



Effectiveness of Health Interventions towards HIV/AIDS in Developing Countries: A Systematic Review

**Sarmad Jamal Siddiqui^{1,2}, Rosnah Sutan^{1*}, Zaleeha Md Isa¹,
Arshad Hussain Laghari³ and Vija Kumar Gemnani²**

¹*Department of Community Health, Faculty of Medicine, University Kebangsaan Malaysia, Kuala Lumpur, Malaysia.*

²*Faculty of Community Medicine & Public Health Sciences, Shaheed Mohtarma Benazir Bhutto Medical University, Larkana, Sindh, Pakistan.*

³*Department of Biochemistry, Ghulam Muhammad Mahar Medical College Sukkur @ Shaheed Mohtarma Benazir Bhutto Medical University Larkana, Malaysia.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Plentiful development has been achieved in interventions for the prevention of HIV. Although, progression of prevention programs based on evidence – informed methods that interpret the effectiveness of these approaches in population is still a challenge. In developing countries, not many interventions are implemented for reduction of HIV burden. The single most important identified problem is lack of demand, supply, and adherence approaches. In current systemic review, recent evidence for the prevention of HIV in a cascade manner is described to see status of current interventions and further needs for improvements.

Methodology: Systemic reviews regarding effectiveness on interventions of HIV prevention were searched. Primary studies were identified from eligible review that evaluated one of following

factors: prevalence of HIV, incidence of HIV, testing uptake of HIV and use of condom. Interventions were categorized that pursued demand for prevention of HIV, improvement in supply for preventive approaches, support related to preventive behaviors or prevent HIV directly. A rating was assigned for each intervention based on evidence strength or randomized controlled trials.

Results: Out of 91 eligible reviews, 264 primary studies were included in this review. Primary studies related to direct mechanisms of prevention that showed strong data for circumcision and effectiveness of pre – exposure prophylaxis. Evidence implies that interventions related to increased supply of preventive methods including clean needles or condoms can be operative. Interventions related to demand – side and adherence approaches were less clear with some studies showing effectiveness. Quality evidence was assessed among various categories. Various interventions showed supportive outcomes and results. In our findings, it was observed that difference between behavioral and structural has not evidently distinguished the interventions.

Conclusion: Growing data is present for the support of effectiveness of products, behaviors, and procedures for prevention of HIV. In developing countries, negligible data is present for implementation of such approaches on community level. Interventions will be required for transforming this evidence to produce impact on population. It will empower the demand for prevention of HIV, supply of preventive technologies and utilization of preventive approaches against HIV. The findings can be eye opener to see actual burden of HIV and their implanted interventions and can be useful to design further intervention programs in future.

Keywords: HIV; prevention; reviews; effectiveness; Health education.

1. INTRODUCTION

There has been advancement in delivery and development of interventions regarding prevention against human immunodeficiency virus (HIV), but every year more than one million individuals are emerging with new HIV cases [1]. HIV prevention reinvigoration have been called by United Nations Program for HIV/AIDS (UNAIDS) concerning methods and demonstrated that globally 25% expenditure of HIV should be reserved for activities of prevention [2]. Cascade of HIV prevention have been growing and used for supporting the implementation and development of interventions and for the facilitation of resource distribution. For HIV prevention, specific cascades elaborates that the target and outcome can be achieved by implanting key components including demand – side interventions for awareness and perception acceptability; supply – side interventions production of easy available and accessible products; and adherence interventions for behavior acceptance. Reframing of interventions regarding HIV prevention that are systematized nearby a cascade of HIV prevention has been suggested by Hargreaves et al. [3]. This reformed cascade can assimilate evidence from various disciplines and can be very useful for programmers. Effective treatment and preventive measures are necessary in those at risk. Such behaviors or products are direct mechanisms for the exertion of effectiveness of program for HIV prevention. The concept of cascade is used to

see effectiveness of programs for the prevention of mother to child transmission. Such approaches have demonstrated the needs for suppression of HIV in communities and is being used widely for assessing the programs. As by the treatment cascade, the prevention cascade can also be powerful intervention by provision of population proportion estimation which were lost at certain steps of implementation, explaining the steps in productive interventions for prevention, which represent components to identify the inadequacies and produce further action plan. Characteristics of interventions for treatment of HIV relies on presenting data i.e., from health facilities that track the patients or studies that are population based. There can be a variety in the approach as per its provision i.e., it follows longitudinal cohorts' pattern that describe the evolution over time or population cross – sectional view at time. Such interventions perhaps include prevention of HIV but highlight the diagnosis steps, treatment linkage, initiation of treatment and suppression of viral load. Testing of HIV is important pathway for both prevention and treatment of HIV. To prevent HIV, achievement of all interventions in single approach is difficult due to variability in different approaches they include. Each intervention can be described and separated out in terms of how it can fail or succeed in epidemiological context to elaborate the required steps for specific approach. An observational data was used by Garnet et al. for implementation of an idea for

cascade of HIV prevention to use as monitoring tool [4].

In current review, the available HIV prevention evidence have been reviewed as was reflected in previous reviews of interventions of HIV prevention. The evidence in relation with cascade of HIV prevention is mapped, that explains intervention characteristics in relevance to each cascade area, assessment of available evidence types on these interventions and identification of area and gaps for further research.

2. METHODOLOGY

2.1 Search Methods and Reviews Selection

Three different systemic searches were performed for the identification of HIV prevention and intervention systemic reviews. Terms included HIV/AIDS MeSH terms, behavior, prevention, and intervention. We searched MEDLINE, Cochrane Library, ClinicalTrials.gov. and ISI Web of Knowledge.

Extraction of data was done from review by data extraction tool, which included their reviews, study design, location, population, intervention, and outcome. Reviews with effectiveness of prevention and intervention on HIV were included. Reviews from both observational and experimental studies were included. Literature review, scoping views and broad overviews were excluded. Reviews having structural and behavioral interventions done in developed countries only were excluded as we focused on areas with highest HIV burden and so the interventions effectiveness could be specific to the context and data synthesis would present heterogeneity of studies.

2.2 Identification of Primary Study and Extraction of Data

Primary studies were extracted from reviews if they meet one of following criteria: Prevalence of HIV, incidence of HIV, condom usage reporting and HIV testing uptake. In studies of only direct mechanisms, incidence of HIV was the primary outcome to match inclusion. HIV testing uptake and condom use were included as adjacent intervention effectiveness outcome. Though some reviews identified intervention and prevention of vertical transmission (mother-to-

child), with special consideration to transmission by needle-sharing and intercourse.

Extraction of minimal data at primary study level was developed including target population, country of focus, design of study and reported outcomes for each study. Primary studies and reviews with prevention cascade of HIV as per Hargreaves et al. [3] Many primary studies qualify for multiple categories, but in current study, based on most projecting component we assigned each study into single category (Table 1).

Studies with demand – side domain in which interventions were influencing the behavior by strengthening awareness of, targeting risk perception and positive attitude, prevention of HIV by technologies and behavior were judged. Such interventions were those providing education, information, and communication as well as those proposed to impact apparent patterns via peer-based methods. Interventions were distributed to various target populations and in wide range of settings.

Studies with supply-side domain in which interventions were influencing the messages and products for prevention of HIV, such as treatment planning for sexually transmitted diseases (STDs), initiatives for needle exchange mainstreaming prevention of HIV and mass condom distribution were judged. Some of these interventions are identified as structural interventions in published literature.

Adherence domain included studies in which interventions supported maintenance of behaviors for prevention or adoption were judged. Such interventions influenced behavioral skills or self – efficacy such as longitudinal risk counselling. In this category, the interventions with targeted determinants of social behaviors theorized for acting as barriers to capability of individuals to adhere or access to prevention were also included such as interventions of employment. Some of these interventions are also characterized as structural interventions in published literature.

To determine the efficacy of procedures, the studies conduct randomized control trials as direct mechanism.

Specific kinds of interventions were identified among each domain. As per target populations, each intervention was classified (Table 1). Based

on reported findings and study design, the direction and type of evidence were assessed for each outcome. Framework produced by Mavedzenge et al. was used for assessing adolescents and young individuals [5]. In each category, based on number of randomized controlled trials for certain outcome, the study design was described with ratings A/B/C (Table 2-3). Effectiveness of interventions was assessed by allocating a score from 1-4 (Table 2). The evidence for behavioral and structural interventions were assessed by two reviewers. After consultation, discrepancies were resolved.

3. RESULTS

A total of 91 reviews were eligible for inclusion [6-97] (Fig. 1), out of which 264 primary studies were extracted (Fig. 2). 178 primary studies were related to demand-, supply-side or adherence interventions. Of them, 118 (66.29%) had observational type of study design. Out of 79 randomized controlled trials, 27 (34.17%) used direct prevention mechanisms against HIV. Out of those studies, 18 (10.11%) included prevalence or incidence as primary outcome; through rest demonstrated use of condoms.

Various approaches were used for the influence on risk perception, attitude, and awareness regarding preventive measures such as text

messages, multimedia, and posters etc. For instance, in Zimbabwe, the Helping Each Other Act Responsibly Together (HEART) campaigns used programs through multimedia, advertisements etc. to convey message regarding risk reduction of sexually transmitted infections and HIV [94]. In KwaZulu – Natal, a school-based program was organized for provision of education of HIV prevention and sexual health through performances in drama and various booklets. [95]. More than half of communication, education and information studies were emphasized on young individuals. A randomized controlled trial by Kwa Vijana provided the data of education regarding sexual health in children of school by a participatory program along with health worker trainings to provide sexual health services [96]. In majority of studies, the primary outcome was the evaluation of condom.

Peer – led interventions were used for female sex workers for their support and to produce a sagacity of community. In Philippines, a peer-delivered program regarding education with use of condoms and trainings on information of HIV [97-98]. 10 studies showed peer – based interventions in young individuals. In Kenya, a project involved peer teaching of students by educators regarding HIV information through quizzes, songs, and competitive methods [99-100].

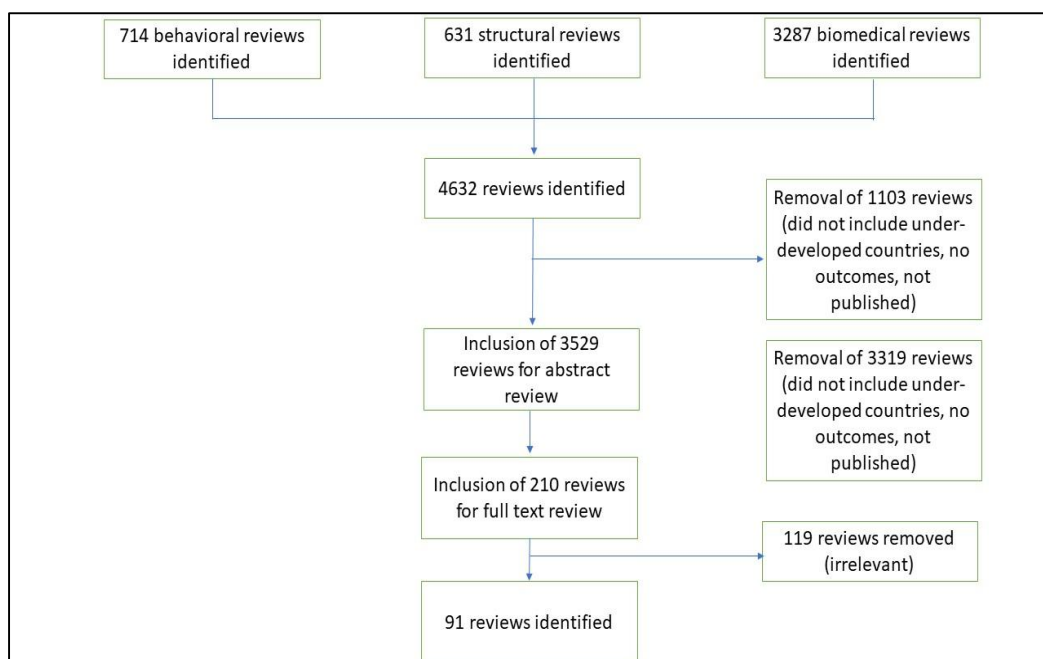


Fig. 1. Systemic reviews identification

Table 1. Categories of prevention intervention against HIV in terms of prevention cascade of HIV

Review & References	Type of Intervention	Subcategory	Outcomes
Demand-side interventions [6-8, 10-12, 14, 17, 19, 27-28, 30, 32, 43, 56-57, 60, 71, 95-96]	Information, education, and communication Peer	Young males, females, individuals on drugs and mass media Young homosexual males, female sex workers, individuals on alcohol or drugs	Awareness Target risk perception Positive attitude
Supply-side interventions [9, 13, 18, 21-22, 24, 26, 31, 33-36, 40, 42, 49-51, 58, 63-64, 79-81, 94-95]	Syringe or needle programs HIV services integration Sexually transmitted infections interventions on community-level Distribution of condoms	---	Messages Products for HIV prevention
Adherence interventions [15-16, 37-39, 41, 44-45, 48, 53-55, 57-58, 60-62, 64-65]	Socioeconomics Counselling	Interventions related to microfinance and transfer of cash Counselling individually, counselling of couples, testing of HIV	Behavior for prevention and adoption (behavioral skills, self-efficacy)
Direct HIV prevention mechanisms [20, 23, 25, 29, 46-47, 52, 54-55, 58-59, 66-70, 72-80, 82-93, 97]	Voluntary circumcision medically Pre-exposure prophylaxis Condoms Treatment of sexually transmitted infections Microbicides Vaccines	Male-to-female and female-to-male transmission, homosexual males	Incidence of HIV HIV testing uptake Condom use

Table 2. Strength assessment of prevention interventions against HIV along intervention types

	No Randomized Controlled Trials (Only observational studies)	1-2 Randomized Controlled Trials	≥3 Randomized Controlled Trials
Consistent effectiveness	C1	B1	A1
Effectiveness on larger scale	C2	B2	A2
Mixed results (beneficial + harmful)	C3	B3	A3
No effectiveness/ harmful effects	C4	B4	A4

	Prevalence		Incidence		Testing of HIV		Use of Condoms	
	Number	QAR	Number	QAR	Number	QAR	Number	QAR
Direct Mechanisms								
Circumcision for heterosexual risk (male-to-female)	-	-	6	B3	-	-	-	-
Circumcision for heterosexual risk (female-to-male)	-	-	33	A1	-	-	-	-
Circumcision for homosexual risk (male-to-male)	-	-	15	C3	-	-	-	-
Individuals-level studies on condoms (heterosexual)	-	-	5	C1	-	-	-	-
Individuals-level studies on PrEP	-	-	5	A2	-	-	-	-
Individual-level studies on microbicide prophylaxis	-	-	9	A3	-	-	-	-
Individual-level studies on STI	-	-	6	A4	-	-	-	-
Individual-level studies on HIV vaccine	-	-	4	A3	-	-	-	-
Interventions based on Demand-Side								
Efficacy of IEC on young individuals	1	B4	2	B4	-	-	18	A3
Efficacy of IEC on males	-	-	-	-	1	C1	7	A2
Efficacy of IEC on females	-	-	-	-	-	-	2	B3
Efficacy of IEC using mass media	-	-	1	B3	-	-	7	B4
Efficacy of IEC on individuals on drugs	-	-	-	-	-	-	3	A1
Efficacy of peer-based interventions on young individuals	-	-	1	B4	2	C1	10	C2
Efficacy of peer-based interventions on male homosexuals	-	-	-	-	1	C1	2	B1
Efficacy of peer-based interventions on sex workers (females)	3	C4	3	C4	3	C1	19	B2
Efficacy of peer-based interventions on individuals on alcohol or drugs	1	B4	2	B4	-	-	3	B3
Interventions based on Supply-Side								
Efficacy of interventions using integration of HIV services routinely	-	-	-	-	3	C1	1	C1

Efficacy of programs concerning clean syringe or needle	4	C1	2	C3	-	-	-	-
Efficacy of interventions based on distribution of condoms	2	C1	-	-	-	-	16	A1
Efficacy of interventions based on STI on community-level	-	-	3	A4	-	-	1	B4
Interventions based on Adherence								
Efficacy of counselling (couples-based)	-	-	1	C1	3	A3	5	A1
Efficacy of counselling (individual-level)	-	-	1	B3	2	B3	10	A1
Efficacy of counselling and testing of HIV	-	-	1	B4	2	B3	11	A1
Efficacy of prevention counselling related to HIV-positive individuals	-	-	-	-	-	-	6	A3
Efficacy of interventions based on microfinance	-	-	1	B4	1	B1	6	A3
Efficacy of interventions based on transfer of cash	2	B1	2	B4	-	-	1	B4

Number indicates the number of studies.
 QAR indicates the Quality Assessment Rating
 IEC = Information, Education and Communication
 PrEP = Pre-exposure Prophylaxis
 STI = Sexually Transmitted Infection

Table 3. PICO Template for questions

Population	Adult males and females
Intervention	Direct mechanisms Demand-side intervention Supply-side intervention Adherence intervention
Comparison	Not applicable
Outcome	Prevalence, incidence, HIV testing, condom use
HIV OR AIDS	
AND	
Behavior OR prevention	
AND	
Intervention	

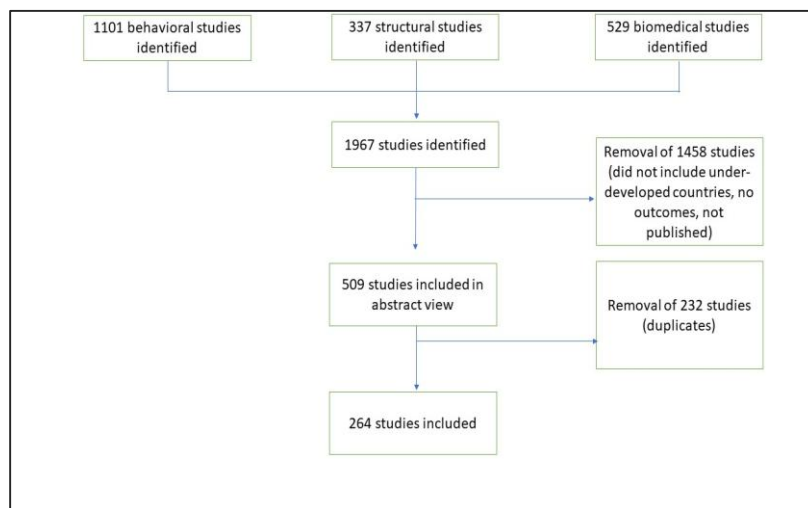


Fig. 2. Identification of primary studies

Policy changes facilitated the approaches such as promoting the use of condoms to population at risk or accessibility to free and clean needles. In 1989, policy for 100% use of condoms in Thailand was launched to promote safety among sex workers with collaboration between various factors [101]. In Cameroon and Dominican Republic, same approaches have been executed for other groups such as young adults [102-103]. An intensive sexually – transmitted infections control program was carried out in Rakai, Uganda through home – based mass treatment with antibiotic as a randomized controlled trial [104].

Ten studies described interventions on individual level. In South Africa, a program was focused on HIV – free individuals and conveyed a 1-hour counselling session regarding risk reduction from health educators [105]. Six posttest counseling studies described prevention counselling regarding patients positive for HIV. In South

Africa, a randomized controlled trial was carried out, between HIV patients and counsellors during their routine clinical visits focusing on risk reduction [106].

Aim of intervention was to enhance the awareness in schools and reduction in rates of HIV in young individuals [107]. An exigence model of management was used by some interventions including programs regarding cessation of smoking in which behavioral monitoring on regular basis was assessed along with incentives for demonstration of required behavior [108]. In few studies, carried out in Zimbabwe and Kenya, the interventions were carried out along with interventions of life – skills and distribution of condoms [109-110].

4. DISCUSSION

Evident data from various randomized controlled trials were found to support the direct mechanism

efficacy for HIV prevention. From evidence, it is also suggested that interventions based on supply-side that enhance approach to such useful technologies can be beneficial and effective, and there is requirement for continued interventional research for increasing the demand and direct mechanisms adherence for HIV prevention. Interventions and their combinations needed for translation of efficient direct mechanism on the level of population impact will necessitate such domain monitoring for the understanding of breaches and for supporting developmental interventions.

For the attainment of impact on population – level much is to be discovered about augmentation to support the adherence and coverage. A range of possible interventions related to such components have been identified in this review. Interventions based on supply-side including initiative of syringe and needle sharing and distribution of mass condom also have influence of such used methods. Though, on outcome of HIV, the efficacy of such interventions has been explored by only few studies.

Interventions based on demand – side described findings including communication, education and information and peer – based interventions on outcome of HIV are unsatisfactory as they rarely reduce prevalence or incidence of HIV. Few studies and trials showed in reviews assessed interventions for increasing circumcision and pre – exposure prophylaxis demand, though data from these components are still in emerging stage [110-116]. Additional research is needed for understating the reason of decreased uptake for these approaches and assessments needed for improved interventions to increase the adherence and uptake. Data is growing for increase in circumcision demand, so systemic reviews of such approaches are defensible. By emergence of direct mechanisms such as vaccines and microbicides, current interventions can be helpful for improvement in accessibility [116-120].

Effectiveness and evidence of interventions based on supply-side is judicious sign of improvements that can be made in prevention of HIV by accessibility of prevention products to population and community. In situations when there is threat to efforts for reduction in incidence of HIV, such interventions can be used for the prevention of HIV and ultimately help in incidence reduction. Our review showed similar

findings and conclusion as described by Mavadzenge et al. [5].

Our review suggests that difference between behavioral and structural has not evidently distinguished the interventions, so the classification in this manner may produce some misunderstanding. In one review there was identification of Steppingstone which targeted young males and females and for the exploration of intervention effect on outcome of individual biological factors through changes in gender customs to structural level [100]. An intervention for youth through social marketing of condom use was added in reviews and was assessed through structural and behavioral search [103]. Such examples show that categorizing the level of intervention operation might not be as useful as compared to its categorization by intervention objective.

This review also showed some gaps that are present in literature data on intervention effectiveness for the prevention of HIV; especially in terms of demand-, supply-side and adherence interventions. Though, large number of studies were identified across these approaches. Majority of such studies were having observation type of design and were dependent on self – reported outcomes in behaviors. This can be understanding in the way that for effectiveness, these studies are less helpful as compared to studies carried out by randomized controlled trials. Although, when randomized controlled trials are not practicable or unethical, then observational design are necessary. Analysis of approaches of HIV preventions can help in identification of barriers for effective population prevention, shown by application of various prevention formulations from data of high-risk areas. These are used to highlight the inadequacy of service delivery in prevention, low risk perception and poor HIV prevention uptake.

Our methodology has few limitations. As we performed review of reviews, the studies were assessed which themselves comprised of systemic reviews; there were no additional biomedical preventive studies were included. Many studies were identified including primary studies of interventions which were complex that contain factors intended to enhance the demand through peer interventions, communication, education, and information. This review aimed for intervention mapping for prevention of HIV framework by main component of intervention.

Although, there was subjective classification and were classified differently by reviewers or might have chosen the intervention cataloguing into many categories. In this regard, some data might be under – reported categories. In this review, the classification was intended into single category so that exaggeration of the evidence can be avoided. Where possible, we elaborated the evidence for outcome of HIV. Although, outcomes from self – reported behavioral studies were only interventional approach shown in studies; especially studies concerning demand-, supply-side and adherence interventions. Due to inclusion of these studies, it was established that adjacent measures can be influenced by interventions. The objective of this systemic review did not include the assessment of methodological precision of primary studies showed by these reviews. We categorized the primary studies rather than reviews, into domains of definite cascade. This review delivered overview of evidence strength and exactness; though, quality of primary studies is not given in details. Due to these minimal extraction of data at the level of data from primary studies, remarks on population heterogeneity in studies. It is important to understand the study design e.g., observational etc., to demonstrate their usefulness and their similarity with other study designs for efficacy. In subsequent step, consideration of significant connection between studied populations and quality of evidence is necessary.

5. CONCLUSION

Recent evidence shows that we have approaches that slog on individual level and reach the level of effect on population by various interventions to prevent HIV. The cascade of HIV prevention that contains these factors gives an outline for the understanding of the reason for failure of direct mechanisms impact on population level and support the implementation and development of interventions for targeting of these domains. HIV prevention has been categorized according to prevention approach so that it can be helpful in highlighting and recognition of gaps in interventions. Development of understanding can be started for specified problems for better demand, supply, and adherence approaches.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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