with outcomes such as numbers tested, new diagnoses, or HIV infections averted. For instance, Skaathun et al. found that a social network testing approach had the lowest cost per new diagnosis ($15,683), outperforming routine hospital testing and modified partner services (36). Tabana et al. demonstrated that home-based counselling and testing increased HIV testing uptake by 37% at a lower cost per test than standard facility-based HTC (34). Shrestha et al. extended trial findings with modelled estimates of HIV transmissions averted and QALYs saved, reporting incremental costs of $9,365 per new diagnosis and $74,476 per QALY gained (32).

HIV treatment interventions

Five studies focused on implementation initiatives for HIV treatment (41–45). Three were conducted in the United States, and two in Sub-Saharan Africa. All targeted people living with HIV (PLHIV) who had not developed AIDS, but their specific populations varied. Lightner et al. evaluated PLHIV experiencing social vulnerability (42), Barton et al. focused on individuals who had not initiated ART (44), and Page et al. addressed adherence support in rural areas through remote provision (41). Most interventions were delivered in healthcare settings, with one relying on a remote approach and another combining clinic- and community-based delivery (41, 45). The most frequent implementation strategy was training and education (n = 3), while others included peer support, the use of digital platforms, and task-shifting.

Implementation costs varied widely, with an average of $3,513 per person reached, ranging from $105 to $11,979. In Sub-Saharan Africa, costs ranged from $105 to $660, while US-based studies reported substantially higher figures ($440–11,979). Lower-cost initiatives were delivered in primary healthcare and community-based settings (43–45). Whereas the most expensive were a remote programme and a multilevel navigation intervention for socially vulnerable PLHIV (41, 42). No consistent pattern emerged linking implementation strategies to cost per reach.

Three studies conducted full economic evaluations (42, 44, 45). Lightner et al. conducted cost-effective analysis by comparing patient navigation models delivered in health departments versus clinics, reporting lower costs per person achieving viral suppression in health departments ($20,632) than in clinics ($37,810) (42). Barton et al. assessed nurse-led versus doctor-led ART delivery in a cluster-randomised trial, with outcomes defined as one-year mortality and viral suppression (44). The intervention generated higher costs and modest health gains, with ICERs of $24,500 per death averted and $12,584 per patient virally suppressed. Barnabas et al. evaluated community-based ART delivery compared with clinic-based care, finding lower costs per person virally suppressed in community and hybrid models ($275–$390) than in clinic-based ART ($214–$422), with sensitivity analyses confirming robustness (45).

Combined interventions

Two studies assessed implementation initiatives that combined more than one type of HIV intervention (46, 47). Frey et al. evaluated a prevention and screening campaign among men who have sex with men (MSM) in Switzerland, which promoted rapid testing, condom use, and PrEP through clinic-based and community outreach strategies (46). Ying et al. examined a clinic-based intervention in Uganda that aimed to increase uptake of both PrEP and ART among sero-discordant couples, compared with ART alone (47).

Both studies employed mixed implementation strategies, with patient engagement and problem-solving around adherence emerging as a common approach. Implementation costs were analysed from the provider perspective, with time horizons ranging from three months to one year. Average costs per person reached ranged from $29 to $91.

Both studies conducted full economic evaluations. Frey et al. linked programme costs to increased HIV testing uptake and adoption of safer sexual behaviours, finding the campaign cost-effective among lower-risk MSM but less so among higher-risk groups (46). Ying et al. used a dynamic transmission model to estimate infections and DALYs averted, showing that combining PrEP with ART was more cost-effective than ART alone, although the ICER per DALY averted exceeded the national threshold of three times GDP per capita (47).

Quality assessment of economic evaluations

Of the 25 included studies, 15 (60%) scored between 8 and 10 on the Drummond checklist and were classified as good quality. Four studies (16%) scored between 4 and 7 and were considered average quality. Among the nine studies that performed cost analysis only, three reported outputs or proxy effectiveness measures and were therefore assessed with the checklist where relevant. The Drummond checklist was not applicable to the remaining six cost-analysis-only studies, which did not report effectiveness data. No study was rated as poor quality. Appendix 3 summarizes the quality assessment of the included studies.

Good-quality studies typically combined robust trial or observational effectiveness data with transparent costing, appropriate time adjustments, incremental analyses, and sensitivity testing (24, 25, 31, 44, 45, 47). Average-quality studies most often lacked comparators, did not apply incremental analysis, or reported limited effectiveness outcomes (32, 42, 46). Cost-analysis-only papers nevertheless contributed detailed and credible cost data, often with transparent reporting of cost categories and, in some cases, sensitivity testing (26, 41).

Common strengths included the use of standardised costing approaches, clear research questions, and transparency in reporting. The most frequent weaknesses were the absence of formal incremental cost-effectiveness analyses, limited adjustment for timing, and insufficient treatment of uncertainty.

Discussion

We identified 25 studies, most of which were conducted in recent years, with nearly half carried out in low- and lower-middle-income countries. To our knowledge, this is the first systematic review to focus on economic evaluations of implementation initiatives aimed at improving the uptake of HIV prevention, screening, and treatment technologies across diverse global settings. The finding reflects a growing interest in assessing the cost-effectiveness of implementation strategies in response to the HIV epidemic. The majority of studies employed quasi-experimental designs and concentrated primarily on screening interventions, particularly HIV testing. User or patient engagement emerged as the most commonly adopted implementation strategy. Although 64% (16/25) of the studies conducted full economic evaluations, the absence of a consistent methodological approach across evaluations limits the comparability and generalisability of findings. This inconsistency poses challenges for assessing the value for money of implementation strategies and hinders evidence-based decision-making.

Our research clearly shows the substantial amount of resources are used to deliver implementation strategies of HIV health-related technologies involve: implementation costs. Overall, we illustrated that these costs varied substantially between contexts, ranging from $12,291 to $4,056,766 in HICs and UMICs and from $16,284 to $22,113,955 in LICs and LMICs, respectively. Moreover, there was a lack of consistency in implementation outcomes, with reach being reported among 23 out of 25 included studies. Our cost per person reached analysis also showed a wide range of results, with the average cost per person reached being higher in HICs and UMICs ($1,694; range $2–11,979) than in LICs and LMICs ($108; range $3–660). We did not find a consistent relationship between implementation strategies and costs, with HIV treatment initiatives generally more costly per person reached than prevention or screening. This is likely to reflect the resource-intensive nature of ART delivery, which typically occurs in clinical settings (1, 48).

This review identified substantial heterogeneity in how implementation costs and outcomes are defined, measured, and reported. A common issue was the conflation of implementation and treatment costs, such as categorising HIV test kits as implementation costs, undermining the accuracy and comparability of economic evaluations. This challenge is well recognised in the literature (2, 7, 10), and recent efforts advocate for a clear separation between treatment components (e.g., HIV testing) and implementation strategies (e.g., educational materials). Tools like Cost-IS can support consistent identification and valuation of implementation costs, improving transparency and transferability across settings (49). Similarly, standardizing implementation outcomes is essential; while most studies reported reach, metrics like adoption (e.g., actual uptake) are critical for robust evaluation (10). Frameworks such as RE-AIM (18), ERIC (9), Consolidated Framework for Implementation Research (50), or Normalisation Process Theory (51), can offer structure for classifying strategies and outcomes, and inform costing. Moreover, practical resources exist to support costing exercises in HIV programmes, including UNAIDS's *Review of costing methods in national HIV strategic planning documents* (2023) and the *Unit Cost Study Repository* by the Global Health Cost Consortium (48, 52). Further research is needed to assess their applicability in low-income settings. Finally, there are methods to combine the implementation and treatment evidence that can strengthen economic evaluations, such as cost per additional HIV test with health gains (2, 10, 48). We recently proposed a stepwise approach to support this integration, helping to align implementation outcomes with broader health impact and contextual factors (10). The use of all these methods will enhance the reproducibility, comparability, transferability, and generalisability of economic findings across diverse settings(8, 14, 18) and support evidence synthesis in the context of the HIV response (10).

Despite persistent gaps in geographical representation, this review highlights gradual progress in the integration of economic evaluation within HIV-related implementation research across diverse income settings. Rivera et al., for example, found that only 8% of HIV self-testing studies in LMICs reported any cost data (53), while Ekwunife et al. noted that none of the PrEP implementation studies included economic outcomes (54). Likewise, Hoomans and Johan observed that implementation science tends to prioritise clinical or behavioural effectiveness over cost considerations (13). In this review, full economic evaluations were identified and distributed across all income levels, demonstrating that the capacity for rigorous evaluation is beyond high-income settings. However, current economic evidence from implementation studies of HIV initiatives was mostly from the United States. There was a lack of evidence derived from studies set in South America and South and Eastern Asia. More evidence is needed from low- and middle-income countries outside Sub-Saharan Africa, particularly in underrepresented populations and regions. Nevertheless, our review shows a considerable improvement in collecting and analysing cost data. This reflects both the targeted scope of our review and the growing interest in assessing value for money in HIV-related implementation initiatives.

The present review also highlighted the challenge of selecting an appropriate cost-effectiveness threshold to determine whether an implementation strategy is cost-effective. Among the studies reviewed, most did not apply explicit willingness-to-pay (WTP) thresholds. For example, Barton et al. used cost-effectiveness acceptability curves without specifying context-specific thresholds (44), while Ying et al. referenced WHO's GDP-based benchmarks, often criticised for lacking local relevance (47, 55). Shrestha et al. offered a more nuanced approach by benchmarking against both QALYs and infections averted

(32). Such an approach may offer greater transparency and consistency in how thresholds are defined, and could strengthen comparability and policy relevance across settings with different income levels. Importantly, cost-effectiveness judgements in implementation studies require additional considerations. For instance, when applying existing WTP thresholds - such as NICE UK's threshold of £20,000 to £30,000 – both implementation outcomes (e.g., increased uptake of HIV testing) and treatment outcomes (e.g., health gains) must be captured and combined (10). Achieving this requires appropriate study designs and robust data (10). Additionally, the use of explicit thresholds can be more challenging in research settings with limited resources, where national WTP benchmarks are often absent due to limited data and varying opportunity costs (14).

Strengths of this review include the growing diversity of study settings and the use of rigorous designs such as cluster randomised controlled trials and hybrid implementation–effectiveness trials. Furthermore, we conducted a comprehensive search across six databases and drew on the established frameworks (e.g., ERIC and RE-AIM) to categorise implementation strategies and outcomes and to assess the quality of full economic evaluations using the Drummond checklist (9, 18, 19). However, we excluded grey literature, which may have omitted valuable programme-level data. Restricting to English, Spanish, and Portuguese may have excluded studies in other languages, such as French, relevant in West Africa. Heterogeneity across studies in terms of cost classification and approaches to costing means statistical synthesis was not suitable for this review.

For decision-makers, the current findings underscore that implementation strategies aimed at increasing uptake of HIV health-related interventions often involve substantial implementation costs. These can vary widely and are not necessarily proportional to population reach or programme intensity. Although high-cost initiatives may still be justified when they effectively target key populations or generate substantial health benefits relative to alternatives (5, 13, 56), further studies are needed to better understand the cost- effectiveness of implementation strategies for key population groups.

Moreover, in the context of global health priorities and the UNAIDS 95-95-95 targets, broader considerations, such as equity, sustainability, and societal impact, are becoming increasingly important. Future economic evaluations of implementation strategies for HIV initiatives may therefore need to go beyond traditional metrics and incorporate complementary approaches, such as Extended Cost-Effectiveness Analysis (57) and Distributional Cost-Effectiveness Analysis (58), which better capture these dimensions across diverse health system contexts.

Conclusion

This review synthesised evidence on the economic evaluation of implementation strategies to enhance the uptake of HIV prevention, screening, and treatment technologies across diverse settings. Implementation costs varied widely across contexts and populations, with no consistent relationship identified between cost and implementation strategy. We found substantial variation in how costs and outcomes were defined, measured, and reported, with many studies relying on partial evaluations and inconsistent cost classifications. These methodological differences limit the comparability and policy relevance of findings. To strengthen the role of economic evaluation in implementation science, greater standardisation in costing methods and outcome reporting is needed. Improving consistency will enhance the transferability and generalisability of results, support more informed resource allocation, and ultimately contribute to achieving the UNAIDS 95-95-95 targets.

Abbreviations

ANC
Antenatal care
ART
Antiretroviral therapy
CB
Cost–benefit analysis
CA
Cost analysis
CEA
Cost–effectiveness analysis
CEAC
Cost–effectiveness acceptability curve
CU
Cost–utility analysis
DALY
Disability–adjusted life year
EE
Economic evaluation
ERIC
Expert Recommendations for Implementing Change
FSW
Female sex worker
HIC
High–income country
HIV
Human immunodeficiency virus

HIVRT
HIV rapid test
HIVST
HIV self–testing
HIVTC
HIV testing centre
ICER
Incremental cost–effectiveness ratio
ImpInit
Implementation initiative
ImpRes
Implementation research
ImpSci
Implementation science
LIC
Low–income country
LMIC
Lower–middle–income country
mDOT
Modified directly observed therapy
MMVC
Medical male voluntary circumcision
MSM
Men who have sex with men
N/A
Not applicable
PLHIV
People living with HIV
PrEP
Pre–exposure prophylaxis
PWID
People who inject drugs
PWUD
People who use drugs
QALY
Quality–adjusted life year
RCT
Randomised controlled trial
RE
AIM–Reach, Effectiveness, Adoption, Implementation, and Maintenance
UMIC
Upper–middle–income country
UNAIDS
Joint United Nations Programme on HIV/AIDS

Declarations

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Table 2

Table 2 is available in the Supplementary Files section.

Figures

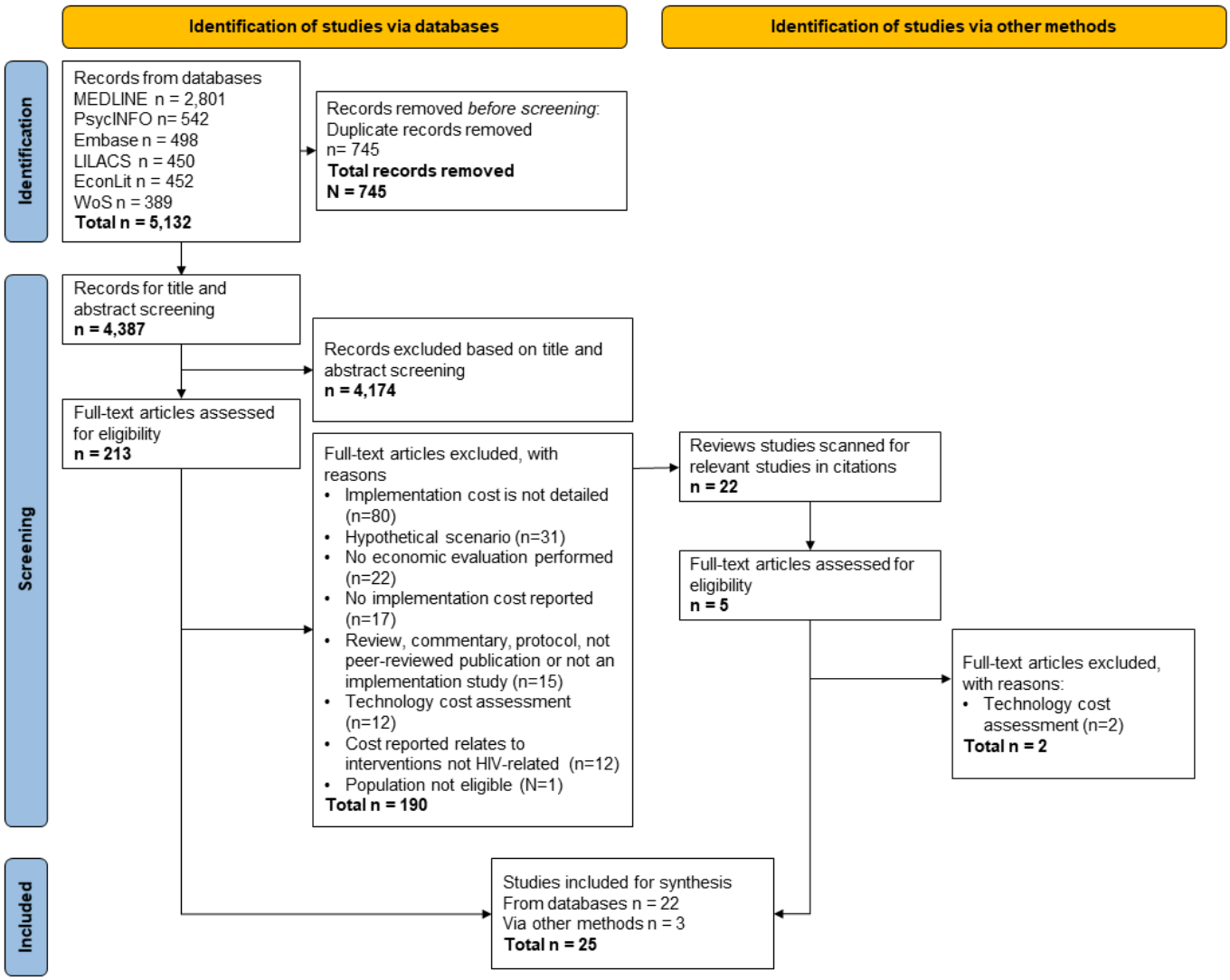


Figure 1

PRISMA 2020 chart flow of identification of new studies via databases and other methods

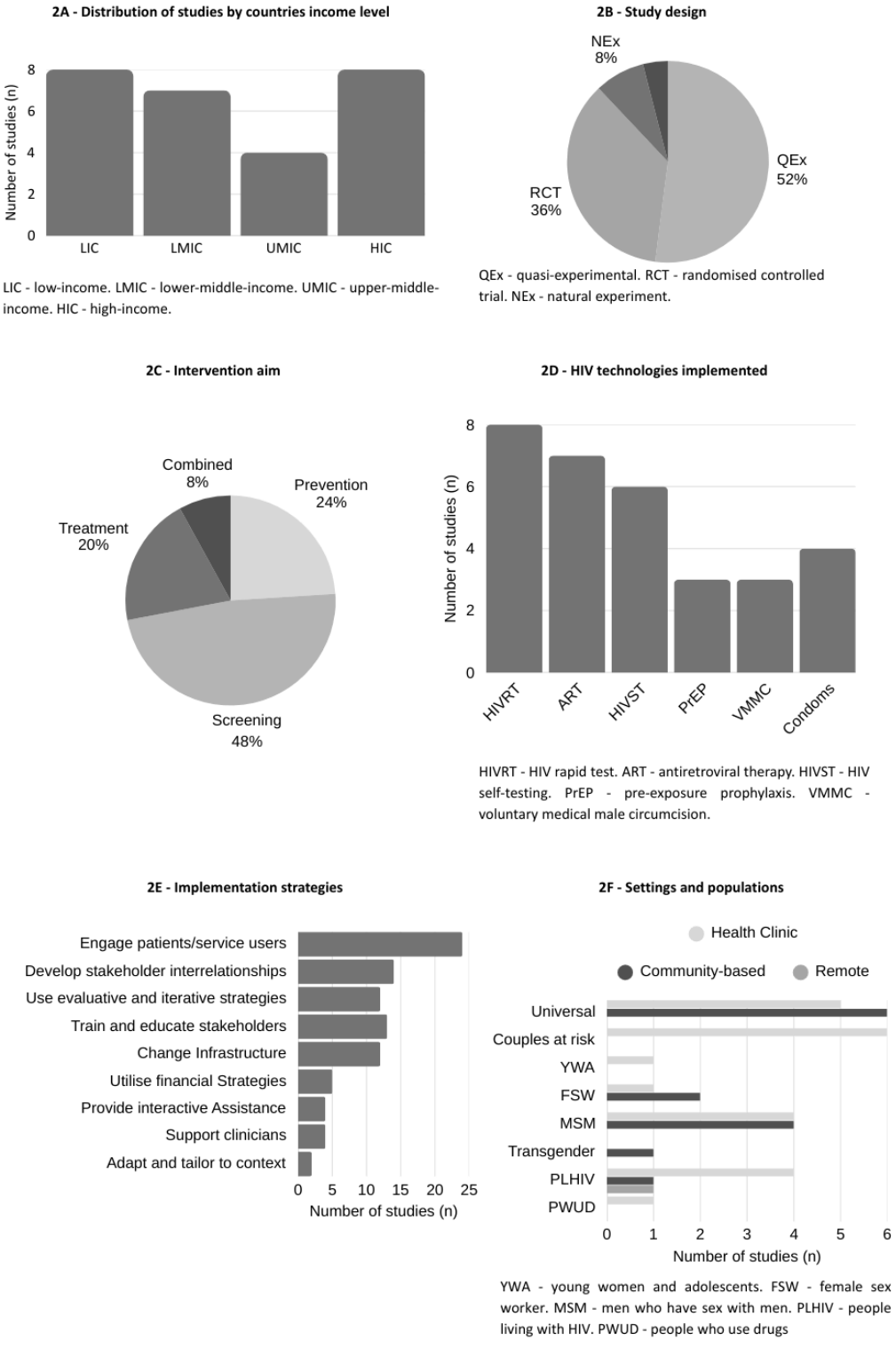


Figure 2

Characteristics of included studies

Supplementary Files

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- Appendix1Searchstrategy.docx
- Appendix2ImplementationstrategiesclassifiedaccordingtotheERICprojectrefinedcompilation.docx
- Appendix3QualiyAssesment.docx
- Table2.docx