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SUBSTANTIVE REVIEW

A Systematic Review of HIV Interventions for Young Women in Sub-Saharan Africa

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Abstract
Adolescent girls and young women (AGYW) ages (15–24 years old) in Southern and Eastern Africa account for nearly 30% of all new HIV infections. We conducted a systematic review of studies examining the effectiveness of behavioral, structural, and combined (behavioral + structural) interventions on HIV incidence and risky sexual behaviors among AGYW. Following PRISMA guidelines, we searched PubMed, CINAHL, Web of Science, and Global Health. Twenty-two studies met inclusion criteria conducted in Eastern and Southern Africa and comprised behavioral, structural, or combined (behavioral and structural) interventions. All findings are based on 22 studies. HIV incidence was significantly reduced by one structural intervention. All three types of interventions improved condom use among AGYW. Evidence suggests that structural interventions can reduce HIV incidence, while behavioral and combined interventions require further investigation.

Keywords HIV · Sexual behavior · Adolescent · Behavioral intervention · Structural intervention · Combination interventions

Resumen
Niñas adolescentes y las mujeres jóvenes (15–24 años) en África meridional y oriental representan casi 30% de las nuevas infecciones por VIH. Se realizó una revisión sistemática de estudios que examinan la efectividad de las intervenciones estructurales, de comportamiento, y combinadas (comportamiento + estructurales) sobre la incidencia de VIH y las conductas sexuales de alto riesgo entre niñas adolescentes y las mujeres jóvenes. Siguiendo las pautas de PRISMA, se buscaron estudios en PubMed, CINAHL, Web of Science, y Global Health. Veintidós estudios cumplieron con los criterios de inclusión realizados en África oriental y meridional, e incluyeron intervenciones de comportamiento, estructurales, o combinadas (comportamiento + estructurales). Todos los resultados y conclusiones están basados en los 22 estudios. La incidencia de VIH fue significativamente reducida por una intervención estructural. Los tres tipos de intervenciones mejoraron el uso de condones entre niñas adolescentes y las mujeres jóvenes. Evidencia sugiere que las intervenciones estructurales pueden

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reducir la incidencia de VIH mientras intervenciones de comportamiento e intervenciones combinadas requieren mayor investigación.

Palabras Clave VIH · Comportamiento Sexual · Adolescencia · Intervenciones de Comportamiento · Intervenciones estructurales · Intervenciones Combinadas

Introduction

Adolescent girls and young women (AGYW) between the ages of 15–24 years in Eastern and Southern Africa are highly vulnerable to Human Immunodeficiency Virus (HIV). In these two regions of Africa, AGYW comprise 10% of the total population yet accounted for nearly 30% of all 1.8 million new HIV infections in 2016 [1]. Also, new HIV cases are eight times higher among women in their teenage years as compared to men of the same age [2]. High HIV rates among AGYW in these regions have been linked to many interrelated factors at different social-ecological levels including, individual (low-risk perception, age-disparate sexual relationships, unprotected sex), interpersonal (unequal power relations, transactional sex), community (harmful gender norms), and societal levels (poverty, harmful gender norms, and economic inequalities) [3–6]. Nearly three decades have passed since the first case of HIV, however a limited number of evidence-based interventions have been found to reduce HIV risk among AGYW [7]. Consequently, HIV researchers have called for adopting combination interventions that will synergistically target different HIV risk factors at multiple levels [4, 8].

HIV prevention interventions aimed at disrupting the different pathways of transmission fall into three broad categories: behavioral, biomedical, and structural interventions [9]. Behavioral interventions target HIV risk in individuals and seek to motivate, educate, or enhance skill-building to reduce behaviors that are known to increase the risk of transmission, with a fundamental assumption being that individual behaviors are entirely the result of rational, unconstrained choices [10]. Evidence suggests behavioral interventions have had minimal impact on HIV incidence in the last three decades because they fail to address the broader contextual factors that precipitate individuals engaging in risky sexual behaviors [11, 12]. Attempting to elicit behavior change in a vacuum, without changing the predisposing forces and structures that lead to these behaviors, represents more of a "band-aid" approach than a long-term, effective solution [11].

Biomedical interventions, although not included in this review, address biological pathways of HIV transmission by the use of prophylactic medications such as pre-exposure prophylaxis (PrEP) and microbicides among the uninfected or antiretroviral therapy (ART) for those already infected [10]. Although biomedical interventions could have a significant impact, evidence of PrEP feasibility in AGYW populations is limited, with the majority of studies testing the efficacy of PrEP being underway [13, 14]. Despite many investments and the potential in biomedical interventions as a primary prevention method, a number of scholars contend that these do not address the root causes of HIV, which are embedded in structural forces—such as gender inequalities—that oppress women and restrain their choices in the negotiation of safer sex; and economic inequalities that lead women to engage in transactional sex relationships and other risky sexual behaviors [4, 8].

Structural interventions are those interventions that target social, structural, and environmental factors. Structural interventions are premised on the understanding that individual behaviors are not randomly distributed within a population, but are instead perpetuated by the interaction of the individuals with these factors [12, 15–17]. Some of these factors include poverty, limited access to education, gender inequitable norms, and food insecurity. Structural interventions, therefore, aim to decrease HIV risk by addressing the structures that constrain AGYW options for adopting lower risk behaviors, including the power to negotiate safer sex by constraining risk behavior options [18].

The complexity of factors driving the increased rate of HIV infection among AGYW in sub-Saharan Africa might best be addressed by equally complex interventions that combine the strengths of both behavioral and structural approaches [19–21]. In the public health literature, interventions that use a combined approach to address risk factors at different levels are referred to as multilevel interventions. Multilevel interventions have been very successful in addressing other public health threats such as cancer among minority populations and in preventing tobacco-related diseases [22–25]. Similarly, combining behavioral, structural, and biomedical interventions has the potential to address different levels of influence, including the individual level (knowledge of HIV, condom use self-efficacy) and structural levels (community norms, economic structure, and policies) known to increase risky sexual behaviors and HIV. To our knowledge, a systematic review that synthesizes the effectiveness of behavioral, structural, and combination interventions has not been conducted.

Therefore, the purpose of this systematic review is to describe behavioral, structural, and combined (structural + behavioral) HIV prevention interventions and their impact on HIV incidence and HIV-related outcomes

among AGYW in Sub-Saharan Africa. We asked the following questions for each type of intervention:

What are the characteristics of the interventions?
What is the impact of the interventions on HIV incidence and risky sexual behaviors?

Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was used to guide the search, abstraction, synthesis, and review [26, 27] (Fig. 1).

Search Strategy

A research librarian was consulted to develop a search strategy to identify studies published in the English language that focused on behavioral, structural, or combined interventions that addressed HIV incidence and risky sexual behaviors (including early sexual debut, condom use, multiple sexual partners, transactional sex, and age disparate sexual relationships) (see Table 1). The search was not limited to a specific publication time frame to ensure that behavioral interventions conducted at the beginning of the HIV epidemic were captured. We defined behavioral interventions as those addressing individual-level factors such as HIV knowledge, beliefs and attitudes, and skills such as condom

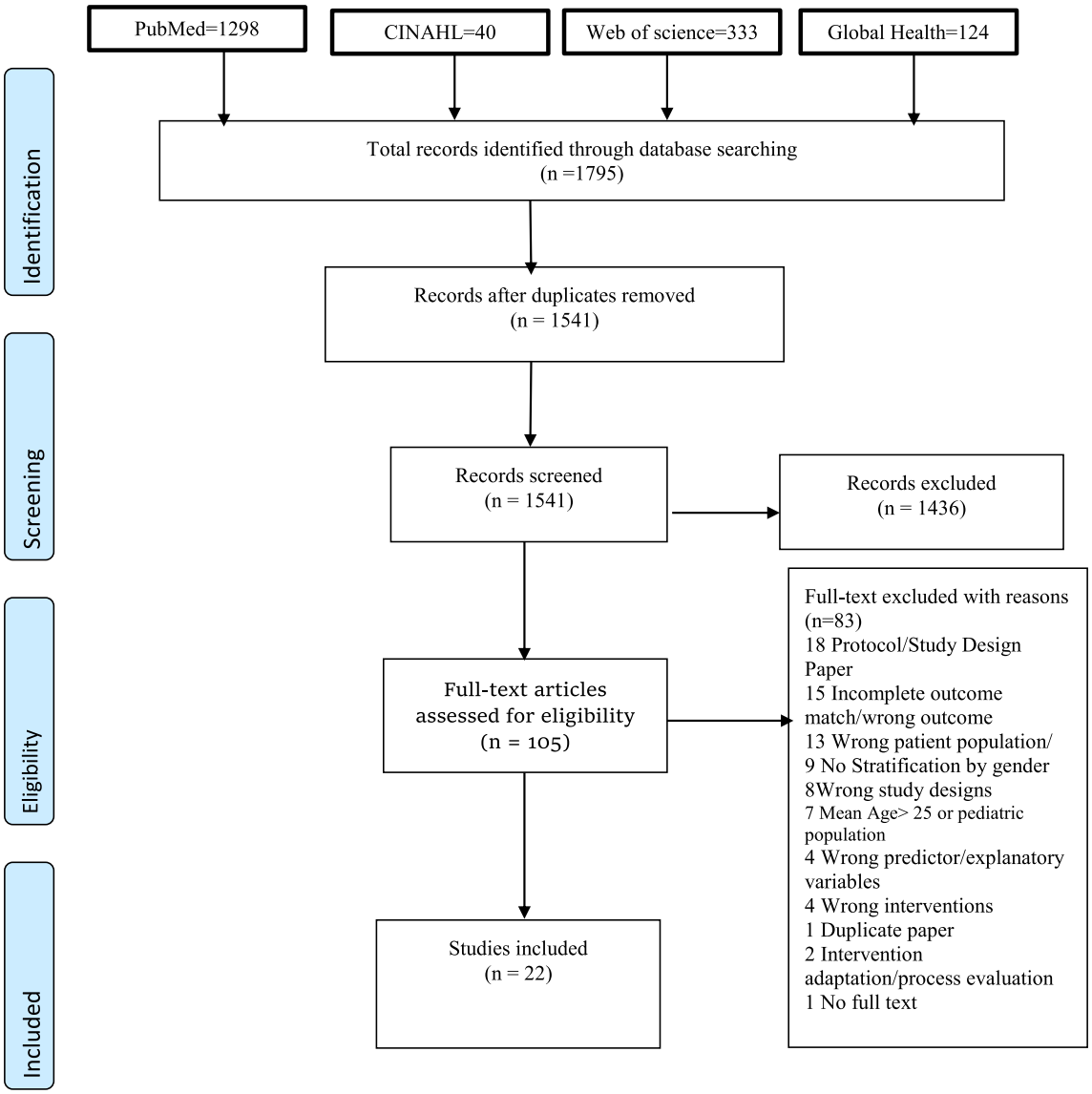


Fig. 1 PRISMA flow diagram

Table 1 Complete search strategy details

Set #	
1	[(woman* OR women* OR girl* OR female* OR gender)) AND (adolesc* OR "young adult" OR teen* OR "emerging adult" OR "young person" OR "young people" OR juvenile OR minor)
2	AND ("eastern Africa" OR "southern Africa" OR Kenya OR Rwanda OR Tanzania OR Uganda OR Malawi OR "South Africa" OR Zambia OR Zimbabwe)
3	AND (HIV OR "human immunodeficiency virus" OR "AIDS" OR "HIV/AIDS" OR "acquired immunodeficiency syndrome" OR "Sexual Behavior"[Mesh] OR "Sexual Behavior" OR "Sexual Behaviors" OR "Sexual Behaviour" OR "Sexual Behaviours" OR "Sex Behavior" OR "Sex Behaviors" OR "Sex Behaviour" OR "Sex Behaviours" OR "unsafe sex" OR "safe sex" OR "sexual activity" OR "sexual activities" OR "sexual practices" OR "sexual practice" OR "sexual health knowledge")
4	AND (micro-finance OR microfinance OR "micro finance" OR "cash transfer" OR "cash transfers" OR structur* OR school OR schools OR empower* OR socioeconomic OR economic OR money OR "HIV education" OR counselling OR "sex education" OR "health promotion")
5	AND (randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR placebo[tiab] OR clinical trials as topic[mesh: noexp] OR randomly[tiab] OR trial[ti] OR "Comparative Study"[Publication Type] OR "Controlled Clinical Trial"[Publication Type] OR Nonrandom[tiab] OR non-random[tiab] OR nonrandomized[tiab] OR non-randomized[tiab] OR nonrandomized[tiab] OR non-randomised[tiab] OR quasi-experiment*[tiab] OR quasiexperiment*[tiab] OR quasirandom*[tiab] OR quasi-random*[tiab] OR quasi-control*[tiab] OR quasicontrol*[tiab] OR (controlled[tiab] AND (trial[tiab] OR study[tiab]) NOT (animals[mh] NOT humans[mh]))]

This search was for PubMed then changed appropriately to match other databases

negotiation [11]. Structural interventions were defined as those addressing contextual and environmental factors, economic factors, community, and societal social norms, which included intervention approaches, such as cash transfers for school attendance, microfinance loans, vocational training, and others [16, 28]. We then defined combined interventions as those addressing one or more individual-level factors, as well as one or more structural-level factors. We searched the PubMed, CINAHL, Web of Science, and Global Health databases on January 23, 2019. All databases were searched using a combination of terms, as shown on Table 1.

Inclusion/Exclusion Criteria

The inclusion criteria were studies that: (1) were conducted in Eastern and Southern Africa; (2) used a behavioral, structural, or combined HIV intervention and aimed to change HIV incidence, HIV risky sexual behaviors, or sexually transmitted infections (STIs), as STIs are often used as proxies for risky sexual behaviors; (3) included samples of adolescent or young women limited to those if the mean age of participants was ≤ 25, or in cases where mean age was not reported a study was included if greater than 75% of their participants fell under the age of 25 as indicated by reported percentages of various age ranges in the studies; (4) used a classical experimental design or quasi-experimental design; and (5) conducted sub-group analysis for female participants when the study included both genders. We excluded studies that had only male samples, studies in which the entire sample was HIV positive (given our priority was the prevention of primary infection), and articles that provided only a description of ongoing study protocols. We also excluded studies that focused on female sex workers or injection drug users, as these are unique populations in sub-Saharan Africa that do not fully represent our population of interest and require different kinds of interventions [29].

Article Selection and Data Abstraction

Article selection and data abstraction were each performed independently by two reviewers (CM and MG) using Covidence systematic review software [30]. First, each reviewer reviewed the titles and abstracts of the 1,541 articles identified through database searches to determine if they met inclusion criteria; where abstracts were unclear, full text was reviewed. Once the initial review was complete, reviewers met on two separate occasions to resolve disagreements related to studies meeting eligibility for inclusion. We then moved to the full text review where each reviewer assessed 105 full-text articles for final inclusion. Conflicting votes were resolved by reviewing the full texts together, specifically assessing each study against all criteria in the order the criteria are presented above.

A data abstraction sheet was developed based on The Cochrane Public Health group Data Extraction and Assessment Template [31]. After pilot testing the tool on a sample of five studies, data were abstracted by the two reviewers in the following categories: (1) study characteristics, including location, participants age, and their unique description as presented in the studies, (2) intervention characteristics, including its components, duration, frequency, setting, and facilitators, and (3) type of outcome measures, including HIV incidence, risky sexual behaviors or acquiring an STI,

validity of measurement tools, length of follow up, and impact of interventions on outcomes.

In addition, the risk for bias among the included studies was appraised using the Mixed Method Appraisal Tool (MMAT) [32] by two reviewers.

Results

In our initial search, we identified 1795 studies. After removing duplicates, 1541 studies were included for abstract review and 105 articles underwent full-text review. Twenty-two studies met the inclusion criteria and were included in the final review (see PRISMA Fig. 1). The primary reasons for exclusion were that the article did not present outcomes (i.e., protocol/study design paper; n = 18) or the study did not assess an outcome of interest for this review (n = 15).

Study Characteristics

Major characteristics of the 22 included studies are presented in Table 2. Studies were published between the year 1999 and 2018. The selected studies were conducted in eight countries within Eastern and Southern Africa, with the greatest representation from South Africa (n = 9) and Kenya (n = 4) (see Table 2 for details). Eight studies were school-based, meaning that the intervention targeted children within the school setting, and 14 studies were community-based, meaning interventions were conducted in a neighborhood or a town in rural or urban areas.

Across studies, sample sizes ranged from 232 to 9,645 individuals. Nineteen studies included samples of young women between the ages of 15 and 25,while four studies included participants older than 25, but the mean age was below the age of 25 (see Table 2). Six studies included female participants only with the others including both genders. In the sixteen studies that included both male and female participants with subgroup analyses of the female-specific data, we report sample size and outcomes relevant to female participants.

Intervention Characteristics

We categorized interventions as behavioral (n = 9), structural (n = 5), or combined (behavioral + structural, n = 8) see (Table 3). Characteristics of interventions within each typology varied. Behavioral interventions primarily focused on skill-building, knowledge, and strategies to reduce sexual risk. Structural interventions primarily provided cash transfers. Combined interventions primarily focused on improving access to health services, skill-building, and livelihood promotion.

Behavioral Interventions

Nine of twenty-two studies (40%) addressed individual behavioral factors only (see Table 3). Of these nine studies, six used a randomized-control trial (RCT) design, and three used quasi-experimental designs. Five interventions were delivered within the school setting [33–37] and four within the community setting [38–41]. Topics addressed in the behavioral intervention components varied across studies, skill-building, such as condom use negotiation; condom application demonstration; decision making and awareness of one's risk; HIV risk behaviors; and topics to understand partner history as well as the decreasing number of partners. Delivery of the behavioral intervention components also varied across studies, including participatory methods such as role-playing, narratives, or discussions. Of the nine behavioral interventions, one was delivered via online modules, which addressed various components, such as information about HIV/AIDS, communication, and motivation to be in healthy relationships [36].

Structural Interventions

Five interventions were categorized as structural, with all five focusing on cash transfers for school attendance and all using an RCT design. One of the five cash transfers studies targeted poor households with orphans or vulnerable children and provided cash transfers of approximately $20 per month paid biweekly to the caregivers for care of children in the households [42]. The other four studies provided either a conditional cash transfer—meaning that AGYW were only eligible to receive the cash payments if they attended 80% of the total days school was in session [43, 44]—or an unconditional cash transfer, which was not based on school attendance [45, 46]. Cash transfers within this group of studies ranged from $1 to $10 monthly per student. These interventions lasted between 10 months to 5 years during which participants received cash transfers.

Combined Interventions

Eight of 22 studies (36%) were combined interventions which addressed both behavioral and structural factors. Unlike the studies testing structural interventions alone, none of the structural-level intervention components in the combined interventions included any form of cash transfers for school attendance. Five were cluster RCTs, meaning randomization occurred at the school, community, or village level; one was an RCT; and two were quasi-experimental

Table 2 Characteristics of included 22 studies

Intervention type	First author, year	Country	Design	Sample Setting	Sample size (n)	Age-range	Gender	Study duration
Behavioral	Fitzgerald, 1999 [37]	Namibia	RCT	School	6626	15–18	F, M	6 months
Behavioral	Agha, 2004 [35]	Zambia	Quasi-experimental	School	515	14–23	F, M	1 year
Behavioral	Erulkar, 2004 [40]	Kenya	Quasi-experimental	Community	1865	10–24	F, M	3 years
Behavioral	Jewkes, 2008 [39]	South Africa	Cluster RCT	Community	342	15–26	F, M	24 months
Behavioral	Smith, 2008 [34]	South Africa	RCT	Schools	2383	Mean age = 14- at baseline	F, M	3 years
Behavioral	Ybarra, 2013 [36]	Uganda	Cluster-RCT	Schools	366	Mean age = 16.1	F, M	Not reported
Behavioral	Wingwood, 2013 [41]	South Africa	RCT	Community	5716	18–35 Mean age = 23.69	F	6 months
Behavioral	Harrison, 2016 [33]	South Africa	Quasi-experimental	School	933	14–17	F, M	5 months
Behavioral	Thurman, 2016 [38]	South Africa	Cluster-RCT	Community	1016	14–17	F, M	22 months
Structural	Baird, 2012 [45]	Malawi	Cluster RCT	Community	328	13–22	F	18 months
Structural	Handa, 2014 [43]	Kenya	RCT	Household-community	1443	15–25	F, M	4 Years
Structural	Hallfors, 2015 [44]	Zimbabwe	Cluster RCT	School	2399	Mean age = 12.2 at baseline	F	5 years
Structural	Pettifor, 2016 [43]	South Africa	RCT	Household-community	2537	13–20	F	3 years
Structural	Beauclair, 2018 [46]	Kenya	Cluster- RCT	Communities	1108	13–22	F	5 months after completion
Combined	Agha, 2002 [47]	South Africa & Botswana	Quasi-experimental	Community	204-SA 2396 -B	SA-17–20 B-13–18	F, M	1 year
Combined	Pronyk, 2006 [50]	South Africa	Cluster RCT	Community	328	14–35	F, M	3 years
Combined	Ross, 2007 [48]	Tanzania	Cluster RCT	Community School	9645	14–18	F, M	3 years
Combined	Cowan, 2010 [49]	Zimbabwe	Cluster RCT	Community	2776	18–22	F, M	4 years
Combined	Doyle, 2011 [56]	Tanzania	Cluster RCT	Community	232	15–30	F, M	9 years
Combined	Jewkes, 2014 [52]	South Africa	Quasi-experimental; interrupted time series	Community	515	18–34	F, M	58 weeks
Combined	Dunbar, 2014 [51]	Zimbabwe	RCT-Pilot Study	Community	315	16–19	F	2 years
Combined	Duflo, 2015 [53]	Kenya	Cluster RCT	School	5716	13.5 baseline, 20.5 end line	F, M	7 years

RCT randomized controlled trials, *Cluster RCT* unit of randomization was a school, village, or community, *F* female, *M* male, *SA* South Africa, *B* Botswana

Table 3 Description of intervention characteristics and their components

Intervention type	First author, year	Components	Facilitators	Delivery	Duration	Follow-up (months)	Control
Behavioral	Fitzgerald, 1999 [37]	Basic facts about reproductive biology and HIV/AIDS, domestic violence, substance abuse Communication skills across genders Discussed age disparate relationships and their role in HIV risk	Volunteer teachers, and Youth who had completed 12th grade	After school group sessions, games, narrative, discussions	14, 2 h sessions delivered over 7 weeks	Immediate post intervention	None, delayed treatment
Behavioral	Agha, 2004 [35]	Information on abstinence, condom use Condom use demonstrations Drama skits to increase awareness of partners sexual history Leaflet is provided with info on abstinence and STIs	Peer Educators	Group Session	1.5hrs	6 months	Peer education on water purification
Behavioral	Erulkar, 2004 [40]	Topics included puberty and values for younger adolescents, and HIV/AIDS, STI knowledge and prevention with older adolescents	Trained counselors Family planning Association of Kenya	Groups- discussions, role playing	4–8 weeks, for 1.5–2 h	3 years	None
Behavioral	Jewkes, 2008 [39]	The sessions covered How we act and what shapes our actions; sex and love Conception and contraception Taking risks and sexual problems; unwanted pregnancy; Sexually transmitted diseases and HIV Safer sex and condoms; gender based violence Motivations for sexual behaviour Communication skills	Staff from PPASA-Trained and supervised	Participatory learning approaches, including critical reflection, roleplay, and drama and draws the everyday reality of participants	50 h, 13.3-h sessions	24 months	3 h session on HIV, safer sex, and condoms
Behavioral	Smith, 2008 [34]	Social-emotional skills, positive use of free time, sexual risk including condom use	12 lessons in grade 8 followed by 6 booster lessons in grade 9	Not clear	Not clear	Every 6 months for 3 years	None
Behavioral	Ybarra, 2013 [36]	Information about HIV, Decision making and communication, motivations to be healthy relationships	Online modules, supervised by RA	Web-based	12 weeks	Not clear	Nome
Behavioral	Wingwood, 2013 [41]	3–2.5 h group based sessions Session 1: Ethnic and gender pride Session 2: Reality of HIV, skills building around condom use, condom negotiation, reducing number of partners Session 3: Sexual communication skills, healthy relationships, and encouraging partners to get STI	2 trained Xhosa speaking health educators indigenous to the Western Cape region	Group sessions	3, 2.5 h sessions over 3 weeks	6 months	Two-2.5-h session: HIV prevention education, healthy nutrition, hygiene and self-care

Table 3 (continued)

Intervention type	First author, year	Components	Facilitators	Delivery	Duration	Follow-up (months)	Control
Behavioral	Harrison, 2016 [33]	In-depth modules on sexuality, HIV, and pregnancy prevention Mandatory school curriculum on sexuality and life skills to complement Life Orientation program	Teachers led, Youth Peer Educators supported	Class sessions	4 months 3 weekly 45 min classes	5 months	Standard government Life Orientation curriculum
Behavioral	Thurman, 2016 [38]	IPTG group sessions focused on interpersonal skills Vhutshillo—behavioral intervention HIV risk factors and pathways also within group sessions	Lay community facilitators Trained young adult	Groups session	10 months	22 months	None
Structural	Baird, 2012 [45]	Conditional cash transfer for school attendance received if student attended 80% of school days per month Unconditional cash transfer monthly Payment not conditional on attendance Participants received $1 to $5 Parents received $4 to $10	Trained counsellors	Individually based on attendance	10 months	18 months	None
Structural	Handa, 2014 [43]	Cash transfers to poor households with at least one orphan or vulnerable Child below 18 years of age The program provides a flat transfer of approximately USD 20 per month (paid bi-monthly) given directly to the caregiver to allow these households to provide for the care and support of OVC	Direct cash transfers to households monthly	Transfers delivered by Children's Department of the Ministry of Gender, Children and Social Development	2 years	4 years	None
Structural	Hallfors, 2015 [44]	School support, fees, uniforms, supplies, and a school-based female "helper" who monitors participant attendance; if the student was absent, she was to find out why and if any assistance (e.g., medical care) was needed School support was conditional on staying in school and fees were paid directly to schools	School based female "helper"	Monthly payment direct to the school	5 years	5 years	None
Structural	Pettifor, 2016 [43]	Cash transfers for to young women of 100 rand Their guardian 200 rands every month conditional on the young woman attending 80% of the school days per month	Direct deposit to banks	Staff	3 years	Every year for 3 years	None

Table 3 (continued)

Intervention type	First author, year	Components	Facilitators	Delivery	Duration	Follow-up (months)	Control
Structural	Beauclair, 2018 [46]	Some schoolgirls received unconditional cash transfers and others conditional cash transfers for 80% of the days school was in session	Cash incentives to individuals	Staff	1.4 years	5 months	None
Combined	Agha, 2002 [47]	The national programs sold subsidized, branded condoms to traditional outlets, such as pharmacies and clinics, and to nontraditional outlets, such as supermarkets, kiosks and street vendors Mass media advertising and billboard messages about condom use and point-of-sales materials (stickers and posters) at condom outlets	Peer education, mass media, youth-friendly services, communities	Mass media, pharmacies and clinics to provide youth-friendly services	In south Africa—11 month Botswana 8 months	South Africa—1 year Botswana 1 year	None
Combined	Pronyk, 2006 [50]	Phase 1 of Sisters for Life Gender and HIV training Reflecting on culture,gender roles, women's work, our bodies, ourselves, domestic violence, gender and HIV, Empowering change Poverty focused microfinance to women Individual borrowing and repayment of loans over 10 or 20-week cycles Community mobilization to affect behaviors Election of natural leaders from within Development of center-based action plans responding to local priority issues	One field worker in every village Trained female facilitators delivered Sisters for Life component	Group sessions Community mobilization	Sisters for Life curriculum [12–15], community mobilization 6–9 months	2 years (cohort 1 and 2), 3 years (cohort 3)	Delayed treatment. The Control group got the main intervention 3 years later
Combined	Ross, 2007 [48]	Youth-friendly sexual and reproductive health services Community-based condom promotion and distribution by youth- social marketing of condoms Youth health weeks focused on interschool competitions Twice yearly youth health days at health facilities	40 min classroom sessions	2–4 health workers per government facility Teachers, peers, youths -for condom distribution	1 year	3 years	None
Combined	Cowan, 2010 [49]	Improve knowledge about reproductive health Improve communication between parents and their children Improve community support for adolescent reproductive health Improve accessibility of clinics for young people	Professional peer educators	Not clear	4 years	4 years	Standard HIV prevention activities

Table 3 (continued)

Intervention type	First author, year	Components	Facilitators	Delivery	Duration	Follow-up (months)	Control
Combined	Doyle, 2011 [56]	Participatory learning Provision of youth-friendly health services Community-based condom promotion and distribution by and for youth, limited community-wide activities including an initial mobilization week in each community and annual youth health weeks	Government workers trained Staff members from the GBD	12–40 school sessions per year	4 years	9 years	None
Combined	Jewkes, 2014 [52]	Stepping stones interventions and creating futures Participatory learning activities Reflect on and critically analyze their livelihoods Develop skills like negotiation for condom use Getting and keeping jobs including work expectations Addressed spending patterns and strategies for saving	Trained secondary school graduates	10 sessions of Stepping Stones followed by 11 sessions of Creating Futures	Not clear	58 weeks	No control group
Combined	Dunbar, 2014 [51]	Life-skills and health education, Vocational training Micro-grants Social supports	Trained counsellors	Groups, individually	2 years	Every 6 months for 24 h	Life-skills and health education alone
Combined	Duflo, 2015 [53]	Stand- alone HIV education subsidy Critical thinking add on- condom use Stand-alone education subsidy which covered school uniforms Joint program-both education subsidy and HIV education program	Trained teachers	In school—uniforms-sessions	7 years	3, 5, 7 years	None

AMREF African Medical and Research Foundation, *HIV* human immunodeficiency virus, *IPV* intimate partner violence, *IPGT* interpersonal psychotherapy for groups, *PPASA* planned parenthood association of South Africa, *OVA* orphans and vulnerable children, *RAs* research assistants, *STIs* sexually transmitted infections

designs. Some of these interventions addressed both structural factors, such as enabling access to services, and behavioral factors through information or skill-building intervention components. For example, one study used mass media to promote condom use, enabled access to condoms through national subsidized programs, branded and made condoms available through non-traditional avenues such as kiosks, and worked with clinic workers to provide youth-friendly services [47]. Two other studies promoted youth-friendly sexual and reproductive health services, social marketing of condoms to youth [48], improved access to clinics, improved communication between parents and children, as well as knowledge on reproductive health [49].

Three of the combined interventions integrated livelihood training (comprised of intervention components around microfinance loans, grants, and vocational training) and behavioral components (including intervention components that reflected on gender and HIV, health education, social support and participatory learning activities) [50–52]. One school based study by Duflo et al. combined school fees subsidies, HIV education for school children, and a condom use information advertisement [53].

Impact of Interventions on HIV Incidence and Prevalence Outcomes

Across studies, 11 of 22 included HIV incidence and/prevalence as the main outcome. One intervention—a structural intervention [45]—had a significant impact on HIV incidence.

Behavioral Interventions

Two behavioral interventions included biomarker outcomes for HIV [39, 54]. The first found that intervention exposure was not significantly associated with a decrease in HIV incidence (aIRR 0.95 (0.67–1.35), p = 0.78) at one and two year follow-up [39]. The other study by Wingood et al. found a higher percentage of HIV cases in the intervention group (5.7%) than in the control group (3.0%) among those who accepted testing at the 6 month follow-up [54]. However, in this study, not all participants accepted testing of HIV at the 6-month follow-up—with only 57.9% of those in the intervention group and 55.8% of those in the control group agreeing to be tested.

Structural Interventions

Three of the five structural interventions included biomarkers for determining HIV outcomes [44, 45, 55]. Of these, one intervention had a significant impact on HIV prevalence. This was a study by Baird et al., which tested both conditional and unconditional cash transfer interventions, which had a significant impact on HIV among school girls with a prevalence of 1.2% for the intervention group (aOR 0.36, 95% CI 0.14–0.91) versus 3.0% in the control group at the 18-month follow-up [45]. The authors reported the intervention impact as estimated prevalence because they did not measure HIV at baseline. Thus, some of the participants might have been HIV positive at the beginning of the study, limiting the investigators ability to report true HIV incidence in both groups. That said, the study was an RCT with balanced baseline intervention and control groups; therefore, the difference between groups in prevalence that occurred over time could be presumed to reasonably represent incidence.

Combined Interventions

Six of the eight combined interventions included biomarkers for HIV [48–50, 53, 48–50]. These studies did not find significant differences between the intervention and the control groups. However, the intervention in the Duflo et al. study, which provided school support, a condom use education component, and school uniforms, was not powered to detect differences in HIV incidence [53].

Impact of Interventions on Risky Sexual Behavior Outcomes

We were also interested in risky sexual behaviors as outcomes, such as early sexual debut, multiple sexual partners, unprotected sex/condom use, and transactional sex. Measures for these outcomes varied across studies, with the most frequent measures being condom use or number of unprotected sexual encounters measured in 21 of 22 studies followed by multiple sexual partners in 10 studies. Condom use was increased by two behavioral interventions [38, 54], one structural intervention [43], and one combined intervention [51].

Behavioral Interventions

All nine behavioral interventions measured condom use or unprotected sex. The second most common behavioral outcome measure was multiple sexual partners, which was used in four of nine studies. Only two of the 11 behavioral interventions (18%) had a significant impact on condom use. One study that included components such as skill building around condom use, condom negotiation, sexual communication skills, healthy relationships and ethnic and gender pride, decreased unprotected sexual intercourse in the intervention group (adjusted mean difference = 1.06; p = 0.02) compared to the control group [54]. In another study, which used two types of behavioral interventions that addressed interpersonal psychotherapy in group sessions and

HIV risks factors and pathways found a significant increase in consistent condom use among girls enrolled in the two interventions relative to the control group, at the 10-month and 22-month follow up ($\beta = 1.21$, SE = 0.52, $p = 0.02$ and $\beta = 1.37$, SE = 0.57, $p = 0.02$, respectively) [38]. In addition, reporting multiple sexual partnerships was decreased at the 6-month follow-up ($p = 0.04$) (aOR not reported) in one study which addressed topics such as abstinence, and provided drama skits to increase awareness on partner sexual histories [35].

Structural Interventions

All six structural interventions measured different risky sexual behavior outcomes. One study that provided a cash transfer conditional on 80% school attedance had a significant impact on condom use, whereby those in the intervention group were 19% less likely to report unprotected sex in the past 3 months (RR 0.81, 95% CI 0.67, 1.00) compared to the control group [43]. Similarly, among studies evaluating sexual debut, one study which provided cash transfers to household heads to support caring for orphan and vulnerable minor children living in the households significantly decreased the odds of early sexual debut by 42% among girls living in intervention households (aOR 0.58, 95% CI 0.39, 0.86, $p = 0.006$) compared to those in the control group [42].

Combined Interventions

All eight combined interventions measured risky sexual behavior outcomes. Condom use was measured in all eight studies, followed by multiple sexual partners (n = 5) and sexual debut (n = 5). Of all these studies, none impacted multiple sexual partners or sexual debut. Transactional sex (TS) was measured in two of eight studies. TS was impacted by a study by Dunbar et al. which combined vocational training, micro grants, and life skills with HIV education, and decreased the odds of transactional sex in the intervention group by 36% from baseline to the 24-month follow up (OR 0.64, 95% CI 0.50, 0.83) [51]. This same study also found that the odds of condom use among young women in the intervention group was 1.8 times that of those in the control group (95% CI 1.23, 2.62) [51].

Risk of Bias

Risk for bias among the included studies was appraised using the Mixed Method Appraisal Tool (MMAT) [32] by the two reviewers. First, risk for bias was generally low given 16 of 22 studies were based on randomized controlled trial (RCT) designs and, and a much smaller proportion used quasi-experimental designs (See Figs. 2 and 3). In accordance with the MMAT scoring, a description of how each criterion was met is preferred as opposed to a single summative score. Among studies based on RCTs, 62.5% described randomization procedures, 68% reported comparable groups at baseline, and 87% reported complete outcome data meaning that they collected data from 85% of all participants or more. However, blinding procedures were unclear or not reported in 81% of studies, which could increase the risk for bias in the reporting of findings.

Like RCTs, risk for bias of the quasi-experimental studies was low with most studies meeting four of the five criteria. However, most of these studies did not report using samples representative of the target population, which may limit the generalizability of study findings.

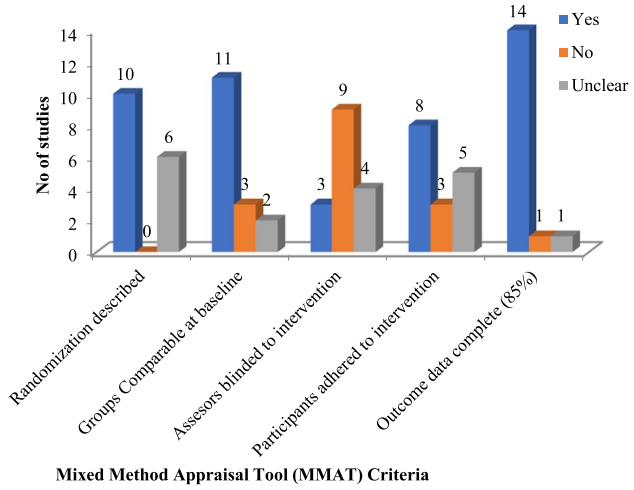


Fig. 2 Risk of bias assessment of the RCTs

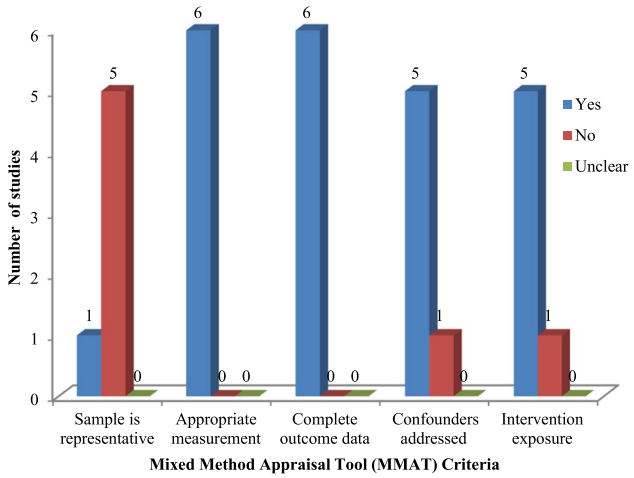


Fig. 3 Risk of bias assessment for the quasi-experimental studies

Discussion

We reviewed the characteristics and impact of behavioral, structural, and combined interventions based on HIV incidence/prevalence and risky sexual behavior outcomes among AGYW in Eastern and Southern Africa. We identified 22 studies, of which 17 used RCT and five used quasi-experimental designs published between the years 1999 and 2018. The risk for bias was identified as low, which, when combined with the rigorous experimental designs used, increases the validity of evidence. There was great variability in the intervention characteristics such that active components varied across studies. Furthermore, intervention characteristics were very diverse in terms of facilitators, mode of delivery, length of follow up, and control group conditions. Only two of 22 studies had similar cash transfer interventions with similar intervention components [45, 55]. Given the variability across the studies, direct comparisons and drawing clear conclusions of the impact of interventions solely by type (behavioral, structural, or combined) cannot be made.

Our review does, however, suggests that structural interventions may be effective at reducing HIV incidence and/or prevalence rates when an intervention component includes cash transfers relative to combination types (structural + behavioral). In 11 of the 22 studies that examined HIV incidence as an outcome, only one structural intervention decreased HIV incidence/prevalence [45]. In this structural intervention of cash transfers for school attendance, they observed a 1.2% HIV prevalence rate in the intervention group (aOR 0.36, 95% CI 0.14–0.91) versus 3.0% in the control group at the 18-month follow-up [45]. However, this finding is subject to scrutiny because, as noted earlier, there was no baseline data on HIV incidence due to testing resources—even though the baseline intervention and control groups were randomized, balanced on multiple other characteristics, and likely balanced in terms of HIV prevalence.

Structural interventions, especially those that provide school-based cash transfers, have been noted to have significant impacts on HIV incidence and prevalence because they are hypothesized to address upstream factors such as poverty [58], which drives risky behavior. Some other pathways that have been hypothesized include school attendance or education as a social "vaccine" that helps expose girls to age-concordant sexual partners who are both less likely to be HIV infected themselves, and less likely to have financial or other resources that are frequently the basis for AGYW to engage in coerced, unprotected, transactional sex [59]. Consistent with this finding are studies demonstrating that education decreases pregnancy rates through decreased sexual behaviors [53]. These upstream factors are important to consider when intervening to decrease HIV rates among AGYW in Eastern and Southern Africa.

One important finding is that the conditional cash transfer intervention conducted by Baird et al. had a significant impact on HIV prevalence, as well as some self-reported behaviors including frequency of recent sexual encounters [45]. In this study, the intervention group was less likely to report having partners older than 25 years of age, and less likely to report having had sex in the past week with at least one partner; however, the study found no significant differences in condom use. Given this intervention was school based, it could further support the use of schools as a "social vaccine." This suggests that having younger sexual partners may be one factor operating in cash transfer interventions to decrease young girls' exposure to HIV—regardless of whether condom use increased.

Evidence on the impact of interventions on HIV incidence was limited by 11 studies that did not include HIV biomarkers, but instead had behavioral outcomes and or were underpowered for this outcome [49, 53]. Wide variation in the elements of the interventions and designs of these studies—including suboptimal statistical power—may explain the lack of impact of combined interventions on HIV incidence. This finding on variation in HIV interventions has been identified in a previous systematic review [60]. One other explanation for this attenuated impact of interventions on HIV is lack of age aggregated data. For example, one behavioral intervention that has had an impact on HIV incidence was among eliminated studies because mean age of the participants was greater than 25 yet it included participants younger than 25 [61]. Given the known risk for HIV in this population of AGYW, future research could benefit from age and gender aggregated data and analysis.

Similarly, findings on risky sexual behaviors remain mixed. For example, condom use was measured in 21 of 22 studies and was impact by two behavioral [38, 54], one structural [43], and one combined intervention [51]. These results indicate that all three types of interventions have the potential to improve condom use in this population. One key finding that applies to this outcome and other risky sexual behaviors is that measures were inconsistent across studies. For example, condom use was measured as number of acts of unprotected vaginal intercourse, number of unprotected sex acts in the last three months, condom use in the last six months, condom use at last intercourse, and consistent condom use (Table 4). Lack of standardized measures in HIV interventions is not new and has been discussed in a previous systematic review [62]. These variations in measures might explain lack of consistent impact of interventions on these kinds of outcomes.

One other explanation for these mixed findings on risky sexual behavior is underreporting of sexual behavior due to social desirability bias. Researchers have found

Table 4 Impact of interventions on outcomes

Intervention type	First author, year	Risky sexual behaviors (RSB) measured	Impact on RSB	HIV	Impact on HIV
Behavioral	Fitzgerald, 1999 [37]	Ever had sex > 2 sexual partners Wsed a condom	NS for all	N/A	N/A
Behavioral	Agha, 2004 [35]	Multiple regular sexual partners Casual sexual partner, Multiple casual partners during the past 3 months Condom use with a regular or casual partner,	Reduction in multiple regular partnerships from 1 week post intervention to 6 months post-intervention (p = .04) [AOR not reported)	N/A	N/A
Behavioral	Erulkar, 2004 [40]	Condom use at last sex Number of sexual partners in the last 3 years	NS for all	N/A	N/A
Behavioral	Jewkes, 2008 [39]	Number of partners Transactional sex with a casual partner Correct condom use at last sex Any casual partner	NS for all	HIV	NS
Behavioral	Smith, 2008 [34]	Condom use Delayed onset of sexual debut	NS for all	N/A	N/A
Behavioral	Ybarra, 2013 [36]	Unprotected sex	NS, however promising trends in Intervention + booster group (5%) reported unprotected sex as those in the control group (21%; aOR = 0.15, p = 0.09	N/A	N/A
Behavioral	Wingwood, 2013 [41]	Number of unprotected sexual acts Preference for dry sex Consistent condom use	Number of acts of unprotected vaginal intercourse (adjusted mean difference = 1.06; p = .02),	HIV	NS
Behavioral	Harrison, 2016 [33]	Condom use at last sexual intercourse among sexually active participants	NS	N/A	N/A
Behavioral	Thurman, 2016 [38]	Sexual Debut Consistent condom use in the past six months Risky sexual-partnership Multiple sexual partners Transactional sex	Condom use (β = 1.21, standard error = .52, p = .02 and β = 1.37, SE = .57, p = .02, respectively) NS for other outcomes	N/A	N/A
Structural	Baird, 2012 [45]	Had sex at least once per week Had sexual partners older than 25 years Sexual debut Consistent condom use	Had sex once a week (aOR 0.46, 95% CI (0.26,0.82) Had sexual partners older than 25 yrs (aOR 0.21, 95% CI (0.07, 0.62) NS for sexual debut or consistent condom use	HIV	For baseline school girls Significant at 18 month follow-up (adjusted OR 0.36, 95% CI 0.14–0.91)
Structural	Handa, 2014 [43]	Sexual Debut Condom use Transactional sex Multiple sexual partners -two or more partners in 12 months	Sexual debut (AOR 0.58, 95% CI 0.39, 0.86, p = .006) NS for condom use and TS 2 + partners in last 12 months (AOR 0.20, 95% CI 0.04, 0.94, p = 0.04)	N/A	N/A
Structural	Hallfors, 2015 [44]	Sexual debut	NS	HIV	NS

Table 4 (continued)

Intervention type	First author, year	Risky sexual behaviors (RSB) measured	Impact on RSB	HIV	Impact on HIV
Structural	Pettifor, 2016 [43]	Age of sexual debut Transactional sex Number of unprotected sex in the past 3 months Age difference	Condom use [RR 0·81 (0·67 to 1·0)] NS for transactional sex, Age difference of partners, sexual debut	HIV	NS
Structural	Beauclair, 2018 [46]	Age difference Condom use Relationship duration (continuous, one-week increments)	NS for all	N/A	N/A
Combined	Agha, 2002 [47]	Condom use Multiple sexual partners	NS for all	N/A	N/A
Combined	Pronyk, 2006 [50]	Sexual debut > 1 partner in past 12 months, Unprotected sex at last intercourse with non-spouse	NS for all	HIV	HIV incidence *Cohort 3 only* (adjusted risk ratio 1.06, 0.66–1.69);
Combined	Ross, 2007 [48]	Sexual debut More than 1 partner in past 12 months Condoms last sex	NS for all	HIV	NS
Combined	Cowan, 2010 [49]	Ever had sex Age of sexual debut < 17 Two or more lifetime partners Two or more partners in last 12 months Condom use at last sex	NS for all	HIV	Biological assessment of HIV (AOR 1.15, 95% CI 0.81, 1.64) and HSV-2 (AOR: 1.24, 95% CI 0.93, 1.65);
Combined	Doyle, 2011 [56]	Age at first sex < 16 years > 2 lifetime sexual partners > 1 partner in last 12 months Used a condom at last sex in past 12 months Used a condom at last sex in past 12 months w/non regular partner > 1 partner in same time period last 12 months > 1 partner in past 4 wks	NS for all	HIV	Biological assessment of HIV (aPR 1.07, 95% CI 0.68, 1.67) and HSV-2 (aPR 0.96, 95% CI 0.87, 1.05)
Combined	Jewkes, 2014 [52]	Condom use at last sex Transactional sex in the last month	NS for condom use at last sex (p = .18) or transactional sex in the last month (p = .25)	N/A	N/A
Combined	Dunbar, 2014 [51]	Transactional sex Condom use with current partner	Transactional sex decreased in intervention group [OR0.64, 95% CI (0.50, 0.83)] Likelihood of using a condom with current partner increased for in intervention group [OR1.79, 95% CI (1.23, 2.62)]	HIV	NS

Table 4 (continued)

Intervention type	First author, year	Risky sexual behaviors (RSB) measured	Impact on RSB	HIV	Impact on HIV
Combined	Duflo, 2015 [53]	Ever had sex Abstinence Reports condom use Age of oldest partner Age at first sex Condom use at last sex	NS for all	HIV	Insufficient power to see differences in HIV

NS not significant, *N/A* not measured in the study, *OR* odds ratio, *AOR* adjusted odds ratio, *RR* risk ratio, *ARR* adjusted risk ratio, *CI* confidence interval, *PR* prevalence ratio, *APR* adjusted prevalence ratio

inconsistencies in self-reported behaviors when different interviewing modes were used [63], with audio computer assisted self-interviewing providing more accurate self-reports of risky sexual behaviors when confirmed with biomarkers such as curable STIs [64]. To address this issue, scholars have recommended the use of biomarkers to help improve measurement to better assess the impact of HIV interventions [65, 66]. Our findings in this review further support the need to use biomarkers of either HIV directly or using curable STIs as proxies when risky sexual behaviors are measured.

Nonetheless, transactional sex—a behavior that is highly linked to HIV in this population—was only measured in six of 22 studies and impacted by one combined intervention which provided vocational training program components that increased the probability that AGYW could earn their own money [51]. This finding is consistent with previous studies where economic factors, such as lack of basic needs and lack of money to buy personal items, increases transactional sex among young women in Sub-Saharan Africa; thus, addressing these factors can help reduce risky behaviors such as transactional sex [67, 68].

Strengths and Limitations

Despite low risk for bias in studies in this review, there are some limitations. The significant variability in the interventions made it difficult to generate direct comparisons between the study findings which were categorized by intervention type (behavioral, structural, or combined). A second limitation was the diverse samples across studies. Another limitation was the variability in study follow-up periods across studies, making it difficult to accurately assess the sustainability of program impacts. Each of these limitations decreases the generalizability of the results. Given the relatively rigorous designs used in the studies, however, the variability of intervention approaches and components afforded the opportunity to identify those that may have greater impact potential for future research.

Implications for Future Research

Going forward, replicating interventions with similar designs to allow for evaluation of effectiveness in different countries may help to address the significant variability in interventions noted in this review. For instance, two similar interventions included in this review were conducted in South Africa and Malawi and they allow us to compare effectiveness in the two countries with similar target populations [45, 55]. In addition, consensus building and prioritization of the type of interventions that are most effective will permit better

designs with more precise elements and endpoints. As noted in the review, the reviewers were often left to discern the intervention type while categorizing the data because the authors did not explicitly state the intervention type or what was done; even studies that included two different interventions did not differentiate between behavioral and structural.

Two important strategies, if implemented, could advance the field of HIV prevention among AGYW: (1) scientific consensus on what distinguishes an intervention as "behavioral" vs. structural" and a set of guidelines on which elements to report and endpoints to measure, and (2) guidelines similar to the Consolidated Standards of Reporting Trials (CONSORT) [69] or STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) used with other types of studies applied to HIV intervention reporting [70]. Each of these steps are essential in aiding the research community in comparing HIV interventions and their relative efficacy.

A final strategy that could help refine HIV interventions by identifying key active components that are impactful in changing the current HIV trajectory among AGYW is the Multiphase Optimization Strategy (MOST) [71]. The MOST method guides researchers by providing a framework to identify how each component works relative to the outcome and how components function together interactively. Identifying these key active ingredients in intervention studies will allow for effective replication and scaling and thus move the field closer to tackling the HIV burden. Finally, future research could improve the state of the science in HIV research by use of reliable biomarkers in conjunction with self-reported risky sexual behaviors because biomarkers are less subject to social desirability.

Conclusion

Findings from this systematic review offer limited evidence to suggest that structural interventions, as a whole, and regardless of intervention components, have the potential to decrease HIV incidence and or prevalence rates. Evidence suggests that all types of interventions can help improve condom use in this population. There was also limited evidence that combined interventions, especially those with components that address upstream factors such as socioeconomic factors, were more effective than behavioral interventions at decreasing risky sexual behaviors such as transactional sex. AGYW are a population in critical need of effective HIV prevention. Further research is needed to build consensus, reporting standards, and rigorous evaluation methods for behavioral, structural, and combination interventions.

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Author contributions CM developed the idea, developed search terms, extracted data, and wrote the manuscript. SK provided critical feedback on the initial development of the idea, read all manuscripts and provided in depth feedback. MG reviewed articles, extracted data, and provided critical feedback. AP provided initial guidance on HIV intervention research and gaps reviewed and provided critical feedback on manuscript. JW provided feedback on manuscript helped shape the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest The authors declare they have no competing interests.

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