

Assessing the effectiveness of interventions increasing the uptake of HIV testing for people of African and Caribbean heritage In High Income Countries - A Systematic review

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Chauhan R. Assessing the effectiveness of interventions increasing the uptake of HIV testing for people of African and Caribbean heritage In High Income Countries - A Systematic review. *J Prev Emerging Disease*. 2023; 6(2):16-31.

ABSTRACT

Background- Migrants like African American(AA) and Caribbean population in High income countries(HIC) have been assessed as being at higher risk for late screening for Human Immune deficiency virus (HIV), a disease which can be prevented by adapting necessary safe sexual measures and giving Anti-retroviral therapy(ART) in initial stages. Timely diagnosis and treatment initiation plays significant role in optimizing HIV related health outcomes and lower transmission rates. This review aimed to evaluate and assess the effectiveness of different interventions conducted to increase the uptake of HIV testing in our targeted population.

Methods- Ovid Medline, Embase, and Central Cochrane were searched on 2 July 2021 and potentially relevant studies identified were undertaken for reference screening. We considered randomized controlled trials(RCTs) and studies conducted after 2008 with interventions to increase HIV testing uptake in AA and Caribbean

population in HIC. Screening, data extraction and critical appraisal was conducted by one reviewer.

Findings- In our review 9 studies met the inclusion criteria. Six various types of interventions were identified conducted in different settings and targeting sub-population like MSM, Transgender and women from AA population. Majority interventions applied behaviour change models and targeted migrants from different ethnicities like Latino, Mexican, Asian and AA population.

Interpretation- Trials implementing multilevel interventions at AA churches and peer/health worker supported interventions through social networking recruitment, prevailed over structural and cultural barriers to show moderate effect estimate. Blending provider-initiated testing and counseling(PITC) with existing primary healthcare settings looks promising and would encourage HIV testing uptake through patient-doctor/health worker relationships among migrant populations.

Key Words: Universal Health Coverage; Health Spending; Health insurance; Out-of-pocket payment

INTRODUCTION

Nigeria HIV is a viral infection attacking immune system of the body causing various vulnerable infections more likely acquired immunodeficiency syndrome(AIDS), which is not a treatable disease and is transmissible through different routes [1]. Delayed HIV diagnosis is associated with negative health outcomes like higher chances of hospitalization, reduced life expectancy by 10 years and ten-fold increased risk of death [2]. Highly sensitive, specific diagnostics and progressive rapid tests with fast results and early treatment have the potential to reach maximum population due to its easy adaptability and thus prevent immune deterioration and transmission of HIV, ART given in time reduces viral load majorly and thus reduces transfer rate and mortality and morbidity, in diagnosed individuals [3,4]

In HICs like United States of America (USA), Canada, and Australia, sexual route is the most common route of transmission as due to proper screening procedures, blood/blood product related transmissions have been nearly abolished and inducing ART has decreased mother-to-child transmission drastically [5] Research reveals that international migrants from high HIV prevalent countries as generalised epidemics, are contributing as larger number of HIV

population in these HICs in contrast to their own citizens [6]. In many HICs unequal distribution of burden of HIV in most vulnerable population-like immigrants, minor ethnicities like black Africans and Caribbean population are observed as the main reason for high HIV prevalence in HICs [7].

By 2018, USA had 1.2 million people with HIV, out of which 482900 were among Black African population living there, They accounted for 13% of the USA population but contribute as 42% (16,002) of 37,968 newly diagnosed HIV cases in USA and surrounding areas [8].

In 2015, WHO European region had 37% of newly detected HIV cases from migrants of the HIV cases transmitted by heterosexual contact and 37% were from sub-Saharan African countries [9]. These migrants are identified as the second largest group affected by HIV in European Union [10]. Population at high risk of HIV are recommended an annual testing by Centres for Disease Control and Prevention, but 40% of AA are reported to be never tested [11]. Statistics reveal that there were considerable disparities in subpopulations encountering delayed HIV diagnosis rates like in US the black African men report to have highest rates(65%) [6].

Literature review indicates persistent effects of mistreatment and challenges faced due to cultural, social, structural, economical barriers and segregation at multilevel causing inequalities in accessing healthcare services in their receiving countries [12,13] The Legality and administrative actions expected to be faced by HIV positive individual and the stigma and discrimination associated not only adds on to the challenges but also discourages migrants to access HIV-related services, including testing and use of preventive measures [14]. Addressing these barriers is crucial to pave a way for all HIV prevention efforts. Adaptation of rapid testing programmes and screening at primary care can possibly increase the HIV testing uptake in high-risk migrant populations and have a clear public health benefit [15].

To our knowledge there is not much conclusive information on interventions that could attain our objective, so this review was conducted to identify and assess interventions that focused to raise uptake of HIV testing in Black African and Caribbean migrant population in the various settings of HICs.

Objectives

To assess effectiveness of interventions to increase the uptake of HIV screening by black African and Caribbean heritage communities in High Income Countries.

Methods-

Eligibility criteria:

We included Studies meeting following inclusion criteria, A) Conducted after 2008 as the WHO and UNAIDS issued new guidelines encouraging "provider-initiated" HIV testing in healthcare settings. The objective was to widen HIV status awareness and increase access to HIV testing, treatment and prevention broadly [16-18] B) Conducted in HIC where a high-income economy is defined by the World Bank as a "Nation with a gross national income per capita of US\$12,696 or more in 2020, calculated using the Atlas Method" [19]. C) Only Randomized controlled trials(RCTs) as they are considered to be gold standard for evidence of effectiveness of interventions [20].

The participants population are black African/Caribbean heritage population living in HIC. Interventions to increase the uptake of HIV screening compared with the usual practice or any other comparative intervention were considered.

All the studies with outcome as HIV testing uptake as primary or secondary outcome and studies specifying population as AA/Caribbean as a part of study population with results mentioned explicitly for them were included. We included English published studies due to lack of translation resources.

Literature search

Search strategy-

Set of Subject Headings were developed and relevant evidence were collected from Ovid Medline/ Embase collectively and Central Cochrane separately. Search Strategy was determined through consultation with an academic information specialist Miss Sarah Herring. RCT Filter was run at the end of the search. Search Strategy is presented in Appendix 1. Potentially relevant studies were included obtained through reference screening of, included studies and relevant ongoing trials and studies completed with no results posted. Due to limited time and lack of manpower other additional sources were not screened.

Search strategy For Ovid/Embase/ Central Cochrane

1. exp HIV/

2. exp HIV infections/
3. Acquired Immunodeficiency Syndrome/
4. HIV*.tw.
5. AIDS .tw.
6. Human Immune Deficiency Virus*.tw.
7. Acquired immune deficiency syndrome.tw.
8. 1 or 2 or 3 or 4 or 5 or 6 or 7
9. exp African Continental Ancestry Group/
10. Minority Groups/
11. African*.tw.
12. Black*.tw.
13. caribbean*.tw.
14. afro caribbean*.tw.
15. afro american*.tw.
16. african ethnic*.tw.
17. 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
18. Screening.tw.
19. exp HIV Testing/
20. HIV screening.tw.
21. HIV test*.tw.
22. diagnosis.tw.
23. test*.tw.
24. assess*.tw.
25. examin*.tw.
26. mass screening.tw.
27. 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26
28. 8 and 17 and 27
29. limit 28 to yr="2008 -Current"
30. limit 29 to English language
31. in south Africa or in Africa or in sub-saharan Africa.ti
32. 30 not 31

Handling of citations

References identified from databases were further assessed in Endnote X9. References were de-duplicated and studies were imported to Rayyan software for abstract screening. Rayyan identified further duplicates. Titles and abstracts screening was run by single reviewer (due to non-availability of second reviewer) and references not meeting the inclusion criteria were excluded during this preliminary screening phase. Any doubts were discussed with supervisors and agreements reached. Full text copies were obtained through endnote and screened in detail to meet the inclusion criteria. A summary table of all excluded studies along with its reason for exclusion was provided.

Data extraction

Standardised data extraction forms were used which were piloted on excel and adapted as necessary while extracting data. Data like objective of study, location, recruitment setting, sample size/type, participant characteristics, interventions, comparators, outcomes were extracted into the spreadsheet.

Data was extracted on the treatment effect estimates, odds ratio, percentage *p*-values, and confidence intervals.

Risk of bias assessment

Cochrane Risk of Bias tool was used to appraise the methodological quality of the trials (ROB 2.0.), [21]. This includes domains covering the randomisation process, deviations from the intended intervention, missing outcome data, and measurement of the outcome. ROB assessment was used to assess the quality of quantitative data retrieved. The assessment was a part of the data extraction process.

SYNTHESIS

Summary of study characteristics was presented in data extraction for data synthesis. Trial data identified too heterogeneous to pool, or reported in a format not suitable for pooling, was presented as a narrative synthesis. It consisted of descriptive text and usage of various tables to summarise data to enable the reader to understand outcomes in the light of different interventions and recruitment process and identified potential bias for each study in the review. Process involved meticulously arranging studies by related population or outcomes assessed, summarising the results of the studies, summarising the range and size of the associations these reported by them, and detailing the most relevant study characteristics. A detailed commentary on the major methodological problems or biases that affected the studies were mentioned, together with a description of how this has affected the individual study results.

Meta-analysis methods

Identical interventions and settings studies were identified and summary measures of effect were estimated through formal meta-analysis.

Dichotomous data was dealt by calculating the relative risk (RR)/odds ratio (OR) for each trial with the associated 95% confidence intervals (CIs). In multi-arm studies, independent comparison of each intervention arm with the control group was done.

Fixed effect model was used to calculate risks ratio, confidence interval and I^2 and q statistics. We used Forest plots for visual assessment of heterogeneity and used the I^2 and Q statistics measures. A Comprehensive plan for analysis was constructed before conducting it. Stata/IC 16.1 was used for performing Statistical analyses.

Results

Search Results:

On 2nd July 2021, electronic database searches resulted in 5782 citations. We identified 6 other references from complimentary searches of references of included studies and ongoing trials. The studies excluded with their respective reasons for exclusion are presented in (Table 1).

Table 1. Excluded studies with reason.

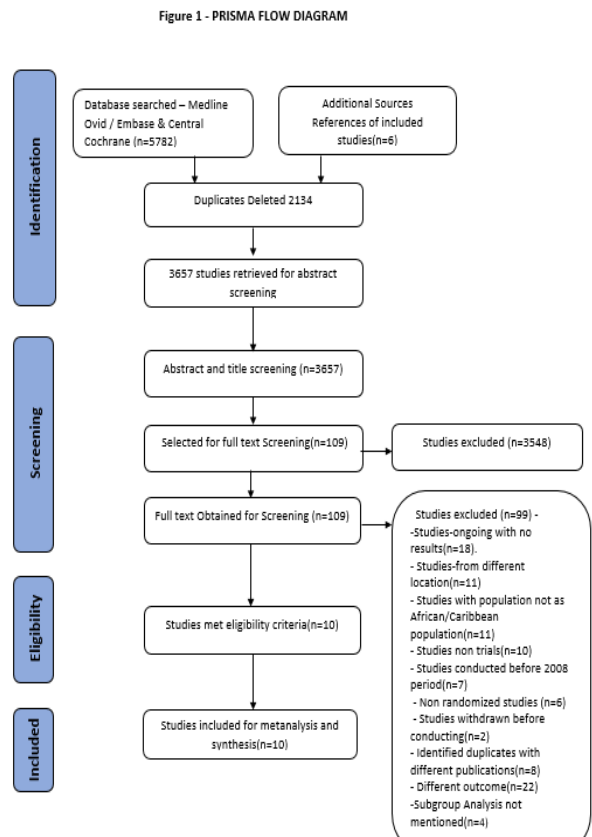
Study Author and Year	Reason for exclusion
(2019). "Home-based intervention to test and start (HITS) protocol Amesty, S., et al. (2014).	Different Outcome
Arnold, E. A., et al. (2019).	Non Rct
Assoumou, S. A., et al. (2018).	Different outcome
Berkley-Patton, J. Y., et al. (2019).	Different outcome.
Buchbinder, S. P. and A. Y. Liu (2015).	Duplicate
Cordova, D. (2018).	Not a trial
Crawford, N. D., et al. (2016).	No subgroup analysis for target population
Dennis, A. M., et al. (2013).	Non Rct
Dilley, J. W., et al. (2011).	Different population and not a trial
	Different outcome

Doherty, I. A., et al. (2016).	Different Location
Dolcini, M. M., et al. (2010). "	Study period 2005-2006
Donnell-Fink, L., et al. (2011).	Different population/ Not a trial
Drain, P. K., et al. (2019).	Different Outcome.
Frye, V., et al. (2020).	Duplicate
Frye, V., et al. (2020).	Duplicate
Gennotte, A. F., et al. (2013).	Not a trial
Gwadz, M., et al. (2014).	Different outcome
Gwadz, M., et al. (2013).	Not a trial
Gwadz, M. V., et al. (2010).	Different outcome
Gwadz, M. V., et al. (2011).	Different outcome
Hussen, S. A., et al. (2013).	Not a trial
Jemmott 3rd, J. B., et al. (2010).	Different outcome
Johnson, K., et al. (2018).	Different outcome
Kim, A. S., et al. (2017).	different population
Koblin, B., et al. (2017).	Duplicate/Not a trial
Kyle, T. L., et al. (2015).	Not a trial
Lau, C., et al. (2004).	Study period 2004
Leblanc, L. J., et al. (2017).	Different population.
Lo, Y. C., et al. (2012).	Not a trial
Lyon, M. E., et al. (2019).	Different outcome
McMahon, J. M., et al. (2015).	Different outcome
Merchant, R. C., et al. (2009).	study period 2005-2006
Miller, R. L., et al. (2017).	Non Rct
Nct (2008). "HIV Testing & Womens Attitudes on HIV Vaccine Trials."	Different outcome
Nct (2010). "A Randomized Controlled Trial of the Bruthas Project."	Different outcome
Nct (2011). "Behavioral Science Aspects of Rapid Test Acceptance."	Different population
Nct (2011). "Project Power: an HIV Risk Reduction Intervention for	Different outcome

Black Men Who Have Sex With Men and Women Nct (2011). "Project Wellness: increasing HIV Testing Among West African Immigrants."	Study withdrawn before trial	African Men Into HIV Counseling and Testing and Care." Nct (2019). "Development and Implementation of an HIV-testing Intervention for Primary Care in Belgium Nct (2019). "Improving Health Outcomes in Young Men (mLab App)."	Different population(general)
Nct (2012). "The Feasibility of Using a General Health Screen to Increase HIV Testing in Community Pharmacies Nct (2012). "Peer-driven Intervention to Seek, Test & Treat Heterosexuals at High Risk for HIV."	Study withdrawn before trial	Nct (2019). "Testing an Intervention to Increase HIV Self-Testing Among Young, Black MSM."	different population(young men)-results in 2023
Nct (2013). "Seek, Test, and Retain. Linkages for Black HIV+, Substance-Using MSM."	Different outcome	Nct (2019). "To Reach Unrestricted Services for Transgender Women."	Not a trial
Nct (2013). "Strategies to Increase HIV Testing, Linkages to Care, and Male Circumcision in Africa Nct (2015). "Church-based HIV Screening: taking It to the Pews."	Different outcome	Nct (2020). "Implementation of Rapid HIV Self-Testing Among MSM Project."	different population(transgender)
Nct (2015). "Facilitating HIV Testing Among Young Adult MSM Through Social Networking."	Different location(Africa)	Nct (2020). Implementation of Rapid HIV Self-Testing Among MSM Project	Different outcome
Nct (2015). "Multimedia WORTH With Black Drug-Involved Women on Probation."	Duplicate	O'Connor, G., et al. (2014).	Different outcome
Nct (2015). "Regular HIV Testing Among At-Risk Latino Men."	Duplicate	Orne-Gliemann, J., et al. (2015).	Target population not analysed separately.
Nct (2016). "Expanding HIV Testing and Prevention to Reach Vulnerable Young Women."	Different outcome	Outlaw, A. Y., et al. (2010).	Different Location
Nct (2017). "POSSE Project: a Community-Level Intervention for Black YMSM."	Different population(Latino)	Paige, M. Q., et al. (2018).	study period 2006-2008
Nct (2019). "Bringing South	Different outcome	Pettifor, A., et al. (2018).	Duplicate
	Different Location(Cape Town)	Pope, D. S., et al. (2010).	Different location
	Non Rct	Sandfort, T. G., et al. (2008).	Different location
	Different Location(south Africa)	Sankoff, J., et al. (2012).	Different location
		Seguin, M., et al. (2018).	Different population/study period 2007-2009
		Sheehan, D. M., et al. (2017).	Non Rct
		Stone, V. E. (2012).	study period from 2000-2014
		Sznitman, S., et al. (2011).	not a trial
		Uhrig, J. D., et al. (2012).	different outcome
		Uhrig, J. D., et al. (2012).	study period from 2007-2008
			Not a trial

Van Heerden, A., et al. (2015).	Different Location
Van Tieu, H., et al. (2017).	Not a Rct
Venkatesh, K. K., et al. (2011).	different location
Villanueva, M., et al. (2021).	different outcome
Wechsberg, W. M., et al. (2015).	different Location
Wilton, L., et al. (2009).	study period from 2005-2007
Witzel, T. C., et al. (2020).	different population.
Young, S. D., et al. (2014).	Duplicate
Robert W Marlin (2014)	Not a trial
Metsch 2012	subgroup Analysis results not done
Tyler B. Wray, 2018	subgroup analysis results not done

The selection process and reasons for exclusion are shown in the PRISMA flowchart presented in (Figure 1)



Full text of 109(105 from Database screening and 4 from references screening) articles were read and appraised against the selection criteria. The majority (n = 100) of articles were excluded due to reasons mentioned in the Prisma like Studies withdrawn, different outcome, different population, different location, subgroup analysis for target population not reported, Non RCT, not a trial and studies still under trial. Total 9 studies met the inclusion criteria and were undertaken for data extraction,[22-30] (TABLE 2).

Table 2. Study Characteristics presented in

author and year	settings	incentives given.	inclusion criteria	Intervention	Control	Follow up duration	population-size/type Intervention baseline(IB) Intervention follow-up(IF) Control baseline(CB), Control follow up(CF)	Results
Berkley-Patton, 2016	African American(AA) churches	\$10 for completing each survey	1)4 churches (≥150 African American adult church members 2) 18 to 64 years and either (a) a church member (attending church once/month) or (b) a community member receiving church outreach ministries (≥4 times/year).	Culturally and religiously tailored HIV Tool Kit materials/activities through multilevel church outlets	Nontailored tools (HIV brochures and testing event announcements)	6 months	N=543 IB=235 IF=127 CB=308 CF=190. All adults	O.R-2.2 (0.97,5.10) P value-.06

El-Bassel 2019	Community supervisions programmes	\$265 for all study activities	1)Both partners were aged 18 or older 2) partners identified each other as their primary sexual partner of the opposite sex 3. The relationship had lasted at least 3 months 4. At least one partner reported having had condomless vaginal and/or anal intercourse with the other in the past 90 days 5. At least one partner reported exposure to an outside HIV risk in the past year (engaged in unprotected sex with another partner, shared syringes, tested positive for an HIV/STI) or at least one partner suspected that their partner had exposure to an outside HIV risk 6. The couple planned to stay together for at least another year 7. The male partner reported either (a) use of illicit drugs or binge drinking (i.e., drinking 5 or more alcoholic beverages on a single occasion) in the past 90 days or (b) attended substance abuse treatment in the past 90 days 8. The male partner was mandated to community supervision, alternative to incarceration or probation verified by court records Identifying as male at birth; Black, African American, Caribbean Black, African Black and/or multiethnic Black; ability to read and respond in English; being 16-29 years of age; not known to be HIV- infected;	Couple based HIV counselling	Individual counselling and testing.	3,6 and 12 months	n = 230 couples IB=230 IF=202 CB=230 CF=192 Adults	PACT intervention-3 months=98 (55.4). 6 months=93 (47.9) 12 months=76 (37.6) HIV control=3 months=105 (55.9) 90 6 months=(46.9) . 12 months65 (33.9)
Victoria Frye 2020	Online advertising, face-toface outreach and referrals by study participants	Received compensati on for completing the baseline visit and for the 3- and 6- month follow-ups	Received personalized recommendation to clinic-based testing or CHTC were provided resources to find an HIV testing site or CHTC site.	Electronic information about each testing method with standard HIV information and without completing the questions for the algorithm and subsequently receiving a	Electronic information about each testing method with standard HIV information and without completing the questions for the algorithm and subsequently receiving a	3 and 6 months	N=236 IB=118 IF=98 CB=118 CF=103.you ng Black men and transwomen	3 months (76% vs.71%; p=.40) and 6 months (73% vs. 72%; p=.81), respectively.

Harawa 2020	Public venues, community-based organizations, parks, and events, provider referrals/fliers placed at public venues, online via Craigslist.com, Instagram, and a study website.	Reloadable gift card at first and redeemable 1:1 for dollar on completion of passport items.	reporting anal intercourse with a man or transwoman in the last 12 months; residing in New York City; willing to participate in a 6-month study; having a working email and phone number for follow-up; and providing informed consent. Black/African-American man, were at least 18 years of age, and resided in Los Angeles County. Participants had to be HIV-negative or unaware of their status and to report condomless anal sex with a man or a transgender woman in the last 6 months. During the study's first 12 months, participants also had to report not having been tested for HIV in the prior year (or to have been recruited from an HIV testing site where their last test was more than 12 months prior).	Customized wellness peer supported plan that included referral to health and support services, incentives, peer encouragement, navigation and social education.	Non-peer supported comparison arm	6 months	N=80 IB=45 IF=34 CB=35 CF=27 MSM	O.R=1.53 [0.21–11.03]
Hawk 2013	Women to host TGP parties through community settings including outreach on the street, in social environments, to civic or provider groups, and to leaders of subsidized housing communities	Hosts received \$50 gift cards. Women who participated in the TGP parties received \$10 gift cards and \$10 gift cards upon completion of a three-month follow up	Self-identified as being African American and were between the ages of 18 and 65, with no other screen out criteria.	women at TGP parties given trained facilitators on HIV education including risk reduction and on site HIV oral swab test.	women at parties with no HIV risk reduction knowledge but collection of baseline data.	0 months	N=149 IB=61 IF=46 CB=88 CF=59 AA women.	66 women (87%) chose to be tested. Forty-five women in the intervention group were tested, which represented 92% of those eligible, and 21 or 78% of those eligible in the control group were tested.
Kenya 2016	Overtown neighborhood of Miami by canvassing community centers, churches, and other community locations identified as high traffic areas for our target population in the community	\$20 gift card	African American had not completed an HIV test within the prior 12 months, were between 18 and 60 years of age, lived in Overtown, and were not known to be HIV positive.	CHW assistance to complete HBRHT	NON community health worker assisted to HRBTC	20 minutes	N=62 IB=30 IF=30 CB=30 CF=27 AA adults	All 30 participants in the experimental condition (OraQuick HIV test with CHW) completed the HIV test. However, three participants in the control condition (OraQuick HIV test only) did not complete the test.

MC Coy 2013	Community agencies	Flat incentive=\$20 gift card for each eligible recruit conditional incentive=\$10 gift card for each eligible recruit	30–60 years, African American or black, and residents of Oakland, Oakland residents, of unknown HIV status (except PLHIV seeds who initiated some recruitment chains), willing to be tested for HIV infection, and willing and able to provide written informed consent.	HIV testing and counseling (HTC) approach using respondent-driven sampling (RDS), financial incentives, and persons living with HIV infection (PLHIV)	conventional outreach based HTC of network associates.	1 year	total 48 seeds recruited network associates=243	Incentives group =adjusted odds ratio = 0.92, 95% CI: 0.27 to 3.13
Merchant, 2018	Multiple social media platforms	\$10 internet-based gift card	age 18–24 years; English- or Spanish-speaking; self-identified black, Hispanic, or white race/ethnicity; living in the US; ever having had anal sex with another man; and not being HIV infected (per self-report).	free oral fluid rapid HIV self-test (n=142).	free mail-in blood sample collection HIV test (n=142) medical facility/community organization of their choice (n= 141)	every one month for 3 months	n=425 MSM IB=142 IB=142 CB=141 IBF=94 IBF=57 CF=79 MSM	Home-based oral fluid rapid HIV self-test Completed assigned HIV test=66.2 % (58.4, 74.0) free mail-in blood sample collection HIV test (n=142)=40.1 % (32.1, 48.2) medical facility/community organization of their choice (n=141)=56.0 % (47.8, 64.2)
Derose 2016	2 medium-sized (125-250 member) African American Baptist, 2 small (100 member) Latino Pentecostal, and 1 large (2000+ member) Latino Catholic churches.	\$20 gift card and a meal for completing each survey.	1) churches that primarily served African American and Latino congregants 2) >70% African American or Latino, ≥100 typical Sunday attendance, and the church reported having conducted no or almost no HIV-related activities previously Friendly and well-respected African American or Latino MSM aged 18 years or older, having had sex with a man in the past 12 months, having a Facebook account or being willing to create one, and being interested in educating others about health	multilevel intervention including HIV education workshop, Peer leader workshops, HIV sermon/imagined contact scenario and Congregation-based HIV testing events	no multilevel intervention given-standard practice-unclear	6 months	n=338. IB=208 CB=130 AA adults	32% vs. 13% in the African American Baptist churches). p < 0.001
Young 2013	Online Internet and social networking sites through paid, targeted banner ads on social networking sites, such as Facebook;	No incentive		Peer leaders in intervention group instructed to communicate about HIV prevention and testing	Peer leaders communicated the importance of exercising, healthy eating, and maintaining a low-stress lifestyle.	12 weeks	N=112 IB=57 IF=52 CB=55 CF=53 MSM	Twenty-five of 57 intervention participants (44%) requested home-based HIV testing kits compared with 11 of 55 control participants (20%) (difference, 24 percentage points [95% CI, 8 to 41 percentage Nine the test

Of the 9 included studies, all were conducted in USA and varied widely in sample size from 62 to 543 maximum participants with 2286 as total number of participants in the review.

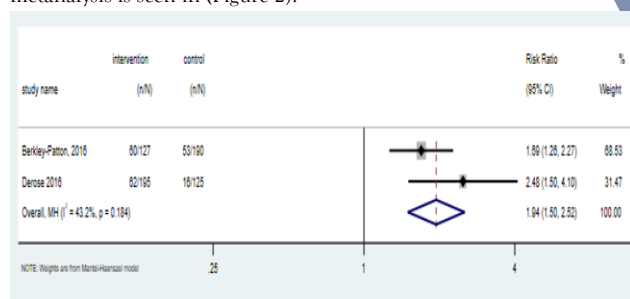
Different set of AA subpopulations have been targeted in our included studies like three studies had Men who have sex with men (MSM) as participant population [25,28,30], one study as transwomen, [24], four

Studies focused on general AA adults, [22,23,27,29]. Two Studies included AA adult men and women, [24,26].

The review studies implemented a diverse range of intervention methods which are grouped into six categories listed and described in details below:

1)AA churches based multilevel intervention and religiously tailored intervention-

Two RCTs conducted in AA churches with similar interventions given as multilevel HIV education were combined for metanalysis. Derose'16 recruited 5 churches with Latinos and AA as church members, ⁽²⁹⁾. It implemented multilevel intervention with HIV education workshops designed to raise awareness about HIV prevention and testing, peer leader workshops and HIV sermon/imagined contact scenario where each pastor or priest was asked to deliver a sermon about HIV and Congregation-based HIV testing events. Counselors conducted rapid oral fluid testing and counseling through a mobile clinic stationed at the church during regularly scheduled service. AA Baptist intervention churches showed higher rates of HIV testing during the follow-up compared to paired control churches (32% vs. 13%) with R.R of 2.48(C.I=1.50-4.18).Berkley 2020 recruited 4 AA churches with 543 AA adults as participants,[22]. It used religiously tailored multilevel intervention where individual-interpersonal contact, ministry groups educational games, printed/video testimonials, facilitated discussion, church services (sermons, responsive readings, church bulletins, church HIV stigma video, pastor-modeled receipt) and community outreach ministries . There was 23% increase in uptake of HIV testing seen in intervention group and 9% in control group. These two church-based interventions seem to have shown effect on increase in uptake of HIV testing. The meta-analysis done shows risk ratio as 1.94(C.I.1.50-2.52)suggesting that the intervention group has 1.94 times chances of increase in uptake of HIV testing than the comparator group with I^2 as 43.2% showing moderate heterogeneity. Forest plot of metanalysis is seen in (Figure 2).



Key - n= number of participants tested for HIV , N= Total number of participants C.I(Confidence interval) MH(Mantel-Haenszel)

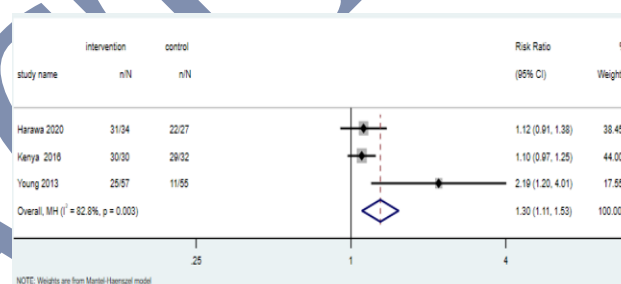
FIGURE NO 2.) Forest plot of metanalysis

Peer/Community Health worker(CHW) supported HIV education intervention: Three trails with intervention based on peer support were grouped for metanalysis. Harawa, et al 2020 recruited 80 MSM from Public venues, community-based organizations, parks, and events, provider referrals/fliers placed at public venues, online via Craigslist.com, Instagram, and a study website,[25]. He introduced Customized wellness peer supported plan that included referral to health and support services, incentives ,peer encouragement, navigation and social education vs non peer supported control arm. Findings obtained are O.R=1.53 [0.21–11.03] showing moderate effect and R.R 1.12(C.I=0.91-1.38)

Kenya 2016 recruited 60 Adult AA from Over town neighborhoods of Miami by canvassing community centers, churches, and various community locations known as high traffic areas for our target population in the community [26,27]. Intervention arm was given CHW assistance to complete home-based HIV rapid test(HBRHT, Ora Quick HIV test) and control arm was given no CHW assistance. All 30

participants in the intervention arm completed the HIV test and 27 participants from control arm completed the test with risk ratio as 1.10(C.I =0.97-1.25)

Study by Young 18 Suggested that a peer-led HIV-testing intervention using social networking communities like paid social networking sites with targeted banner ads such as Facebook led to high rates of participant engagement and an increase in home-based HIV testing,[28,29,30]. The trial recruited 112 MSM. It used Peer leaders in 4 intervention group instructed to communicate about HIV prevention and testing compared to control group with Peer leaders communicating the importance of exercising, healthy eating, and maintaining a low-stress lifestyle. 44% participants from experimental group requested home-based HIV testing kits compared to 20% in control participants 20% with Risk ratio 2.19(C.I=1.20-4.01) 36% who requested the test took it and mailed it back compared with 18%in control group . The meta-analysis of the three studies gives Risk ratio of 1.30 with Confidence interval as 1.11-1.53 shows effect estimate as 1.30 times than the comparator group for the studies. I^2 of 82.8% shows high heterogeneity. Forest plot for metanalysis is seen in (figure 3).



Key - n= number of participants tested for HIV , N = Total number of participants, C.I(Confidence interval), MH(Mantel-Haenszel)

FIGURE NO 3.) Forest plot of metanalysis

Exposure to electronic personalized messages recommending matched HIV test vs messages with no recommendation: Frye 2020, recruited 236 young black men and transwomen from online advertising, face to face outreach and participants referrals, ⁽²⁴⁾. Matched as per algorithm questions answered by participants beforehand, they received electronic personalized messages recommending either clinic-based testing or self-testing or couples HIV testing and counselling(CHTC) individually along with resources to find an HIV testing site or CHTC site and control arm messages gave information about each testing method without them completing the questions for the algorithm for a recommended approach and standard HIV information. Electronic personalized messages against messages with no personal recommendation showed very small change in effect on HIV testing with 6 months finding as 73% vs. 72%; $p=.81$ respectively and R.R of 1.02(C.I=0.87-1.20). HIV testing increased in both arms simultaneously suggesting that an electronic message giving knowledge on available options and/or increasing risk awareness is adequate to remarkably raise HIV testing.

Couple based counselling compared with individual counselling by recruiting 230 AA adult couples from community supervision programs (CSPs) EL, Bassel 2019: measured primary outcome as various HIV preventive measures and uptake of HIV testing as secondary outcome ,which showed more or less not much change in number of participants who got themselves tested for HIV, ⁽²³⁾. Out of 460 participants 341(74.6%) were AA, and results were not mentioned

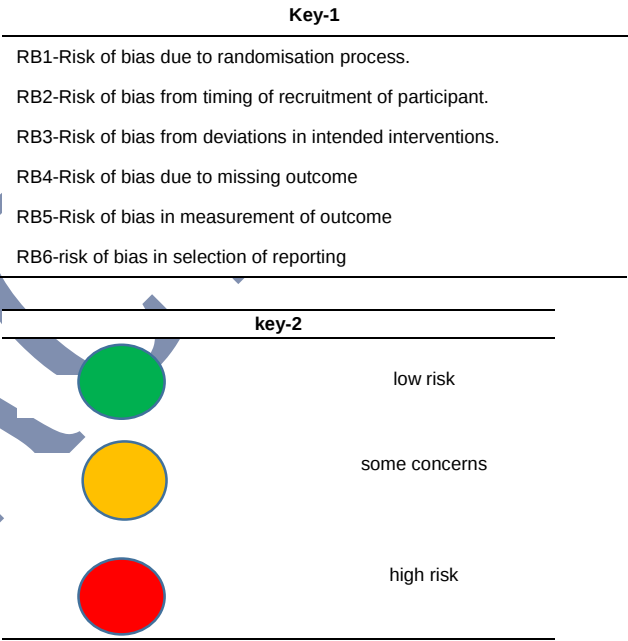
separately but considering larger portion of population as our target population so we included this study. The power and connect (PACT) intervention given to couples in experimental arm was guided by social cognitive theory with multiple HIV preventive measures and couple-based skills and control group gave one 45-minute session consisting of individual rapid oral HIV/STI testing with pretest and posttest counseling and referrals to HIV or STI treatment and other social services. PACT intervention group and control group showed 12 months findings as 76/230 (37.6%) and 65/230 (33.9%) respectively with and R.R of 1.17(0.89-1.54).More interventions based on couple-based counselling intervention to increase the uptake of HIV testing as primary outcome could be considered to understand the effect of the same.

The girlfriend project(TGP) party with onsite offer for HIV testing and HIV prevention counselling as an intervention: Hawk et al recruited 149 AA women from community settings through outreach on the street, social environments, civic/provider groups, and to leaders of subsidized housing communities,[26]. TGP facilitator received incentives to host parties for members of their social networks. A single session intervention parties of two hours, where trained facilitators provided HIV risk-reduction information, informal assessments and referrals related to addicted and domestic violence and on-site HIV oral swab testing compared to the baseline parties conducted to inform women about the study and collect baseline data with no other HIV information shared. Women who reported as HIV negative were only eligible for testing. Out of 49 eligible women from experimental arm 45 women got themselves tested and out of 27 eligible women from control arm,21 women got themselves tested with R.R of 1.181(C.I=0.95-1.47)

Multi arm intervention-First arm as using provision of Free oral swab test, 2nd arm as free mail-in blood sample collection HIV test compared with using medical facility/community organization of their choice: Merchant 2018 recruited 425 young MSM of different ethnicities of age 18-24 years from multiple social media platforms,⁽²⁸⁾. As mentioned, findings did not differ by race/ethnicity hence we included this study. The study implemented multi arm intervention where first two intervention arm participants received free oral fluid rapid HIV self-test and mail-in blood sample collection of HIV testing respectively with instructions and gift cards and weblinks of companies for buying the allocated test kit and comparative arm were recommended for medical facility/community organization usage of their choice with no gift cards provided but various website weblinks for locating testing sites. The findings showed completed assigned HIV test in intervention arm of free oral swab test as 66.2% (C.I=58.4, 74.0) with free mail-in blood sample as 40.1%(C.I=32.1, 48.2) and using community-based facility as 56.0% (C.I=47.8, 64.2). First intervention arm compared with third control arm showed R.R of 1.18(C.I=0.98-1.43).Second intervention arm compared with control arm with R.R of 0.72(C.I=0.56-0.92).The study suggested lack of awareness or distrust in the oral swab test and participant exhibited their confidence and trust in tests and medical staffs at clinic. Raising awareness about the success and authenticity of oral swab test could help to increase the uptake of HIV testing in these vulnerable populations.

Risk of Bias: The ROB scores for the studies included in this systematic review ranged low risk, moderate and high risk where five studies showed moderate risk, two studies showed high risk and three studies give low risk of bias presented with reasoning in table no and (figure4).

Author	RB1	RB2	RB3	RB4	RB5	RB6	Overall Bias
Berkley-Patton, et al 2016,							
El-Bassel, et al 2019,							
Victoria Frye, et al 2020							
Harawa, et al 2020,							
Hawk, et al 2017							
Kenya, et al 2018,							
Merchant, et al 2018,							
Deroose, et al 2016,							
Young, et al, 2015,							



DISCUSSION

Based on criteria of recruitment setting and similarities in intervention implemented, we grouped studies for meta-analysis to observe evidence of effect. The meta-analysis conducted for two different groups of interventions shows R.R as 1.94(C.I-1.50-2.52) in study trials with AA churches as setting showing some effect of evidence and for peer supported intervention R.R was 1.30(C.I= 1.11-1.53). Berkley and Deroose are pilot study and looking at the effect of this pilot study large population size study is currently under trial(reference) based on the same study design,. The intervention based on independent access to HIV testing showed less engagements and more doubts. Peer supported and Church approach are likely to have limited sustainable impact on the uptake of HIV testing. We found no study with Caribbean immigrants as participants. Measures of Implementation process were evaluated only in one study by Deroose 2016,[29]. The review revealed various types of recruitment settings like AA churches(n=2)[22,29],. community and local venue based(n=5) and multiple settings(n=4), social media platform (n=3) that n Increasing the uptake of HIV testing. High attendance rates and perceived effectiveness were observed in two different grouped studies of

peer/CHW supported and AA churches-based studies, [22,25,27,29,30]. Eight studies provided incentives to participants for completing the intervention and one study by Young 2018, did not give incentives. We found 18 studies that met our inclusion criteria, out of which 13 studies are under trial and 5 are said to be complete with no results posted which can be considered potential for any future review, the list of same is provided in Table no. Systematic review by Aung2017 [31]. identified peer or trained facilitators supported interventions as one of the potential interventions that showed evidence of effect, [12]. The population targeted in that review were international immigrants in all countries, so a direct comparison with its findings is not suggestive, owing to difference in challenges of stigma and discrimination, socio-cultural and administrative barriers the immigrants in HICs face. There is no review that is identified targeting the same population and outcome in recent few years.

LIMITATIONS AND STRENGTHS

It was a comprehensive search and addresses a potential research question which is not covered in a systematic review in last few years to our knowledge. Review included only RCTs so other potential non RCT and study designs were refrained to be a part. Screening, data extraction and critical appraisal was conducted was single reviewer leading to few limitations and biases. Time limitation and manpower constraint led to some restrictions in search from grey literature and electronic databases. Findings from studies conducted on MSM population may not be generalized on AA/Caribbean population considering difference in barriers these sub-population faces. All trials included in the review are conducted in US, its applicability in other HICs is conditional due to difference in socio-cultural, economical and structural backgrounds among them. Our inclusion criteria reported exclusively on AA and Caribbean migrants meant that we might have missed interventions from studies that had a broader scope of subject groups such as ethnic minorities.

CONCLUSIONS

Though early detection of HIV is identified as instrumental in preventing HIV transmission, very few interventions aiming to increase the HIV testing among AA and Caribbean population in HIC were available through the search. Broader interventions addressing barriers among individual migrant and health care provider, health systems and social determinants at a national level are likely to show evidence of effect. A rigorous grey literature search including contacting authors and organizations operating in this field may provide more evidence of interventions that aim to increase HIV testing uptake among migrants. Researches from various settings, interventions based on more generalized approaches, better service utilization, interventions overcoming stigma, socio-cultural and economical barriers, social determinants of health need to be reviewed to overcome the issue of late HIV testing in the targeted migrant population.

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