The effects of the Determined, Resilient, Empowered, AIDS-free, Mentored, and Safe (DREAMS) program on HIV incidence and other health-related outcomes among adolescent girls and young women: a systematic review and meta-analysis

Marie-Claude C. Lavoie,[a,b,c,*] Natalia Blanco,[a,b] Taylor Lascko,[a,b] Caitlin Baumhart,[a,b] Jos Verbeek,[d,l] Kirsten Stoebenau,[e] Cassidy W. Claassen,[a,b,f] Linah K. Mwango,[g] Brianna Lindsay,[a,b] Ndwapi Ndwapi,[h] Caroline Ngeno,[i] Emily Koech,[j] Emilie Ludeman,[k] Man Charurat,[a,b,c,l] and Kristen A. Stafford[a,b,c]

[a]Center for International Health, Education, and Biosecurity, Institute of Human Virology, University of Maryland School of Medicine, Baltimore, MD, USA
[b]Institute of Human Virology, University of Maryland School of Medicine, Baltimore, MD, USA
[c]Division of Global Health Sciences, Department of Epidemiology and Public Health, University of Maryland School of Medicine, Baltimore, MD, USA
[d]Amsterdam University Medical Centers, Cochrane Work, the Netherlands
[e]Department of Behavioral and Community Health, University of Maryland School of Public Health, College Park, MD, USA
[f]Division of Infectious Diseases, Department of Medicine, University of Maryland School of Medicine, Baltimore, MD, USA
[g]Ciheb-Zambia, Lusaka, Zambia
[h]Bummhi, Gaborone, Botswana
[i]Center for International Health, Education, and Biosecurity, Maryland Global Initiatives Corporation (MGIC), An Affiliate of the University of Maryland Baltimore, Nairobi, Kenya
[j]Ciheb-Kenya, Nairobi, Kenya
[k]Health Sciences and Human Services Library, University of Maryland, Baltimore, MD, USA

Summary

Background In sub-Saharan Africa, adolescent girls and young women are twice as likely to be living with HIV as their male counterparts. This systematic review assesses the impact of the Determined, Resilient, Empowered, AIDS-free, Mentored, and Safe (DREAMS) program on health-related outcomes, access to services, sexual risk behaviors, and HIV knowledge.

Methods We searched different databases and conference abstracts from January 2014 to April 2024. We included studies where DREAMS was the primary intervention. We completed meta-analyses using random effects models. Risk of bias and certainty of evidence were assessed. PROSPERO: CRD42022340294.

Findings Seven unique studies were included. The incidence rate ratio (IRR) of HIV incidence was 0.74 (95% CI: 0.63–0.87, 1 study) in DREAMS compared to the comparison group. For self-report of sexually transmitted infections (STI) symptoms, the IRR was 0.84 (95% CI: 0.71–0.98, 1 study). The odds ratio (OR) for awareness of HIV status was 2.34 (95% CI: 1.23–4.44, 1 study). The risk ratio for HIV testing was 1.17 (95% CI: 1.05–1.30, 1 study). For condom use, the OR was 1.22 (95% CI: 0.86–1.72, 1 study). For transactional sex, the OR was 0.99 (95% CI: 0.69–1.41). The OR for the number of sexual partners was 0.74 (95% CI: 0.60–0.91, 1 study).

Interpretation The evidence suggests that DREAMS results in a reduction in HIV incidence and STI symptoms. DREAMS may result in a slight increase in the uptake of HIV testing and a large increase in awareness of HIV status. DREAMS may also reduce the number of sexual partners. Developing a unified and granular evaluation framework would be beneficial in advancing research and generating evidence on DREAMS.

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*Corresponding author. W Lombard St, Baltimore, 21201, USA.
E-mail addresses: mlavoie@ihv.umaryland.edu (M.-C.C. Lavoie), nblanco@ihv.umaryland.edu (N. Blanco), tlascko@ihv.umaryland.edu (T. Lascko), cbaumhart@ihv.umaryland.edu (C. Baumhart), jos@jverbeek.eu (J. Verbeek), kstoeben@umd.edu (K. Stoebenau), cclaassen@ihv.umaryland.edu (C.W. Claassen), lkmwango@cihebzambia.org (L.K. Mwango), brianna.lindsay@som.umaryland.edu (B. Lindsay), nndwapi@bummhi.org (N. Ndwapi), cngeno@mgic.umaryland.edu (C. Ngeno), ekoech@mgic.umaryland.edu (E. Koech), eludeman@hshsl.umaryland.edu (E. Ludeman), mcharurat@ihv.umaryland.edu (M. Charurat), kstafford@ihv.umaryland.edu (K.A. Stafford).
[l]Full professor.

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Research in context

Evidence before this study

In sub-Saharan Africa, adolescent girls and young women (AGYW) are twice as likely to be living with HIV as their male counterparts. In response, the United States President's Emergency Plan for AIDS Relief (PEPFAR) launched the Determined, Resilient, Empowered, AIDS-free, Mentored, and Safe (DREAMS), a comprehensive, multi-layered HIV prevention program. DREAMS, a public-private partnership with a multi-sectoral approach grounded in a theoretical framework, is intended to include layering of evidence-based interventions to prevent HIV acquisition among AGYW. We searched the MEDLINE (PubMed), Embase, Cochrane CENTRAL, CINAHL, and PsycINFO databases from January 2014 to April 2024 without restriction for the study design. We also searched conference proceedings of AIDS, the International AIDS Society (IAS), the International Conference on AIDS, Sexually Transmitted Infections in Africa (ICASA), and the Conference on Retroviruses and Opportunistic Infections (CROI). We found no systematic review or meta-analysis on the effects of DREAMS on health-related outcomes.

Added value of this study

This systematic review and meta-analysis is the first on the effects of DREAMS on health-related outcomes, access to health services, and sexual risk behaviors.

Implications of all the available evidence

Evidence suggests that DREAMS results in a reduction in HIV incidence and may reduce sexually transmitted infections (STI). DREAMS may result in a large increase in awareness of HIV status and an increase in the uptake of HIV testing. DREAMS may also reduce the number of lifetime sexual partners. The evidence is very uncertain about the effects of DREAMS on condom use and transactional sex. PrEP-related outcomes were reported seldomly and inconsistently despite being a highly effective HIV preventive measure. The certainty of evidence varied between very low and low; however, the direction of the effect was similar across most outcomes. Accompanying DREAMS with an evaluation framework would enhance methodological approaches to assess DREAMS and facilitate evidence synthesis to guide future implementation. Future robust research is needed to assess the effects of DREAMS on health-related outcomes.

Introduction

In 2022, 63% of all new HIV infections in sub-Saharan Africa were among women and girls, compared to 30% in all other geographical regions.[1] Adolescent girls and young women (AGYW) are twice as likely to be living with HIV as their male counterparts.[2] This disparity arises from several factors stemming from social and gender inequalities.[3,4] In response, the United States President's Emergency Plan for AIDS Relief (PEPFAR) developed the Determined, Resilient, Empowered, AIDS-free, Mentored, and Safe (DREAMS) initiative, a comprehensive, multi-layered HIV prevention program.[5] DREAMS is now implemented across 15 countries in sub-Saharan Africa.[6]

DREAMS is a large-scale HIV prevention program implemented in real-world settings supported by a public-private partnership and a multi-sectoral approach. DREAMS is grounded in a theory of behavior change directed to societal, structural, and individual factors contributing to HIV risk among AGYW.[7] The program includes layering of evidence-based interventions across the health, education, and social welfare sectors to comprehensively address HIV risk factors among AGYW.[7,8] DREAMS addresses individual, community, and structural factors and consists of four core packages of interventions, which include: (1) empowering AGYW and reducing their HIV risk through condom promotion and provision, pre-exposure prophylaxis (PrEP), post-violence care, HIV testing, family planning services, and social asset building (e.g., relationships with peers and adults); (2) economically strengthening families and AGYW through parenting/caregiving programs, and economic empowerment activities and educational subsidies; (3) mobilizing communities for change through school-based HIV and violence prevention and community mobilization/norms change; and (4) reducing risk of sexual partners of AGYW through HIV testing, treatment, and voluntary medical male circumcision.[7] The DREAMS theory of change postulates that implementing multiple interventions from the DREAMS core package will act synergistically to produce the program's outcome and impact.[7] The guiding principles of DREAMS include layering these core intervention components, optimizing the implementation quality through training of program implementers and healthcare workers, including training on non-judgmental and adolescent-friendly services, and using evidence-based programs.

Although DREAMS has been implemented for nearly ten years,[6] no systematic review has been completed. Given the widespread implementation of the DREAMS program across sub-Saharan Africa as an integral part of PEPFAR, a systematic assessment of its evidence from real-world evaluations can inform the future implementation and sustainability of this large-scale program. This systematic review and meta-analysis assesses the effects of DREAMS program on health-related outcomes, access to services, sexual risk behaviors, and HIV knowledge among AGYW in real-world settings.

Methods

This review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement. The protocol for this systematic review and meta-analysis was published in PROSPERO (PROSPERO 2022 CRD42022340294. Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42022340294).

Search strategy and selection criteria

We searched the MEDLINE (PubMed), Embase, Cochrane CENTRAL, CINAHL, and PsycINFO databases, and conference proceedings of AIDS, the International AIDS Society (IAS), the International Conference on AIDS, Sexually Transmitted Infections in Africa (ICASA), and the Conference on Retroviruses and Opportunistic Infections (CROI). Keywords and database-specific terminology (e.g., MeSH) were used to capture the concepts of DREAMS intervention and health-related outcomes (Supplement S1). The search included papers published from January 2014 to April 2024, as DREAMS was launched 2014.[6] There were no language restrictions. We additionally searched the reference lists of the included papers.

We included studies where DREAMS was the primary intervention [Intervention (I)]. We referred to "cohorts" when the concurrent comparison groups included participants who were not exposed or were not actively participating in DREAMS. In contrast, we referred to an "uncontrolled before and after" (UCBA) design, also known as pre- and post-design, for studies comparing outcomes before and after the implementation of DREAMS [Comparison (C)]. We included health-related outcomes such as HIV incidence, health services uptake and access such as HIV testing, sexual risk behaviors (i.e., transactional sex), and HIV knowledge [Outcomes (O)] in adolescent girls and young women [Population (P)]. We did not expect to find randomized controlled trials (RCTs) as DREAMS is a longstanding program and was launched as a large HIV prevention program in countries with high HIV prevalence. Therefore, we anticipated identifying real-world evaluations using observational or quasi-experimental design aimed to provide real-world evidence. We excluded publications reporting parental skills, community mobilization, educational strengthening, and economic strengthening outcomes.

The final list of records was de-duplicated electronically using Covidence.[9] For all included publications, at least two reviewers completed the study/reports selection; the appraisal process included reading the title and abstract to determine if the references needed further review (denoted by "yes", "no", or "unclear"). At least two reviewers (NB, MCL, TL, CB) independently read the full texts meeting the inclusion criteria. They classified each as "yes", "no", or "unclear" using a standardized template. Reports classified as "no" were excluded. All reviewers reached a consensus to determine eligibility for titles categorized as "unclear" by at least one of the two reviewers. Using a standardized data extraction form, at least two reviewers extracted the following data elements from the included reports: authors, year of publication, type of publication, country, aims, study design, setting, population, DREAMS components/interventions, comparison group, outcomes, sample size, follow up time, statistical analysis, data source(s), and results. The two review authors resolved differences through discussion. We contacted the study authors when data were missing.

Data analysis

In this systematic review, we synthesized data from comparable studies based on the PICO elements (population, intervention, comparison group, and outcomes). In the meta-analysis, we included outcomes reported in (1) at least two unique studies or (2) from one study if it included data from two or more countries or other distinct geographical areas with similar PICO across settings. We separated forest plots by study design (cohort vs UCBA). For the outcomes not meeting these criteria, we performed a narrative synthesis.

For studies adjusting for similar confounders and including similar populations, we pooled the adjusted estimates in the meta-analysis as recommended.[10] For studies not meeting those criteria, we either used descriptive analysis or performed meta-analysis separately. We completed meta-analyses using random effects models. We calculated pooled estimates and 95% confidence intervals (CIs). Statistical heterogeneity was evaluated using the Tau squared, the I squared statistic (I^2 larger than 50% was considered heterogeneous), and Q tests. When the data were available, we stratified by age groups as HIV incidence and prevalence are higher among older AGYW compared to younger adolescent girls.[11–13] We also used the Q-test to evaluate subgroup differences between age groups categories [adolescent girls ranging from 10 to 19 years of age compared to young women ranging from 18 to 24 years of age]. We performed the meta-analysis using the Comprehensive Meta-analysis software (Englewood, NJ) and STATA (College Station, Texas). Each included report was assessed for potential risk of bias using the Newcastle–Ottawa scale for observational studies.[14] We assessed the

certainty of the evidence of the included reports using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) using the GRADEpro software.[15] We used the GRADE domains of risk of bias, indirectness, inconsistency, imprecision, publication bias, large effects, plausible confounding, and dose-response gradient to downgrade or upgrade starting from low because all studies were observational.[16] For pooled outcomes, which included cohort and UCBA studies, we reported on the certainty of evidence (GRADE) for the study design with the lower risk of bias. When the outcomes from different study designs had an equivalent risk of bias, we selected the cohort study design over the uncontrolled before-and-after design for the certainty of evidence.

Using terminology from GRADE for the meta-analysis, we use the words 'probably' or 'the evidence suggests' to indicate moderate-certainty evidence, 'may/maybe' for low-certainty evidence, and 'uncertain' for very low-certainty evidence.

Role of the funding source

There was no funding source for this study.

Results

The search yielded 498 records, including one identified by reviewing the list of references for the included studies. After removing 172 duplicates, we reviewed 327 titles and abstracts and selected 35 for full-text review. Reports were excluded (Supplement Table S2) due to ineligible study design or methods (n = 15), intervention (n = 3), study outcomes (n = 3), population (n = 1), time period (n = 1), or duplicate (n = 2) (Fig. 1). We identified seven studies (reported in 10 publications) meeting our inclusion criteria.

Table 1 summarizes the characteristics of each included publication. There were no RCTs or cluster RCTs, as expected, as DREAMS was launched simultaneously across countries as part of a comprehensive HIV prevention program. A total of 7 studies (10 publications) were included. An independent DREAMS Impact Evaluation, a multi-institution collaboration, included six reports.[17] Among them, we identified four reports with similar study populations and methods, and two with distinct populations and methodological approaches. Chabata et al. included young women who sell sex compared to AGYW from the general population included in the other reports.[22] Birdthistle et al. reported on outcomes measured before-and-after the DREAMS implementation with no concurrent comparison group, referred to as uncontrolled before and after (UCBA),[23] while the remaining studies of the DREAMS Impact Evaluation used a cohort design with a concurrent exposed and non-exposed group. Based on these differences, we have three unique studies (six publications) related to the DREAMS Impact Evaluation Protocol.[17] Based on this classification, we included three studies with a prospective cohort design and four UCBA studies (Table 1). The cohorts included participants exposed and non-exposed to DREAMS (definitions varied across studies on exposure). In contrast, the UCBA included an analysis comparing data from the pre-implementation of DREAMS to post-implementation without a concurrent comparison group. Among the seven, four studies were conducted in a single country while the remaining three included multi-country studies.

As reported earlier, DREAMS includes four core packages.[7] The level of description of DREAMS varied across studies. Four studies refer to DREAMS or its core package in general terms.[23,25–27] Three studies included additional information on the interventions provided within each component (e.g., social asset building, parenting/caregiver program, school-based HIV prevention).[17,22,24] Five studies mentioned providing PrEP within the DREAMS program (Supplement Table S3).[17,22,24,25]

In the DREAMS Impact Evaluation study[17] (4 publications[18–21]), participants were considered to be exposed to DREAMS if they reported being invited to participate in DREAMS (Table 1). Three studies defined DREAMS exposure as residing in a geographical area where DREAMS is offered,[22,23,26] two studies used enrollment in DREAMS,[24,27] and one study did not specify how exposure to DREAMS was defined.[25]

We used the Newcastle–Ottawa tool to assess the risk of bias in observational studies.[14] We assessed the risk of bias of each publication and eligible outcome. Across 27 results reported, the total score varied from 3 to 9 with an average of 7 out of 9, the highest score indicates a lower risk of bias (Supplement S4). Supplement Table S5 summarizes the definitions of outcomes used across the included publications.

Health-related outcomes

HIV incidence

Cohort. We did not perform a meta-analysis for the cohort studies due to differences in the included population (young women who sell sex compared to AGYW from the general population).[20,22] Chabata et al. reported an adjusted rate ratio for HIV incidence of 0.68 (95% CI: 0.40–1.19, 1017 participants) among young women who sell sex who reside in DREAMS districts compared to those living in non-DREAMS districts in Zimbabwe.[22] In South Africa, the DREAMS Impact evaluation reported an adjusted HIV incidence rate ratio of 0.83 (95% CI: 0.46–1.52, 1957 participants) in DREAMS compared to the comparison group.[20]

UCBA. One study with two countries (Kenya and South Africa) reported on HIV incidence.[23] In the meta-analysis using adjusted estimates, the pooled rate ratio for HIV incidence was 0.74 (95% CI: 0.63–0.87, 1 study, I^2 = 0%, consistency across locations, 29,596 participants, low certainty of evidence) in DREAMS compared

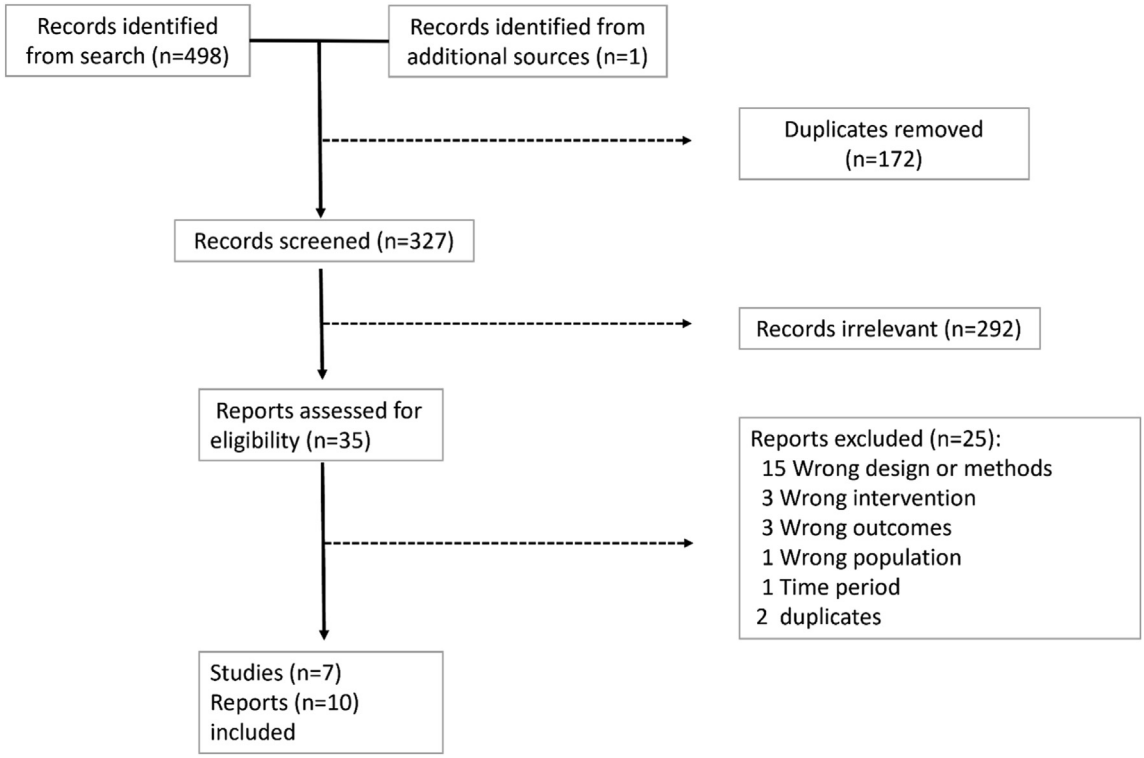

Fig. 1: **Study diagram**.

to the comparison group. There was no difference between age groups (p = 0.15) (Fig. 2).

Sexually transmitted infections (STI)

Cohort. One study from South Africa reported on the adjusted incidence of herpes simplex virus type 2 (HSV-2).[20] In this single-country study, the adjusted incidence rate ratio was 0.96 (95% CI: 0.76–1.23, 1957 participants) when comparing DREAMS to the comparison group.

UCBA. One study included data from three countries (Kenya, Malawi, and Zambia).[24] In the meta-analysis using adjusted estimates, the pooled incidence rate ratio was 0.84 (95% CI: 0.71–0.98, 1 study, I^2 = 45%, consistency across locations, 2875 participants, low certainty of evidence) in DREAMS compared to the comparison group (Fig. 3). There was no difference between age groups (p = 0.280).

Health services (uptake or access)

Awareness of HIV status

Cohort. In the meta-analysis using adjusted estimates, the pooled odds ratio for self-reported awareness of HIV status was 2.34 (95% CI: 1.23–4.44, 1 study, I^2 = 93%, heterogeneity across locations, 3860 participants, low certainty of evidence) in DREAMS compared to the comparison group[18] (Fig. 4). There was no significant difference in effect size between the two age groups (p = 0.43).

Chabata et al. was not included in this pooled analysis as the study population included young women who sell sex.[22] In this study, the adjusted odds ratio for awareness of HIV status was 1.22 (95% CI: 0.90–1.66) in DREAMS compared to the comparison group.

Uptake of HIV testing services

Cohort. In the meta-analysis using crude estimates, which included one study reporting on three distinct geographical areas,[19] the pooled odds ratio for HIV testing uptake was 2.75 (95% CI: 0.99–7.63, 1 study, I^2 = 87%, heterogeneity across locations, 2602 participants) in DREAMS compared to the comparison group (Fig. 5A). There was no difference between age groups (p = 0.42).

Mulwa et al. reported that 79% of those newly invited to DREAMS in 2018 received HIV testing services compared to 58% among those never invited to DREAMS (descriptive analysis, no measure of association provided).[21] Mulwa et al., also from the DREAMS Impact Evaluation, was not included in the meta-analysis due to potential overlap in the study population.

UCBA. One study reported data from three countries (Kenya, Malawi, and Zambia).[24] In the meta-analysis using adjusted estimates, the rate ratio for HIV testing

No	Author year	Type of publication	Setting	Study design	Age groups	Definition of participation in DREAMS	Comparison group	Primary data analysis
1	DREAMS Impact Evaluation study[a,17]							
	Floyd 2022[18]	Manuscript	Kenya (Gem and Nairobi) and South Africa (uMkhanyakude)	Prospective cohort	13–22	Self-report of being invited to participate to DREAMS	Self-report of not being invited to participate in DREAMS	Multivariable logistic regression, adjusted first only for age group and area of residence and then for other variables, including education, wealth index, ever had sex, and ever pregnant. The analysis was also conducted within a causal inference framework.
	Gourlay 2022[19]	Manuscript	Kenya (Gem and Nairobi) and South Africa (uMkhanyakude)	Prospective cohort	10–24	Self-report of being invited to participate to DREAMS	Self-report of not being invited to participate in DREAMS	Descriptive analysis across years stratified by setting, age at enrollment, and exposure to DREAMS.
	Mthiyane 2022[20]	Manuscript	South Africa (uMkhanyakude)	Prospective cohort	13–22	Self-report of being invited to participate or participating in DREAMS	Self-report of not being invited to participate or participating in DREAMS	Multivariable logistic regression adjusted for sociodemographic variables, sexual relationship, and migration. Additionally, multivariable Poisson regression model to estimate the incidence rate ratio of HIV incidence comparing AGYW with exposure to DREAMS compared with those without this exposure.
	Mulwa 2021[21]	Manuscript	Kenya (Nairobi)	Prospective cohort	10–14	Self-report of being invited to participate in DREAMS	Self-report of not being invited to participate in DREAMS	Descriptive analysis and multivariate logistic regression (age and site adjusted and fully adjusted).
2	Chabata 2021[b,22]	Manuscript	Zimbabwe	Prospective cohort	18–24	Participants reside in DREAMS districts	Participants reside outside DREAMS districts	Age-adjusted and fully-adjusted (i.e., education, marital status, STI symptoms, number of sexual partners, self-identification as female sex workers, HIV prevalence at enrollment) Poisson Regression.
3	Birdthistle 2021[c,23]	Manuscript	Kenya (Gem) and South Africa (uMkhanyakude)	UCBA[c]	15–24	Participants reside in DREAMS districts who were eligible to participate in DREAMS	Baseline	Poisson regression estimating rate ratios for the effect of calendar period on HIV incidence (overall and by age group). Interrupted time series analysis.
4	Mathur 2022[24]	Manuscript	Kenya, Malawi, Zambia	UCBA	15–24	Enrolled in DREAMS	Baseline	Generalized Estimating Equations with Poisson distribution to examine temporal changes and controlling by site, marital, education and orphanhood status.
5	Tapsoba 2022[25]	Manuscript	Kenya (Kisumu, Homa Bay Counties)	Prospective cohort	18–24	Active in DREAMS at first interview (no definition provided)	Non-active in DREAMS at second interview (no definition provided)	Multivariate Generalized Estimating Equations with logistic distribution. Models were adjusted by county of residence and factors with p value less than 0.1.
6	Tiberio 2020[26]	Abstract	Tanzania	UCBA	15–24	Participants reside in DREAMS districts who were eligible to participate in DREAMS	Baseline	Conditional logistic regression to examine outcome changes from baseline to 12 months.
7	Walubita 2022[27]	Abstract	Zambia	UCBA	10–24	Enrolled in DREAMS	Baseline	Descriptive comparison of the categorical distribution of outcomes before and after the completion of the intervention.

[a]Reports part of the DREAMS Impact Evaluation study conducted among adolescent girls and young women. [b]Study conducted as part of the DREAMS Impact Evaluation study with the study population including young women who sell sex (YWSS) from Zimbabwe. [c]Study conducted as part of the DREAMS Impact Evaluation study. The study design includes uncontrolled before and after within the open cohort study design of the original study.

Table 1: **Characteristics of included publications.**

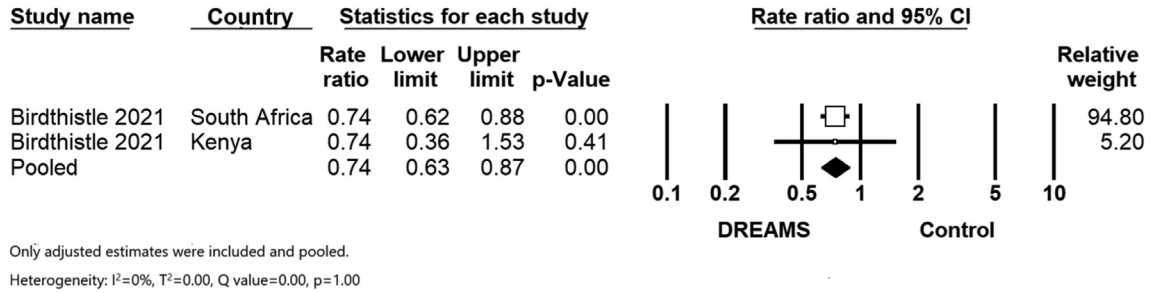

Fig. 2: **HIV incidence forest plot.**

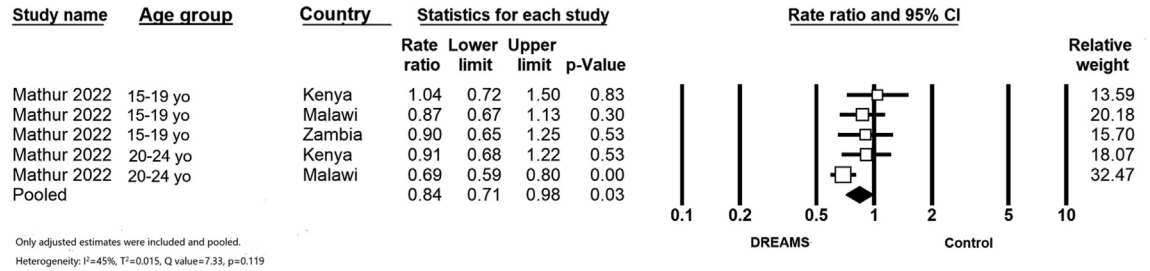

Fig. 3: STI Self-reported symptoms forest plot.

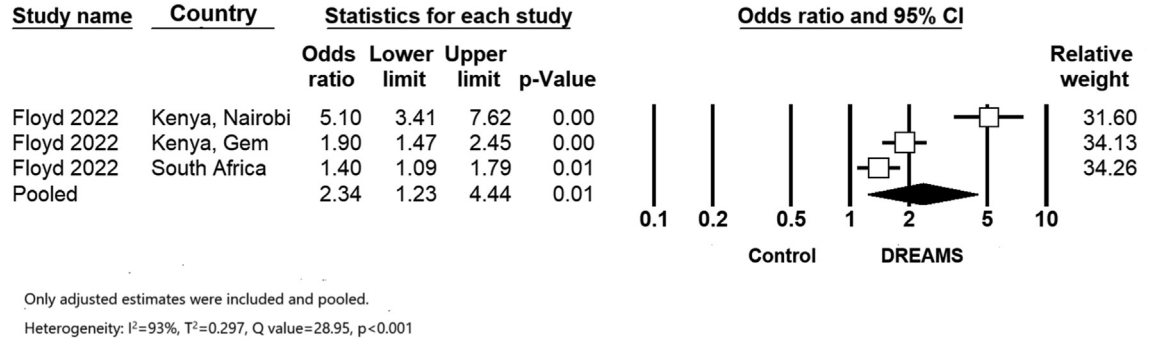

Fig. 4: Awareness of HIV status forest plots.

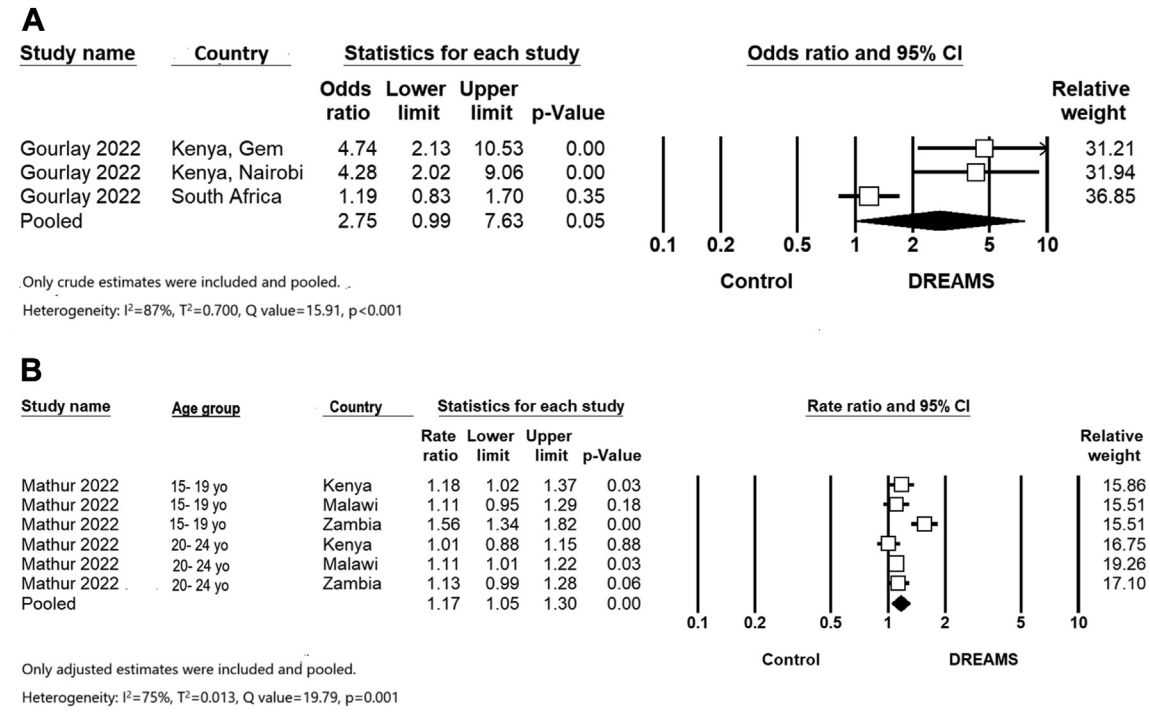

Fig. 5: Uptake of HIV testing forest plot for A) prospective cohorts and B) UCBA.

was 1.17 (95% CI: 1.05–1.30, 1 study, I^2 = 75%, heterogeneity across locations, 2875 participants, low certainty of evidence) in DREAMS compared to the pre-implementation period (Fig. 5B). There was no difference in effect size between age groups (p = 0.16).

PrEP

Due to the heterogeneity of PrEP-related outcomes, we conducted a narrative synthesis. Three studies reported on PrEP-related outcomes.[17,22,25] Chabata et al. reported AGYW residing in DREAMS districts were 63 times more likely to report using PrEP (ever having used PrEP) than those residing outside DREAMS districts [adjusted Odds Ratio (aOR) = 63.8, 95% CI: 19.8–205.9].[22] Tapsoba found that AGYW in Kenya who reported PrEP persistence at three months were nearly four times more likely to be active in the DREAMS program compared to AGYW who did not continue on PrEP (aOR = 3.85, 95% CI: 1.07–13.82). However, only 4.6% of participants had protective tenofovir-diphosphate levels, indicating low adherence to PrEP.[25] Within the Evaluation Impact Study,[17] Floyd et al. reported ever use of PrEP between 10% and 20% among older AGYW in Kenya who were invited to DREAMS (descriptive analysis, no measure of association provided).[18] Gourlay et al. reported low PrEP uptake among those invited to DREAMS (9% in Gem, Kenya; 26% in Nairobi, Kenya; and <1% in uMkhanyakude, South Africa).[19]

Sexual risk behaviors and HIV knowledge

Condom use

Cohort. In the meta-analysis using adjusted estimates, which included three geographical areas reported as part of the DREAMS Impact Evaluation Study,[18] the pooled odds ratio was 1.22 (95% CI: 0.86–1.72, 1 study, I^2 = 22%, consistency across locations, 1395 participants, very low certainty of evidence) in DREAMS compared to the comparison group (Fig. 6A). There was no difference between age groups (p = 0.17).

Separately, Chabata et al. reported that women who sell sex exposed to DREAMS had an aOR of 1.72 (95% CI: 1.12–2.63) for condom use with clients compared to the comparison group and an aOR of 1.39 (95% CI: 1.02–1.89) with a regular partner.[22]

UCBA. One study reported data from three countries (Kenya, Malawi, and Zambia).[24] In the meta-analysis using adjusted estimates, the rate ratio for condom use was 0.70 (95% CI: 0.59–0.84, 1 study, I^2 = 0%, consistency across locations, 2875 participants) (Fig. 6B) in DREAMS compared to the comparison group. There was no difference between age groups (p = 0.58).

Condom self-efficacy

Tiberio et al. also reported an increase in condom self-efficacy after participating in the DREAMS program (no data included).[26]

Transactional sex

Cohort. In the meta-analysis using adjusted estimates, among DREAMS participants across three geographical areas, the pooled odds ratio for transactional sex was 0.99 (95% CI: 0.69–1.41, 1 study, I^2 = 0%, consistency across locations, 3282 participants, very low certainty of evidence) in DREAMS compared to comparison group.[18] There was no difference between age groups (p = 0.81) (Fig. 7A).

UCBA. One study reported data from three countries (Kenya, Malawi, and Zambia).[24] In the meta-analysis using adjusted estimates, the incidence rate ratio was 1.29 (95% CI: 0.85–1.96, 1 study, I^2 = 50%, consistency across locations, 2875 participants) in DREAMS compared to the pre-implementation of DREAMS (Fig. 7B). There was no difference between age groups (p = 0.64).

Number of lifetime sexual partners

Cohort. In the meta-analysis using adjusted estimates, the pooled odds ratio for the number of sexual partners (<1 vs 2> sexual partners) across three geographical areas was 0.74 (95% CI: 0.60–0.91, 1 study, I^2 = 0%, consistency across locations, 3465 participants, low certainty of evidence) in DREAMS compared to the comparison group.[18] There was no difference between age groups (p = 0.30) (Fig. 8A).

UCBA. One study reported data from three countries (Kenya, Malawi, and Zambia).[24] In the meta-analysis using adjusted estimates, the pooled odds ratio for the number of lifetime sexual partners was 1.01 (95% CI: 0.95–1.07, 1 study, I^2 = 0%, consistency across locations, 2875 participants) in DREAMS compared to the pre-DREAMS implementation period (Fig. 8B). There was no difference between age groups (p = 0.53).

HIV knowledge

UCBA. Walubita et al. observed an increase in HIV knowledge after the implementation of a core DREAMS activity [a 13-week HIV training] (i.e., 82% in the post-intervention compared to 60% in the pre-intervention believed that having multiple sexual partners increases their odds of contracting HIV) across 2392 included participants (descriptive analysis, no measure of association provided).[27]

Certainty of evidence

We started the assessment of the certainty of the evidence at low due to the observational nature of the studies. Studies were further downgraded due to the risk of bias, imprecision, publication bias, and plausible confounding of the estimate or upgraded based on large effect or dose-response gradient (Table 2). Based on GRADE, the certainty of the evidence was

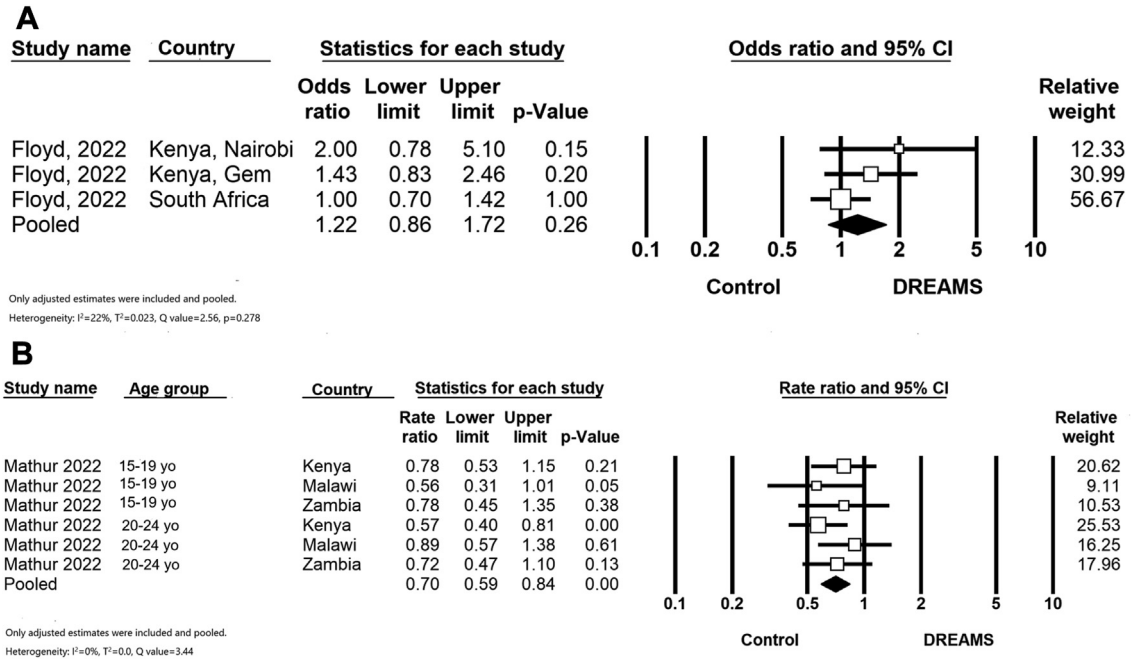

Fig. 6: **Condom use forest plots for A) prospective cohorts and B) UCBA.**

ranked from very low to low for the pooled estimate among cohort or UCBA studies (when cohort studies were not available).

Discussion

In this systematic review, we identified seven unique studies across six African countries. Using the GRADE

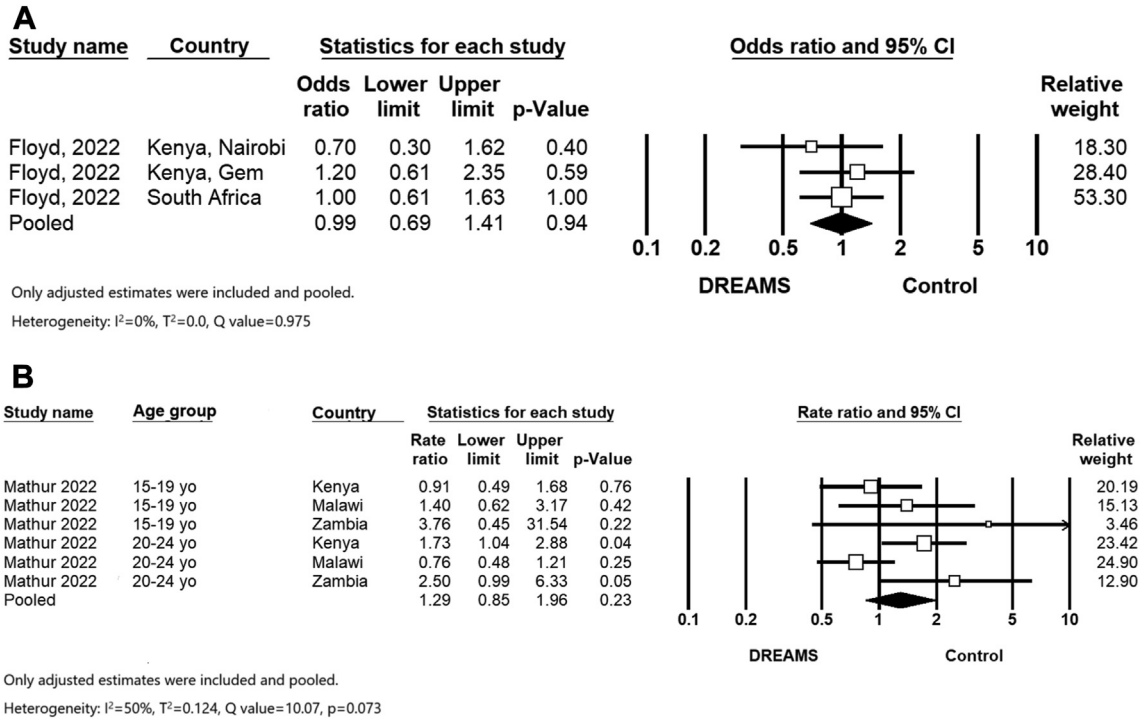

Fig. 7: **Transactional sex forest plots for A) prospective cohorts and B) UCBA.**

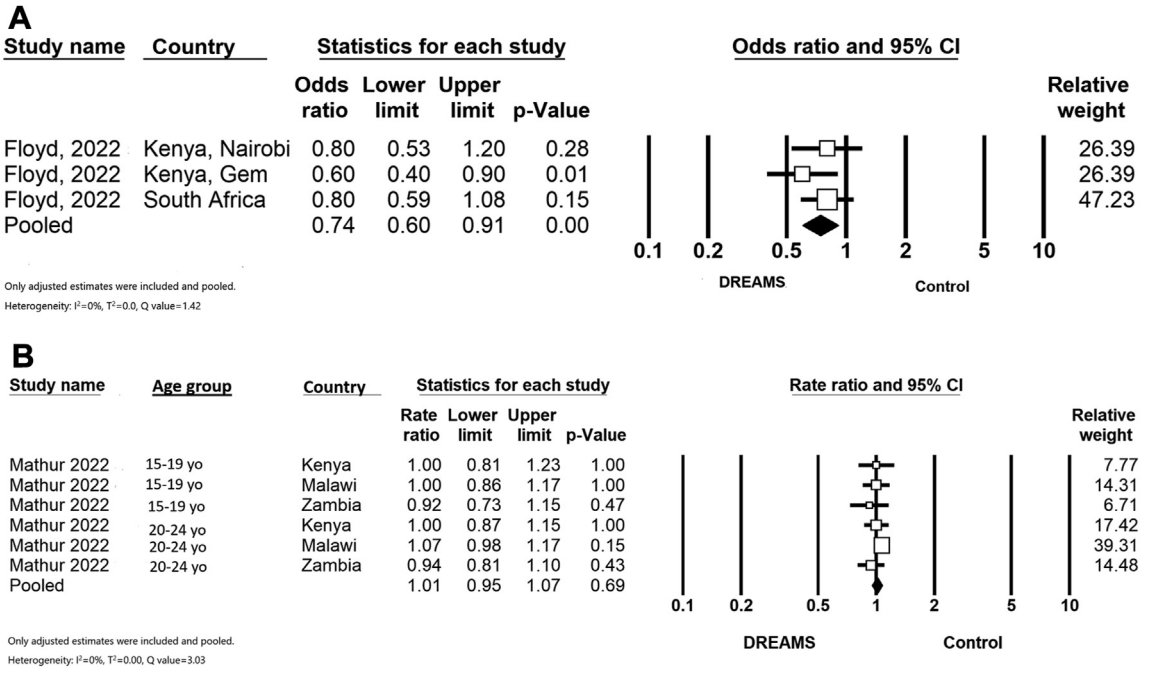

Fig. 8: **Lifetime sexual partners forest plots for A) prospective cohorts and B) UCBA.**

certainty of evidence, we found that for health-related outcomes, DREAMS probably results in a reduction in HIV incidence and may reduce self-report of STI symptoms slightly. For access to health services, DREAMS may result in a slight increase in uptake of HIV testing, and a large increase in awareness of HIV status. For PrEP, we could not perform a meta-analysis due to the heterogeneity of the definition of the outcomes across studies. For sexual risk behaviors, DREAMS may reduce the number of lifetime sexual partners. The evidence is very uncertain about the effects of DREAMS on condom use and transactional sex. These two outcomes are often affected by several factors beyond women's control, including unequal gender norms and social norms towards adolescents' and women's sexuality.[28]

Although no prior systematic reviews have been conducted on DREAMS, other systematic reviews have been conducted on HIV prevention programs. In a systematic review of HIV interventions for young women in sub-Saharan Africa, researchers found that structural interventions, such as cash transfer, were associated with a reduction in HIV incidence.[29] However, a more recent systematic review found that evidence for cash transfer on HIV acquisition remains limited.[30]

Conceptually, DREAMS is well-grounded in a comprehensive theoretical framework.[7] However, opportunities exist to strengthen the evaluation framework and methodological guidance.[8,31] A unified and granular evaluation framework for DREAMS will facilitate evidence synthesis and increase our understanding of the effects of DREAMS. For the study population, most studies used proxy measures to determine exposure to DREAMS, such as participants residing in DREAMS districts or being invited to DREAMS; therefore, the exposed group may include both exposed and non-exposed persons. In addition, a dose-response effect may occur in DREAMS, where AGYW completing more sessions have better outcomes than those participating in fewer sessions/interventions.[32–34] Using the DREAMS list of participants, as previously used,[24,27] could provide evidence on the impact of level of exposure to DREAMS.

For the study outcomes, although DREAMS includes a logic model with program outcomes, a more defined set of outcomes would promote consistency and homogeneity across studies to facilitate comparison and generate evidence. PEPFAR indicators consist of aggregate level measures useful to observe trends and uptake but limit our understanding of assessing DREAMS on specific outcomes and across populations. For the intervention,[27,24,32–34] most studies refer to the DREAMS program without specifying the intervention components offered. Adapting standardized intervention reporting tools for DREAMS, such as the Template for Intervention Description and Replication,[35] could enhance the systematic reporting of DREAMS. This level of specificity would enhance replicability and understanding of the DREAMS core package effects across different settings. This insight could help identify and prioritize effective DREAMS interventions. For instance, our meta-analysis found that DREAMS was

Certainty assessment							No of patients		Effect		Certainty	Importance
No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	DREAMS	Control	Relative (95% CI)	Absolute (95% CI)		
HIV incidence												
1	Non-randomized studies	Not serious	Not serious	Not serious	Not serious	None	12,698 participants	16,898 participants	**Rate ratio 0.74** (0.63–0.87) [HIV Incidence]	–	⨁⨁◯◯ Low	The evidence suggests DREAMS results in a reduction in HIV Incidence.
STI self-reported												
1	Non-randomized studies	Not serious	Not serious	Not serious	Not serious	None	528/2875	637/2875	**Rate ratio 0.84** (0.71–0.98)	–	⨁⨁◯◯ Low	DREAMS may reduce STI self-reported slightly.
Awareness of HIV status												
1	Non-randomized studies	Not serious	Not serious	Not serious	Not serious	None	1575/2248 (70.1%)	960/1612 (59.6%)	**Odds ratio 2.34** (1.23–4.44)	**180 more per 1000** (from 49 more to 272 more)	⨁⨁◯◯ Low	DREAMS may result in a large increase in awareness of HIV status.
Uptake of HIV testing services												
1	Non-randomized studies	Not serious	Not serious	Not serious	Not serious	None	2534/2875	2196/2875	**Rate ratio 1.17** (1.05–1.30)	–	⨁⨁◯◯ Low	DREAMS may increase uptake of HIV testing services slightly.
Condom use												
1	Non-randomized studies	Not serious	Not serious	Not serious	Serious[a]	None	253/726 (34.8%)	241/669 (36.0%)	**Odds ratio 1.22** (0.86–1.72)	**47 more per 1000** (from 34 fewer to 132 more)	⨁◯◯◯ Very low	The evidence is very uncertain about the effect of DREAMS on condom use.
Transactional sex												
1	Non-randomized studies	Not serious	Not serious	Not serious	Serious[a]	None	91/1813 (5.0%)	88/1469 (6.0%)	**Odds ratio 0.99** (0.69–1.41)	**1 fewer per 1000** (from 18 fewer to 23 more)	⨁◯◯◯ Very low	The evidence is very uncertain about the effect of DREAMS on transactional sex.
Number of lifetime sexual partners												
1	Non-randomized studies	Not serious	Not serious	Not serious	Not serious	None	356/2062 (17.3%)	389/1403 (27.7%)	**Odds ratio 0.74** (0.74–0.91)	**56 fewer per 1000** (from 56 fewer to 18 fewer)	⨁⨁◯◯ Low	DREAMS may reduce number of lifetime sexual partners.

CI: confidence interval; **OR:** odds ratio. [a]Confidence interval includes 1.00.

Table 2: **GradePro certainty of evidence per outcome.**

not associated with a significant reduction in transactional sex, highlighting the need to better understand which specific components target this outcome. DREAMS has included economic strengthening to mitigate this risk. Yet, as previously reported, limited information is provided on the particular intervention designed to impact this outcome.[8] This level of specificity on the intervention components is especially relevant as PEPFAR is embarking on and transitioning to the "DREAMS Next Generation" program. This new phase focuses on sustainability by streamlining the core DREAMS package to include only the most essential and programmatically impactful components.[31]

This systematic review is subject to limitations. We used three main categories to select the included outcomes associated with DREAMS rather than all listed in

the DREAMS logic model.[7] Despite this limitation, these broad categories included most DREAMS logic model outcomes. We combined studies in different geographical locations within a country as separate studies in the meta-analysis. Due to a possible intra-country clustering of the results, this might have overestimated the pooled effect-sizes. However, we expect some similarities across the DREAMS sites, as PEPFAR purposely selected DREAMS sites based on high HIV rates among the target population.[31] We used the information reported in the included studies to describe the components offered as part of DREAMS, which may or may not have represented the extent of intervention components provided. Moreover, many studies used surveillance or programmatic data that may have potential data quality challenges, especially compared to a more controlled research environment.

This systematic review and meta-analysis is based on a limited number of studies. Future research is warranted to assess the effects of DREAMS using more methodologically robust methods. After 10 years of implementation, it would be unfeasible and unethical to randomize participants to the DREAMS program. Despite the challenges associated with large-scale real-world implementation and evaluation, testing the effects of specific interventions or implementation strategies within DREAMS on selected outcomes using study designs with comparison groups such as cluster randomized trials, stepped wedge, or controlled before and after could be integrated into studies. Furthermore, few studies included PrEP, one of the most effective prevention strategies against HIV acquisition, but with well-known challenges related to uptake and persistence. As new PrEP formulations, such as long-acting injectables, begin to be more widely available, further research is needed to identify intervention and implementation strategies to support PrEP uptake and persistence within DREAMS.

The evidence suggests that DREAMS results in a reduction in HIV incidence, self-reported STI symptoms, and number of sexual partners. DREAMS may result in an increase in HIV status awareness and uptake of HIV testing. The evidence is uncertain about the effect of DREAMS on condom use and transactional sex. There is a particular dearth of evidence for PrEP-related outcomes within DREAMS, and few studies included HIV incidence as the primary outcome for DREAMS. Developing a unified and granular evaluation framework with guidance on reporting the DREAMS components implemented, definition of exposure, and standardized outcomes would strengthen future research on the effects of DREAMS.

Contributors

MCL and NB developed the study concept with input from all authors. MCL, NB, TL, and CB completed the data abstraction and verification. NB and MCL worked on the data analysis and wrote the first draft of the manuscript. All authors contributed to data interpretation and reviewed and edited the manuscript. All authors had access to the data and agreed to submit it for publication.

Data sharing statement

This study used publicly available data.

Declaration of interests

MCL, NB, TL, CB, KS, CWC, LKM, BL, NN, CN, EK, MC, and KAS have received grants from the US Centers for Disease Control and Prevention (CDC), the National Institutes of Health (NIH), and/or The United States Agency for International Development (USAID) for work not directly related to this project. CWC has received consulting fees for Gilead for work unrelated to this project. CN has served in a leadership or fiduciary unpaid role for Spur Afrika Board. EK received support for attending meetings and/or travel from NIH. MC reports unpaid data safety monitoring boards for NIH (UH3HD096929) and the Institute of Human Virology. MC serves in a leadership or fiduciary unpaid role for several boards (Ciheb-Kenya, Ciheb-Zambia, Ciheb-Tanzania, Ciheb-Malawi, Bummhi). KAS reports unpaid data safety monitoring board at the Institute of Human Virology. KAS serves in a leadership or fiduciary unpaid role for MGIC-Nigeria. JV and EL report no conflict of interest.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.eclinm.2025.103176.

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