

REVIEW ARTICLE

Innovative pre-exposure prophylaxis interventions among adolescent girls and young women during COVID-19 lockdown period in sub-Saharan Africa: A systematic review

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Abstract

Adolescent girls and young women are key, and priority populations impacted by a higher risk of acquiring human immunodeficiency virus. In 2015, pre-exposure prophylaxis was introduced as a biomedical human immunodeficiency virus prevention tool. However, its uptake continues to be lower in sub-Saharan countries, particularly among adolescent girls and young women. The uptake may have worsened during the Coronavirus disease 2019 lockdown restrictions. Innovative interventions to improve its uptake were implemented, this review aimed to identify and describe these interventions in sub-Saharan Africa. We searched four electronic databases (PubMed, Scopus, Google Scholar, and MEDLINE) between 01 April 2019 and 30 April 2024 and 1212 articles were identified. Of these 287 full-text articles were assessed and ultimately, 14 articles were included since they reported on the pre-exposure prophylaxis interventions implemented before and during the lockdown period among adolescent girls and young women. Innovative interventions like using social media platforms and decentralizing pre-exposure prophylaxis through community delivery were identified across Sub-Saharan African countries. Irrespective of the challenges in implementing these interventions, improvements in pre-exposure prophylaxis uptake and adherence were observed. These interventions can potentially improve access to traditionally hard-to-reach individuals and address structural barriers to better access human immunodeficiency virus prevention service delivery. (*Afr J Reprod Health* 2024; 28 [9]: 191-213).

Keywords: Adolescent girls and young women, Covid-19, Pre-exposure prophylaxis, Innovative interventions, Sub-Saharan Africa

Résumé

Les adolescentes et les jeunes femmes constituent des populations clés et prioritaires exposées à un risque plus élevé de contracter le virus de l'immunodéficience humaine. En 2015, la prophylaxie pré-exposition a été introduite comme outil biomédical de prévention du virus de l'immunodéficience humaine. Cependant, son adoption continue d'être plus faible dans les pays subsahariens, en particulier chez les adolescentes et les jeunes femmes. L'adoption pourrait s'être aggravée pendant les restrictions de confinement liées à la maladie à coronavirus 2019. Des interventions innovantes pour améliorer son adoption ont été mises en œuvre, cette revue visait à identifier et décrire ces interventions en Afrique subsaharienne. Nous avons effectué des recherches dans quatre bases de données électroniques (PubMed, Scopus, Google Scholar et MEDLINE) entre le 1er avril 2019 et le 30 avril 2024 et 1 212 articles ont été identifiés. Parmi ces 287 articles en texte intégral ont été évalués et finalement, 14 articles ont été inclus car ils rendaient compte des interventions de prophylaxie pré-exposition mises en œuvre avant et pendant la période de confinement auprès des adolescentes et des jeunes femmes. Des interventions innovantes telles que l'utilisation des plateformes de médias sociaux et la décentralisation de la prophylaxie pré-exposition par le biais de la prestation communautaire ont été identifiées dans les pays d'Afrique subsaharienne. Indépendamment des difficultés liées à la mise en œuvre de ces interventions, des améliorations dans l'adoption et l'observance de la prophylaxie pré-exposition ont été observées. Ces interventions peuvent potentiellement améliorer l'accès aux personnes traditionnellement difficiles à atteindre et éliminer les obstacles structurels pour un meilleur accès à la prestation de services de prévention du virus de l'immunodéficience humaine. (*Afr J Reprod Health* 2024; 28 [9]: 191-213).

Mots-clés: Adolescentes et jeunes femmes, Covid-19, Prophylaxie pré-exposition, Interventions innovantes, Afrique subsaharienne

Introduction

Adolescent girls and young women (AGYW) aged 15-24 years living in Sub-Saharan Africa (SSA) are

disproportionally affected by the human immunodeficiency virus (HIV)¹. Social (gendered norms), behavioural (sexual risk-taking), and structural (labour migration) factors are attributable

to the upsurging HIV incidence and prevalence among AGYW². New HIV infections also continue to rise in SSA, specifically among AGYW³. In 2022, they accounted for more than 77% of all new HIV infections in SSA, and they were more susceptible to acquiring HIV compared to their male counterparts¹. To control and reduce these incidences, in 2015 countries in SSA developed policies to incorporate pre-exposure prophylaxis (PrEP) into the national HIV-prevention strategies following the World Health Organization's (WHO) recommendations^{4,5}. This incorporation progressed well because, by the end of 2019, more than one-third of people receiving PrEP globally were in Africa⁵. Oral PrEP, defined as an antiretroviral medicine used by HIV-negative individuals to prevent HIV acquisition was found to be a significant biomedical tool in addressing high HIV incidence among high-risk populations, such as AGYW⁶. Studies have shown that PrEP is a highly effective HIV prevention method, particularly for AGYW⁷⁻⁸. This group is exposed to sexual risks such as coerced sex, condomless sex, and intimate partner violence⁹.

Since PrEP had to be incorporated within the existing HIV-prevention strategies, its provision was not a standalone intervention in the healthcare facilities⁵. For instance, PrEP delivery was integrated into services like family planning, maternal and child health or sexual and reproductive services among AGYW¹⁰. Despite the efforts made to increase its availability in SSA among the population groups mentioned above, the uptake and adherence remain low¹¹. Barriers such as lack of access, low social support for users from both peers and community and inadequate information were indicated as challenges in the use of PrEP interventions¹¹⁻¹³. Adolescent girls and young women are prioritised by the Joint United Nations Programme on HIV/AIDS (UNAIDS) to achieve control of the HIV epidemic by 2030¹. However, Covid-19 has created barriers to the continuity of vital health services¹⁴. For instance, in 2020 the delivery of HIV prevention and treatment services were disrupted globally due to its rapid spread and lockdown restrictions¹⁵. These HIV treatment and prevention disruptions include services like testing, ART, viral load testing and suppression, provision of PrEP, prevention of vertical transmission, and voluntary medical male circumcision¹⁵. From the above services, AGYW were mostly impacted

because of the inability to access oral PrEP. One cohort study conducted in South Africa on PrEP uptake showed that, during the lockdown period, 57% of women missed prescription refill visits, compared to 34% before the lockdown¹⁶. Another study on the effects of PrEP uptake during Covid-19 among university students in KwaZulu Natal province, South Africa, found low adherence levels because of the lockdown restrictions¹⁷.

Responding to these negative consequences, guidelines for managing and easing HIV and other health services were published by the WHO to mitigate the impact of Covid-19¹⁸. These guidelines were based on developing and implementing innovative interventions for HIV service continuity. Innovative interventions are defined as novel or creative ways that can generate more impact for more people¹⁹. During the pandemic, the United States President's Emergency Plan for AIDS Relief (PEPFAR) countries not limited to (South Africa, Namibia, Zambia, etc) continued with the provision of PrEP through innovative interventions as they are essential for the prevention of HIV²⁰. These include using virtual options for client initiations, refills, and check-ins, decentralizing the dispensing of PrEP through community delivery, and moving to multi-month dispensing²¹.

However, there is limited data regarding the successes and challenges of these interventions²². This review aimed to identify and describe these innovative PrEP interventions and summarize their success and challenges among AGYW in SSA. The information is intended to inform the programme implementors regarding the feasibility, accessibility, and sustainability of these interventions for increased uptake as well as to prepare for future pandemics.

Methods

The systematic review forms part of a doctoral study by the first author who has obtained the University of Johannesburg (UJ) Higher Degrees Committee and Faculty of Health Sciences, Research Ethics Committee (REC) approval (REC-2435-2023). Additionally, this study falls under two umbrella studies in the South African Medical Research Council (SAMRC)/ UJ Pan African Centre for Epidemic Research (PACER) Extramural Unit, namely harnessing big heterogeneous data to

evaluate the potential impact of HIV responses among key populations in generalised epidemic settings in SSA (REC-1504-2022) and Epidemiologic analyses of the impacts of Covid-19 to inform tailoring and adaptation of implementation strategies for HIV service delivery among key populations in sub-Saharan (REC-1504-2022), which also obtained ethics approval from UJ REC.

Study approach

Before conducting the review, a protocol was developed and registered with the International Prospective Register of the Systematic Reviews database (PROSPERO) (CRD42023439020). This review was done in line with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines²³. Since most countries in SSA introduced PrEP in 2016, authors focused on published studies that provided information on both PrEP interventions implemented before (from 2016) and during the Covid-19 lockdown period (between 28 March to 01 June 2020) among AGYW. The review was conducted from June 2023 to April 2024.

Eligibility of research question

A Population Intervention Comparison Outcome (PICO) framework (Table 1) was used to categorize the search terms used from the research question. For example, the research question for this review was: Which innovative PrEP interventions were developed and implemented during Covid-19 lockdown period to improve uptake among AGYW in SSA?

As illustrated below the synonyms for the categorized words were identified as well as their search terms using the Medical Subject Headings (MeSH)

Search strategy

The search strategy was developed in consultation with the Librarian assigned to the Faculty of Health Sciences from the University of Johannesburg. A literature search was conducted using online databases such as PubMed, Google Scholar, Scopus, and MEDLINE. Moreover, a manual search was also included for more information using various reports from significant health websites such as Pre-Exposure Prophylaxis–HIV.gov;

aidsmap.com/topic/prep; and cdc.gov/hiv/basics/prep/about-prep.html. Finally, reference sections of relevant review articles were searched for any studies potentially meeting inclusion criteria. There were restrictions regarding the timing of conducting the study, for instance, the review included studies conducted from 1 April 2018 towards 30 April 2024. Furthermore, Table 2 (Appendix A) shows a sample search strategy in PubMed.

Inclusion and exclusion criteria

The inclusion and exclusion criteria used for both identifying and selecting articles were informed by the PICO framework and are described in Table 3.

Exclusion criteria

The review excluded all studies that did not meet the inclusion criteria, for example, those of meta-analyses, systematic reviews, and other types of secondary research. Some of the exclusion criteria included (1) studies not about PrEP; (2) not conducted in SSA; (3) not involving AGYW; (4) not describing PrEP interventions; (5) not describing or measuring PrEP outcomes or outcomes of the interventions; (6) no specific interventions and no outcomes; and (7) letters, editorials, and commentaries.

Study screening and extraction

To ensure that different stages of the systematic review are adhered to throughout the review process, the authors obtained the Covidence training organized by the above-mentioned Librarian from the University of Johannesburg. The training was significant because all the retrieved articles were imported into the Covidence software, which is the systematic review manager²⁴, before the screening process. During the importation phase, all the duplicates were automatically removed by the software. After all the articles and reports were prepared for the screening phase, the first author began the screening process based on the title and abstract information. The screening processes involved the division of the articles and reports into three groups, “yes, no, and maybe”. Following this was the exclusion of irrelevant sources in consultation with the co-authors.

Table 1: The population intervention comparison outcome framework

(P) Population	Synonyms	MeSH teams
Adolescent girls and young women	AGYW Adolescent Adolescents, Female Youths Teens Female Adolescents Teenagers Young adult	"Adolescent"[Mesh]
(I) Intervention	PrEP Pre-Exposure Prophylaxis Prophylaxis, Pre-Exposure Pre-Exposure Prophylaxis (PrEP) Methods Delivery of healthcare Community-Based Distribution	"pre-exposure prophylaxis"[MeSH Terms] "Methods"[Mesh] "Delivery of health care"[MeSH Terms]
Innovative pre-exposure prophylaxis interventions		
(C) Comparison	Coronavirus Disease 2019 SARS-CoV-2 Infections Covid-19 Pandemic 2019 Novel Coronavirus Disease 2019-nCoV Disease	"Covid-19"[MeSH Terms] "Sars-cov-2"[MeSH Terms] "Covid-19"[All Fields] OR "covid-19"[MeSH Terms] OR 2019 Novel Coronavirus Disease [Text Word]
Interventions implemented before and during covid-19 lockdown period		
(O) Outcome	Sub-Saharan Africa SSA Africa, Sub-Saharan (Africa, South Africa, Nigeria, Congo, Ethiopia, Lesotho, Botswana, Cameroon, Zimbabwe, Rwanda, Ghana, Uganda, Kenya)	"Africa south of the Sahara"[MeSH Terms]
Feasibility, Accessibility, and Sustainability of the innovative PrEP interventions within Sub-Saharan African Countries		

Table 2: Inclusion criteria using the population intervention comparison framework

Aspect	Description
Population	Adolescent girls and young women aged 18 years and above. Residing within Sub-Saharan African countries Involved in PrEP interventions before and during the Covid-19 lockdown period
Intervention	Innovative PrEP interventions implemented during the Covid-19 lockdown period on 5 March 2020. The interventions will be described in terms of the target population, types, and content of interventions, duration of the intervention, outcomes of the interventions, PrEP outcomes, key findings, and effectiveness of the interventions
Comparison	The review will compare interventions implemented before the Covid-19 lockdown period which are those developed from 2016 after the WHO recommended PrEP use and the ones implemented during the lockdown period between 28 March to 01 June 2020, among AGYW.
Outcomes	The review will assess how feasible, accessible, and sustainable these interventions were in various countries in SSA. Some of the PrEP outcomes that will be assessed include the uptake and adherence rates among the target population. As well as the success and challenges of the implemented PrEP interventions

Two team members (LLO, EP) independently evaluated the complete text and abstract of the qualifying articles using the inclusion and exclusion criteria, as well as a predetermined and agreed-upon

score criterion for each evaluation. In case of differences, a third member (RNP-M) gave input and made the final decision based on the reviews of the two members.

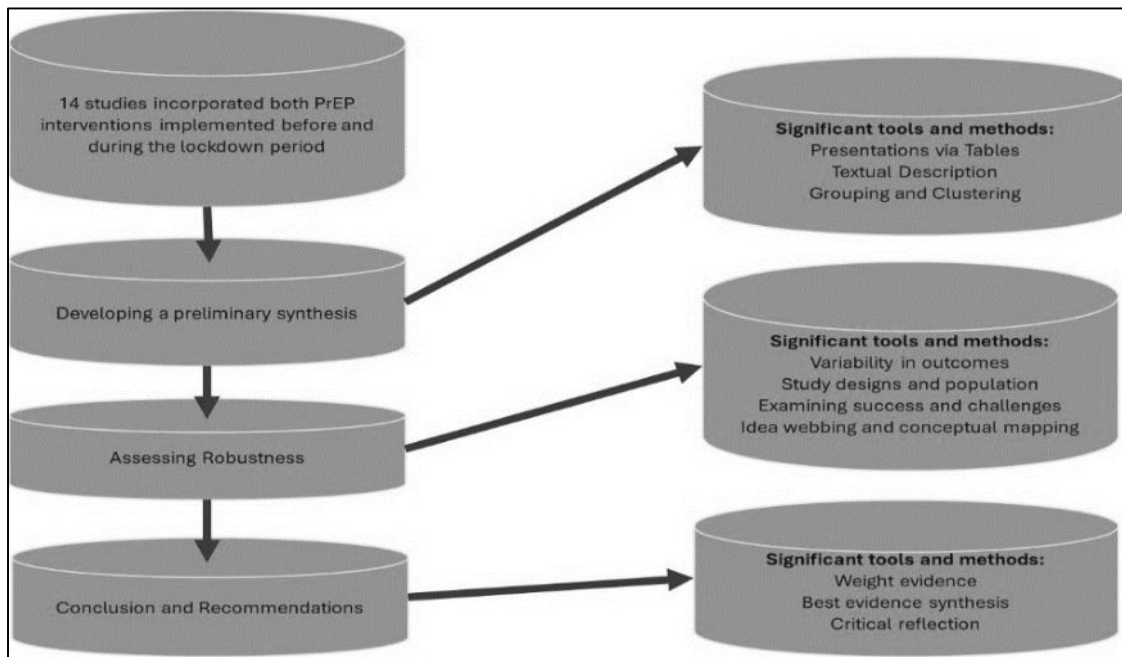


Figure 1: Synthesis process and the tools used adapted from Popay *et al*²⁶

All eligible articles were finally included for data extraction. Additionally, to be more comprehensive in the search strategy, a hand search of the reference list of the selected articles was performed. In a case where the first author (LLO) could not retrieve relevant full-text articles from the databases, the faculty Librarian was consulted for further assistance. For instance, some articles required payment for their full text to be downloaded, however, the inter-loan library was made to retrieve articles. The quality appraisal was ensured using the Critical Appraisal Skills Programme Systematic Review (CASP SR) checklist (Appendix C), which investigates the research's validity, precision, and generalizability.²⁵

Data extraction

Eligible articles were extracted using a developed tool according to the research question under study and the PICO framework. Extraction was primarily done by the first author (LLO) and verified by the second author (EP). All articles that reported on both PrEP interventions implemented before and during the Covid-19 lockdown period were considered. For instance, innovative PrEP interventions are those implemented during the lockdown period like virtual options for client initiations, refills, and check-ins, decentralizing of PrEP through community delivery,

and moving to multi-month dispensing. Additionally, the ones implemented before Covid-19 include the integration of PrEP into existing sexual and reproductive health services (HIV testing, family planning, maternal child health care, etc) among AGYW. The following information was summarized by two reviewers/authors based on the relevant headings like the study and author/s names, year of publication, country, study design, study population, intervention type, a brief description of the intervention, and key findings.

Critical appraisal and narrative analysis

All included studies were synthesized through critical appraisal and narrative synthesis approaches. The methods were suitable because they can be used in systematic reviews to synthesise findings from multiple studies focusing primarily on the utilization of words and text in summarizing the results²⁶. The analysis followed the four stages of the narrative approach including 1) developing a theory of how the innovative interventions worked, why, and for whom; 2) developing a preliminary synthesis; 3) exploring the relationships between and within the studies; and 4) assessing the robustness of the synthesis²⁶. The illustration of the synthesis process and the used tools can be found in Figure 1.

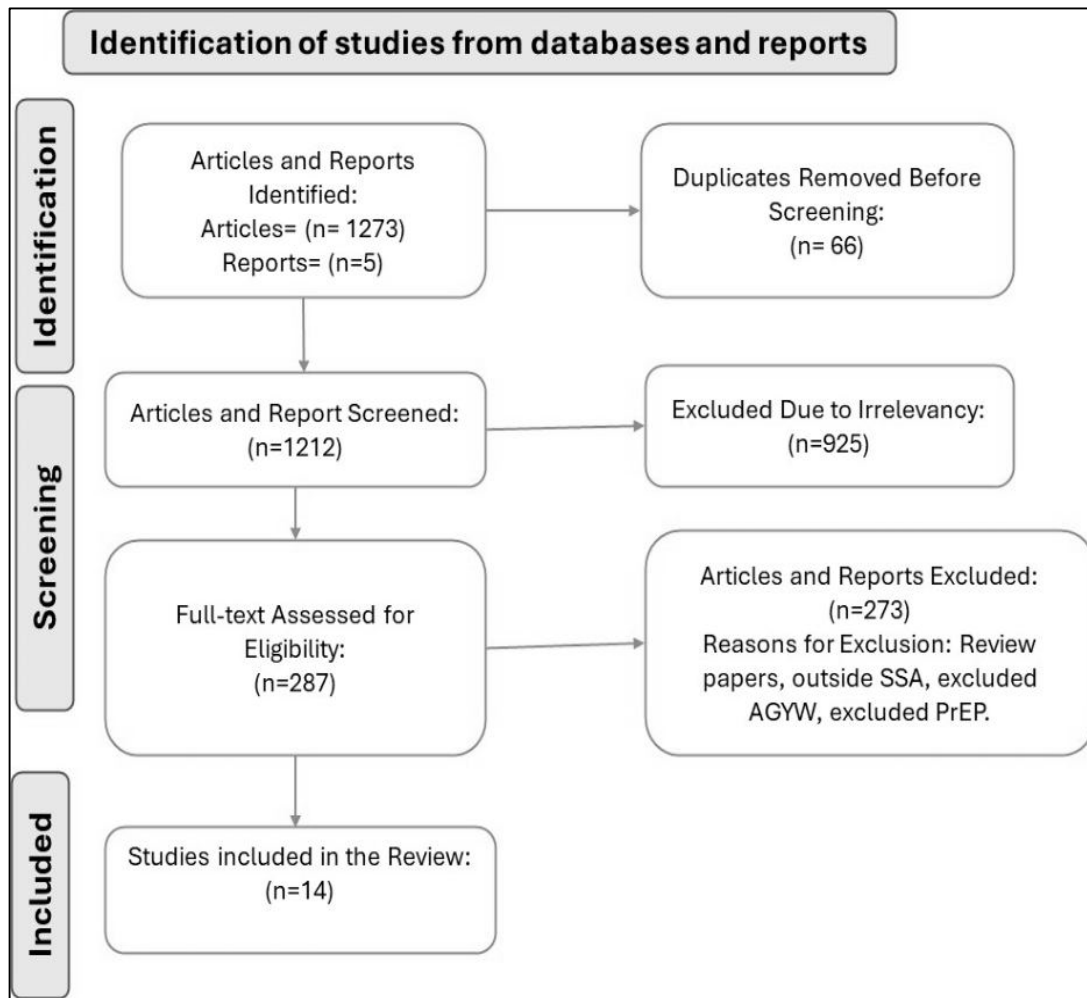


Figure 2: PRISMA flow diagram representing the selection processes of the articles adapted from Page *et al*²³

Literature search results

Results of the identified, screened, eligible and included articles are summarized in Figure 2. A total of 1273 records were retrieved from multiple databases, and 5 records were from grey literature. Of the 1278 saved records, 66 duplicates were removed, which leaves 1212 records for the title and abstract screening. From these records a total of 925 were excluded due to their irrelevancy (e.g., not related to the study, excluded the required target population, not primary studies, etc.) and only 287 records were eligible for full-text screening. Following the full-text screening 273 articles were excluded because they did not meet the inclusion criteria. Ultimately, 14 articles were included for a detailed examination since they met the inclusion criteria. Of the included studies (n=7) focused on the

adaptation of innovative ways for service continuation during the Covid-19 lockdown period, and (n=7) studies reported on the integration of PrEP into existing interventions for AGYW before the pandemic. These included studies were all published between the year 2018-2023.

Results

Characteristics of the included studies

The included studies report both on the PrEP interventions implemented before and during the lockdown period towards improving uptake and adherence among AGYW. Since 2015, the WHO recommended that PrEP must be integrated into already existing interventions to improve its outcomes. Table 3 shows the characteristics of these

Table 3: Characteristics of the articles on the intervention implemented before the Covid-19

First author, year	Study titles	Country/setting	Existing intervention	Aim of the study	Study period	Findings
Mayanja <i>et al.</i> , 2022 (27)	Oral pre-exposure prophylaxis preference, uptake, adherence and continuation among adolescent girls and young women in Kampala, Uganda: a prospective cohort study	The Good Health for Women Project clinic, Uganda	Offered daily oral PrEP to AGYW via the sexual reproductive health services	Oral PrEP preference, uptake, adherence, and continuation among AGYW vulnerable to HIV in Sub-Saharan Africa	Jan 2019 – Dec 2020	Half of AGYW preferred oral PrEP, uptake and adherence were low, uptake was associated with sexual behavioural risk and oral PrEP preference.
Martin <i>et al.</i> , 2023 (28)	Patterns of HIV pre-exposure prophylaxis use among adolescent girls and young women accessing routine sexual and reproductive health services in South Africa	Wits RHI, South Africa	Offered daily oral PrEP within routine sexual and reproductive health services	To describe the patterns of PrEP use among AGYW initiated on daily oral PrEP for the prevention of HIV	Jan 2019- Dec 2021	The need for improved access and continuity of services across delivery sites for young people who may experience challenges with consistent and convenient health service access given their lifestyles and mobility remains critical
Rousseau <i>et al.</i> , 2023 (29)	A community-based mobile clinic model delivering PrEP for HIV prevention to adolescent girls and young women in Cape Town, South Africa	Cape Town, South Africa	The Tutu Teen Truck Integrated PrEP delivery into its provision of comprehensive sexual and reproductive health services	To explore the feasibility and acceptability of providing PrEP to AGYW via a community-based mobile health clinic known as the Tutu Teen Truck	July 2017- October 2019	The accessibility, visibility, and convenience of the TTT made the services highly acceptable to AGYW and facilitated their uptake of SRHS including PrEP
Pintye <i>et al.</i> , 2021 (30)	Influences on early discontinuation and persistence of daily oral prep use among Kenyan adolescent girls and young women: A qualitative evaluation from a prep implementation program	Kisumu County, Kenya	AGYW offered PrEP within the maternal child health and family planning clinics	To explore factors influencing early PrEP discontinuation and persistence among Kenyan AGYW who accepted PrEP within a programmatic setting	Oct-Dec 2018	The need for improved access and continuity of services across delivery sites for young people who may experience challenges with consistent and convenient health service access given their lifestyles and mobility remains critical

Kasaro <i>et al.</i> , 2023 (31)	Integration of HIV prevention with Sexual and Reproductive Health Services: Evidence for Contraceptive Options and HIV Outcomes Study Experience of Integrating Oral Pre-exposure HIV Prophylaxis in Family Planning Services in Lusaka, Zambia	Kamwala District Health Center in Lusaka, Zambia	The integration of oral PrEP in family planning services	To describe the integration of oral PrEP in family planning services using the Evidence for Contraceptive Options and HIV Outcomes study experience	Oct 2017-Aug 2018	The setup and integration of oral PrEP and FP services are feasible in the setting. However, uptake of PrEP was very low
Pintye <i>et al.</i> , 2018 (32)	Integration of PrEP services into routine antenatal and postnatal care: Experiences from an implementation program in Western Kenya	Western Kenya	Integration of PrEP Services into Routine Antenatal and Postnatal Care for young women and adolescents	To evaluate the workflow patterns and additional staff time associated with integrating PrEP into ANC/PNC services	June 2017	We found that initiating clients on PrEP within ANC/PNC requires a moderate amount of additional time per client within already heavily burdened MCH systems
Cassidy <i>et al.</i> , 2022 (33)	Delivering PrEP to young women in a low-income setting in South Africa: Lessons for providing both convenience and support	Khayelitsha, South Africa	Offered PrEP, in conjunction with contraception and risk-reduction counselling, to women aged 18–25, in a government-run clinic in Khayelitsha	To describe participants' experiences and engagement with the PrEP program, participant adherence over time, and the indirect benefits of the PrEP program	2017-2020	Many women did not sustain PrEP use, however, a minority continued to engage in PrEP services, and a significant proportion showed sustained good adherence.

interventions by the first author's name, year, title of the study, settings/localities, name of the existing interventions, aim of the study, study period, and key findings. The included studies were conducted in SSA countries. For instance, three studies are from South Africa^{28,29,33}, two from Kenya^{30,32}, one from Zambia³¹, and one from Uganda²⁷. Most of the interventions in which PrEP was integrated were family planning^{30,31,33}, sexual reproductive health services²⁷⁻²⁹, maternal child, and health services³⁰, and antenatal and postnatal care services³². The studies aimed at assessing the feasibility²⁹ of the PrEP integration, some focused on the factors influencing the initiation, uptake, adherence and continuation^{27,28,30} and the acceptability³³ of the PrEP interventions. Furthermore, based on the key

findings, all studies focused on the effectiveness of these integrations according to the PrEP outcomes (initiation, uptake, adherence, and retention).

Characteristics of the included studies on the innovative interventions

The characteristics of the studies reported on the innovative PrEP interventions are reported below in Table 4 by first author's name, year, study settings/localities, target population, age, study design and the duration with which the studies were conducted. The studies were first grouped according to their study settings, target populations and participants' age. Then we grouped the information on the study designs and periods where studies were conducted.

Table 4: Characteristics of studies on innovative interventions during the lockdown period

First author, year	Study titles	Country	Target population	Study period	Study design
Malkin <i>et al.</i> , 2022 (34)	Adapting high-impact practices in family planning during the covid-19 pandemic: experiences from Kenya, Nigeria, and Zimbabwe	Kenya Nigeria Zimbabwe	Kenya: Young adolescents aged 10-19 Nigeria: Adolescent girls aged 15-19 Zimbabwe: hard-to-reach communities	Kenya= July – Dec2020 Nigeria= April 2020 – March 2021 Zimbabwe = April – Nov 2020	Qualitative data collection tool
Duby <i>et al.</i> , 2022 (35)	Adaptation and resilience: Lessons learned from implementing a combination of health and education intervention for adolescent girls and young women in South Africa during the Covid-19 pandemic	South Africa	38 intervention implementers	November 2020- March 2021	Qualitative in-depth and semi-structured interviews
Kerzner <i>et al.</i> , 2022 (21)	Pre-exposure prophylaxis (PrEP) uptake and service delivery adaptations during the first wave of the Covid-19 pandemic in 21 PEPFAR-funded countries	21 PEPFAR-funded countries	Adolescent girls and young women (15-24) and Key populations	April 2020- March 2021	Mix method approach (qualitative and quantitative analysis)
Hanass-Hancock <i>et al.</i> , 2023 (36)	Masibambane-ladies chat: Developing an online gender-enhanced prep information motivation workshop for young South African women	South Africa	Multiple stakeholders including young women aged 18-25	March 2020-March 2022	A step-by-step participatory approach
Matambanadzo <i>et al.</i> , 2021 (37)	“It went through the roof”: an observation study exploring the rise in PrEP uptake among Zimbabwean female sex workers in response to adaptations during Covid-19	Zimbabwe	Young women involved in sex work	Jan -Dec 2020	Retrospective study design
Henderson <i>et al.</i> , 2023 (38)	The future of pre-exposure prophylaxis (prep) for HIV prevention: A global qualitative consultation on provider perspectives on new products and	Globally including African countries (Mali, Namibia, Nigeria, Zambia,	Pre-exposure prophylaxis providers	Jan-Feb 2022	Semi-structured interviews

Butler <i>et al.</i> , 2023 (39)	differentiated service delivery Implementing differentiated and integrated HIV prevention services for adolescent girls and young women: experiences from oral prep rollout in primary care services in South Africa	Zimbabwe, Uganda) South Africa	Adolescent girls and young women aged 15-24	During the South African lockdown period which lasted for 21 days from March 26, 2020	Mixed methods including (monitoring routine data, facility assessments, stakeholder engagement, training and progress reports, and observations)
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Most of the studies were conducted in South Africa (four studies^{35,21,36,39}) followed by Zimbabwe (three studies^{34,37,38}), Nigeria (three studies^{34,21,38}) and lastly Kenya (two studies^{34,21}). Regarding the study populations, there was quite a variation in the kinds of participants included in each study. Whilst two studies included service providers³⁸ and intervention implementers³⁵, five studies contained key populations (KPs) including female sex workers (FSWs) and AGYW^{34,21,38,37,39}. Regarding age, as illustrated below, some studies did provide participants' ages, and some did not, especially for the ones that included the intervention implementers.

A qualitative research design was used considerably in most studies, for instance, out of seven included studies, five studies employed this design which is commonly utilized in exploratory studies. Only two studies by Matambanadzo *et al.*,³⁷ and Butler *et al.*,³⁹ conducted a retrospective analysis of the programme data to evaluate the implementation outcomes of the implemented innovative interventions. Furthermore, the study durations for all included studies on innovative PrEP interventions were during the Covid-19 lockdown period (2020-2022) as it was one of the requisites of the review.

Innovative interventions implemented during Covid-19 lockdown periods

Table 5 summarizes the various measures used for HIV service continuity. The information illustrates the different types of innovative interventions and where they were implemented in community

settings. We also included how they were implemented and who the beneficiaries thereof.

Types of innovative interventions and places where they were implemented

During the Covid-19 lockdown periods, different types of innovative interventions were implemented to mitigate its impact on the provision of health services. These innovative interventions include but are not limited to the WhatsApp application (app), house visits, telephone follow-up, mobile services, multi-month dispensing of PrEP, and the community pick-up points as listed in Table 5.

WhatsApp application intervention

WhatsApp app, a mobile messaging application was shown to have played a significant role in connecting people as well as in service continuity during the lockdown periods. Six included studies^{34,35,21,36,37,39} applied the app for various reasons including the provision of counselling, initiating, and continuing with PrEP, continuing with interactive workshops to promote the importance of PrEP among young women, and creating group chats for the beneficiaries to report any adverse events.

House visits intervention

From the reviewed and included studies, door-to-door intervention was used only in one study³⁵. This was implemented during stage five of the lockdown period; intervention implementers were provided with permits for home visits to mitigate the non-adherence of PrEP and to provide sexual reproductive health services among AGYW.

Table 5: Types of innovative interventions implemented during Covid-19 lockdown periods

First author, year	Country	Innovative Interventions	Place	Mode of delivery	Beneficiaries
Malkin et al., 2022 (34)	Kenya Nigeria Zimbabwe	WhatsApp app Peer mobilizers	Online Communities	Virtual delivery social. distanced community-based program	Youth Adolescent girls
Duby et al., 2022 (35)	South Africa	Door-to-door Screening Telephone follow-up Mobile services offered out of the mobile unit social media platforms, WhatsApp group	Community Households Communities Online	Households' visits Conducted remotely. In-person	AGYW
Kerzner et al., 2022 (21)	21 PEPFAR-funded countries	Multi-month dispensing of PrEP Virtual demand creation activities Decentralized, community-based	Facilities Online Within communities	In-person Remotely In-person	AGYW Key populations
Hanass-Hancock et al., 2023 (36)	South Africa	Interactive workshop via a social media platform such as WhatsApp group	Online	Virtual delivery	Multiple stakeholders including young women aged 18-25
Matambanadzo et al., 2021 (37)	Zimbabwe	Differentiated service delivery models. Peer demand creation Community-based delivery Multi-month dispensing Virtual platforms	Community Online Facilities Online	In-person Virtual In-person Remotely	Young women involved in sex work
Butler et al., 2023 (39)	South Africa	Remote services Community pick-up points Multimonth scripting Telephone calls, WhatsApp groups, social media, and the chatbot on my prep website	Home delivery of oral PrEP Clients pick up PrEP within the community Healthcare facility Home-based	Mobile clinic Mobile clinic Facility-based Online	Adolescent girls and young women aged 15-24

Telehealth interventions

Similar to the WhatsApp app, the telehealth intervention was used to provide psychosocial support and more information about the sexual

reproductive health among the beneficiaries and this was utilised in two studies^{35,39}. Additionally, this was also to retain the already existing cohort of the AGYW within PrEP programmes using their information on databases³⁷.

Mobile service intervention

Six studies utilised the community-based delivery intervention, which refers to the provision of services outside clinics or healthcare centres^{34,21,37,39}. This was to sustain and increase access to PrEP, the services relied mostly upon peer educators and outreach workers to create demand and follow-up support³⁴. One study utilised the community-based intervention by linking the PrEP clients to local pharmacies and laboratories³⁸. Furthermore, another study made use of the community pick-up points, this involved clients arranging the suitable pick-up place and time at either a local private pharmacy, tertiary institution halls, or community-based organizations (CBOs) premises³⁹.

Multi-month dispensing of pre-exposure prophylaxis

In normal circumstances, beneficiaries who are newly initiated on PrEP would receive only one month's supply and requested to return for follow-up. However, during the Covid-19 lockdown period, this could not be established, instead beneficiaries were provided for three months at a time, deserting the initial requirement for monthly clinic visits³⁷.

The mode of delivery and beneficiaries of the implemented innovative interventions

Due to the rapid spread of Covid-19, stringent measures were implemented to reduce the infection rates. Some of these measures included social distance and the acceptance of limited numbers of individuals to access health facilities⁴⁰. To adhere to the Covid-19 lockdown guidelines, most of the developed and implemented innovation interventions were delivered virtually. Although the included studies in Table 5 mostly considered virtual delivery, they also incorporated the in-person mode of delivery using the house visits approach³⁴. Furthermore, as shown below, the interventions were focused more on KPs including AGYW and FSWs highlighting their significance in controlling the HIV epidemic.

Successes and challenges of the implemented innovative interventions

Table 6 summarizes the successes and challenges in the implementation of these innovative interventions as well as the aims of the selected studies.

Study aims of the selected studies

All the included studies contained the evaluation and adaptation elements, for instance, the study conducted in four countries (South Africa, Zimbabwe, Kenya, and Nigeria) aimed to describe how digital technologies were adapted to maintain access to services during the Covid-19 lockdown periods³⁴. Another evaluated the implemented interventions for PrEP uptake in various programs before and after the start of the Covid-19 lockdown period²¹. More studies' aims are shown in Table 6.

Challenges and successes of the implemented interventions

It can be acknowledged that the HIV health services were maintained through the implemented innovative interventions during the Covid-19 lockdown periods, however, various challenges were highlighted. These challenges are categorized for both the development and implementation stages. Challenges for the developmental stage include adaptation and human capacity. Intervention implementers indicated how they had to restrain the biomedical services like contraceptives and PrEP among AGYW through mobile or fixed healthcare centres in or near schools and communities due to the Covid-19 lockdown disruptions³⁵. Another interesting challenge from the facilitators was the issue of rendering services within communities among AGYW. Because they had to recruit and train additional staff members who are closer by age to AGYW to provide sexual reproductive health services to assist in maintaining continuous participation in the programme³⁴. Regarding the challenges in the implementation stage, facilitators mentioned that they have struggled to reach some of the programme beneficiaries due to incorrect contact details³⁵. Another challenge was the extra cost in the implementation phase because peer educators had to be provided with "mobile data and talk time" to continue with support for PrEP uptake and adherence³⁷. Despite the experienced challenges, some positive milestones were achieved as well. Of the most appreciated innovative interventions is differentiated service delivery where services are rendered according to the needs and preferences of interested clients³⁸. This intervention was recommended for expansion to increase PrEP uptake and adherence. Various stakeholders complimented

Table 6: Challenges and successes in the implementation of innovative interventions

First author, year	Country	Aim of the study	Innovative interventions	Challenges	Successes
Malkin <i>et al.</i> , 2022	Kenya Nigeria Zimbabwe	To describe how high-impact practices in family planning were adapted across Kenya, Nigeria, and Zimbabwe to maintain access to services in response to the coronavirus disease.	WhatsApp app Peer mobilizer	Shortage of resources like extra personnel because staff members were attending emergencies such as Covid-19 patients	In Zimbabwe Family planning access was maintained through Mobile Outreach Peer Mobilizers in Nigeria Help Adolescents Access SRH Services Continuity of some health service provision to AGYW willing to access approachable mobile units and outreach services
Duby <i>et al.</i> , 2022	South Africa	To examine how implementation and service provision were impacted by Covid-19 pandemic and related restrictions, describing the adaptation implementers made to respond to this context.	Door-to-door Screening Telephone follow-up Mobile services are offered out of the mobile unit. Social media platforms, WhatsApp group	Recruiting was very difficult because even though there were girls, they refused to let me in. AGYW beneficiaries have provided staff with incorrect telephone numbers and inaccessible physical addresses	Services were maintained through the adaptations of the implemented innovative interventions
Kerzner <i>et al.</i> , 2022	21 PEPFAR-funded countries	To examine PrEP uptake in PEPFAR programs before and after the start of the Covid-19 pandemic.	Multi-month dispensing of PrEP. Virtual demand creation activities Decentralized, community-based	PrEP health care staff were unavailable due to widespread worker strikes, due to Covid-19 reassignment, or Covid-19 quarantine and isolation protocols, which were reported most widely in Kenya and South Africa	Services were maintained through the adaptations of the implemented innovative interventions
Hanass-Hancock <i>et al.</i> , 2023	South Africa	To describe the processes of transforming an in-person group-based intervention to promote the uptake of PrEP among young women in South Africa to an online interactive “workshop” during the Covid-19 pandemic.	Interactive workshop via a social media platform such as WhatsApp group	Women often had older smartphones, which have insufficient space for certain apps such as PowerPoint or PDFs.	Realized that WhatsApp was a better platform, as it uses less internet data than Facebook Messenger

Matamba nadzo et al., 2021	Zimbabwe	We hypothesize that peer-led community-based provision of PrEP services influenced both demand and supply-side determinants of PrEP uptake. We observed the effect of these adaptations on PrEP uptake among FSW accessing services in Sisters in 2020	Differentiated service delivery models. Peer demand creation Community-based delivery Multi-month dispensing Virtual platforms	Extra cost in the implementation phase, peer educators were provided with “mobile data and talk time” to continue with support for PrEP uptake and adherence.	DSD adaptations led to a large increase in PrEP initiations compared to pre-Covid levels demonstrating that a peer-led, community-based PrEP service delivery model is effective and can be adopted for long-term use
Henderson et al., 2023		We explored PrEP provider perspectives on differentiated PrEP service delivery and new PrEP products to inform World Health Organization (WHO) guidelines and programme implementation	Differentiated service delivery models.	Some providers from lower-income settings noted that workforce limitations and supply constraints limit the ability of services to continue offering PrEP services outside of healthcare facilities.	During the Covid-19 pandemic, telehealth and mobile services ensured that people could continue accessing PrEP
Butler et al., 2023	South Africa	Sought to inform the introduction and integration of oral PrEP as part of a combination HIV prevention and sexual and reproductive health services in South Africa	Remote services Community pick-up points Multimonth dispensing Telephone calls, WhatsApp groups, social media, and the chatbot on my PrEP website	Flexibility around the mobile clinic location and in the time-of-service provision was needed because working hours had to be extended to evenings and weekends.	These strategies helped to shape implementation, enhancing the decentralized community-based service delivery model.

the community-based service delivery intervention because they felt that it has not only improved access to PrEP but also reached those who were reluctant or unable to seek health facility-based services³⁸.

The feasibility, accessibility, and sustainability of innovative pre-exposure prophylaxis interventions

Irrespective of the Covid-19 lockdown disruptions, accessibility to PrEP has always been the significant factor in its uptake and adherence among AGYW¹¹. As a result, one of the intentions of this review was to evaluate the implemented interventions in terms of their feasibility, accessibility, and sustainability as a response to future pandemic preparedness. Based on the literature review of various studies, the three elements were assessed according to their definitions and by the development of different questions that

answer their presence or not in any given intervention. For instance, feasibility was assessed by using questions like: Can the innovative PrEP interventions be developed? Can they proceed to the implementation stage? And if so, how can they be implemented?

Questions such as (were the implemented innovative PrEP interventions reachable enough to the beneficiaries? And were beneficiaries able to utilize the provided services through these interventions?) were used to assess the accessibility element. Furthermore, the sustainability element focused on the maintenance of the interventions in the long term.

Figure 3 illustrates various questions used to assess these three elements. All the included studies in this review proved that the developed and implemented innovative interventions can be sustainable in the long term. Table 7 summarizes the

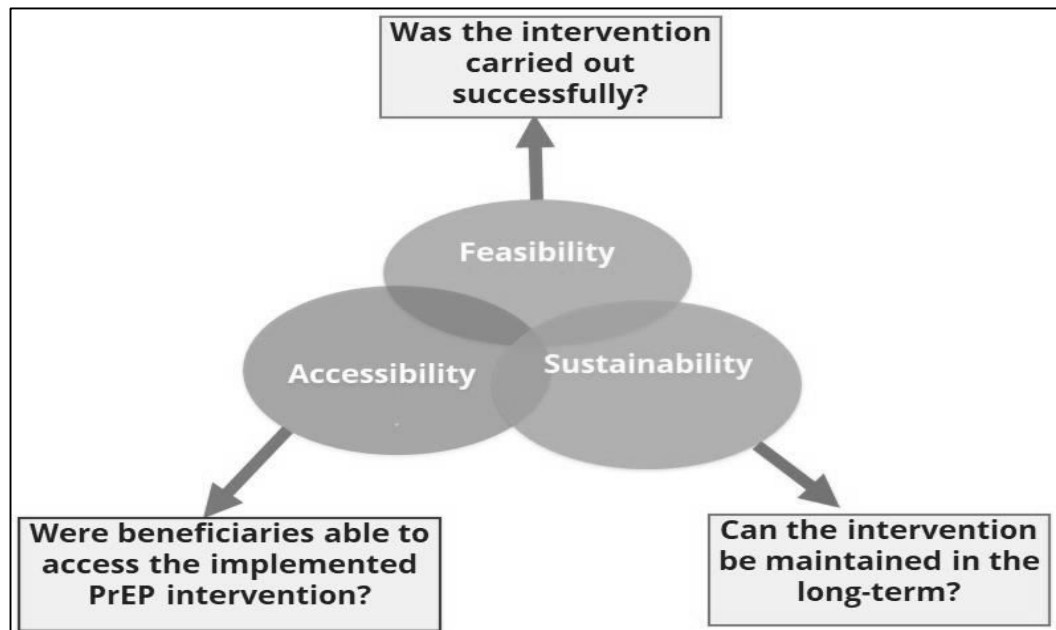


Figure 3: Feasibility, accessibility, and sustainability of the implemented interventions adapted from Iwelunmor et al⁴²

key findings of various studies as well as the indications of the feasibility, accessibility, and sustainability of these interventions. The presence of the three elements was indicated by either a yes or no answer using the above-mentioned assessment questions.

Feasibility of the implemented innovative interventions

The Covid-19 lockdown periods have impacted greatly the provision of health services. However, this can be acknowledged because opportunities were provided to introduce and enhance the existing intervention models that were previously thought to be costly or unfeasible to implement³⁷. The implementation of various online platforms and telephonic conversations was viewed to be pragmatic and feasible during the Covid-19 lockdown periods, particularly for maintaining service continuity³⁵. Furthermore, these online platforms like the WhatsApp application were feasible because they could be accessed by most young women³⁶.

Accessibility of the implemented innovative interventions

Of the seven included studies, six have illustrated the accessibility element of the HIV prevention tool because implementers and facilitators ensured that

PrEP was made available to beneficiaries in different community settings away from the health facilities^{21,34,35,37-39}. The differentiated service delivery was also acknowledged by PrEP providers across various regions as it maintained services and ensured access to KPs during the Covid-19 lockdown period³⁸. Moreover, workshop facilitators ensured that online platforms are utilized to provide accessibility to the interactive workshops aimed at promoting PrEP uptake among young women³⁶.

Sustainability of the implemented innovative interventions

The sustainability element of these interventions was delineated in various studies. For instance, the Covid-19 lockdown period in Zimbabwe commenced late in March 2020, and as a result program sites were required to close for one week and mobile clinics for 6 weeks. Between 6 April and 18 May 2020, they resumed as essential services, but all the adapted PrEP service delivery interventions were sustained towards 2021³⁷. Indicating the sustainability element of these interventions.

Study findings regarding the improved pre-exposure prophylaxis and related services

The developed and implemented innovative interventions were aimed at health services

Table 7: Key findings together with the feasibility, accessibility, and sustainability elements

First author, year	Country	Findings	Feasibility	Accessibility	Sustainability
Malkin <i>et al.</i> , 2022	Kenya Nigeria Zimbabwe	Over 6 months, the program reached 1,048 youth with community dialogues, and 4,656 youth received FP services.	Yes	Yes	Yes
		A contraceptive education Facebook campaign gained more than 80,000 followers, reached 5.9 million adolescents, and linked 330 adolescents to program-supported facilities from January to March 2021	Yes	Yes	Yes
		The number of outreach clients served per week peaked at 1,759 (July 2020) from a low of 203 (May 2020). Clients choosing long-acting reversible methods increased from 22% to 59% during the 3 months before and after lockdown, respectively	Yes	Yes	Yes
Duby <i>et al.</i> , 2022	South Africa	Despite attempts to respond to the context and adapt services, overall Covid-19 negatively affected implementation and service provision, and heightened issues around community acceptability of the programs	Yes	Yes	Yes
Kerzner <i>et al.</i> , 2022	21 PEPFAR-funded countries	PrEP initiators increased by 157% from 233,250 in the pre Covid-19 period compared with 599,935 in the Covid-19 period. PrEP uptake among AGYW increased by 159% from 80,452 AGYW in the pre-Covid-19 period to 208,607 AGYW in the Covid-19 period	Yes	Yes	Yes
Hanass-Hancock <i>et al.</i> , 2023	South Africa	We showed that it is possible to develop a gender-enhanced PrEP motivation and information workshop during the Covid-19 pandemic.	Yes	Yes	Yes
Matambanadzo <i>et al.</i> , 2021	Zimbabwe	PrEP uptake in 2020 occurred at rates <25% (315 initiations or fewer) per month prior to the emergence of Covid-19. Beginning May 2020, PrEP uptake increased monthly, peaking at an initiation rate of 51% (n =1360) in September 2020	Yes	Yes	yes

Henderson <i>et al.</i> , 2023	Globally including African countries (Mali, Namibia, Nigeria, Zambia, Zimbabwe, Uganda)	Across regions, PrEP providers supported differentiated service delivery and recommended expanding these approaches to increase the uptake and persistence on PrEP	Yes	Yes	Yes
Butler <i>et al.</i> , 2023	South Africa	There was high uptake of oral PrEP among AGYW accessing services and increases in the number of people initiated on PrEP over the course of the project despite the challenges of the Covid-19 pandemic	Yes	Yes	Yes

continuity during the Covid-19 lockdown period. However, looking at the findings of the included studies services were not only maintained but were also improved. For instance, the study by Kerzner *et al.*,²¹ showed an increase of 599,935 in PrEP initiators during Covid-19 period compared to 233,250 before the pandemic. In terms of PrEP uptake among AGYW, an increase of 208,607 during Covid-19 from 80,452 before the lockdown period was discovered²¹. Similar findings were achieved in Zimbabwe, where PrEP uptake initiators were low (315) in 2020 before the emergence of Covid-19 but the numbers increased to 1360 in September 2020³⁷. Furthermore, the findings showed that although there were recoveries in HIV services other interventions need to be improved according to the lessons learned to prepare for future pandemics.

Discussion

This systematic review aimed to identify and describe the innovative PrEP interventions implemented during the Covid-19 lockdown period among AGYW in SSA countries. Also, the attempt was to evaluate these interventions according to the feasibility, accessibility, and sustainability elements in preparing for future pandemics. The review also included studies reported on both PrEP interventions implemented before and during the Covid-19 pandemic. Including these PrEP interventions enabled the reviewers to present some comparisons between them in terms of the uptake and adherence among AGYW. From the included PrEP

interventions implemented before Covid-19, it is evident that there were challenges and successes in integrating PrEP into existing services. For instance, the nursing staff reported time constraints in the integration of PrEP within the antenatal/postnatal care and the maternal child health care services which resulted in low uptake and adherence³². Another study in Zimbabwe commended the feasibility of the integration, but the uptake and adherence of PrEP were very low among AGYW³¹. These key findings confirm what has been reported in various literature studies about the insufficient retention of PrEP particularly in SSA countries.

The included innovative interventions were not only focused on PrEP uptake but ranged from various sexual reproductive health services (family planning). Due to the very limited published literature on this area, different analysis methods were applied to provide a comprehensive overview of the retrieved articles. Additionally, the implementation of innovative interventions proved to have circumvented the impact of Covid-19 lockdown periods on HIV service continuity among AGYW.

However, the included innovative interventions were not equally acknowledged in various studies because in some instances services were improved and in others were not. For example, in the study of Matambanadzo *et al.*³⁷, the use of telehealth intervention was positively used for PrEP adherence counselling support for FSWs. However, the same intervention was dispraised as implementers could not reach some of the AGYW since they did not have their own cell phones³⁵. The

implementers also indicated that with the telehealth intervention, AGYW were not comfortable in discussing sensitive issues over the phone, particularly when they were surrounded by family members³⁵. The same discrepancies were also found in a study by Auchus et al⁴¹, where they quantified the impact of telehealth on retention in care for vulnerable HIV-infected populations at an HIV clinic in San Francisco. Based on the study findings, the overall nonattendance rate decreased by 3% after the telehealth transition and clients found the transition to be convenient and safe, however, some of the disadvantages of this were the technical barriers and unfamiliarity⁴¹. Furthermore, the positive impact of the use of telehealth intervention was mostly illustrated in medication adherence studies⁴³. Some consistencies were also noticed in how studies reported the benefits of the mobile service delivery intervention. In one study, PrEP providers highlighted that the intervention was more beneficial due to the limited mobility caused by the Covid-19 lockdown disruptions³⁸. Additionally, another study mentioned that mobile units like vans were utilized to maintain PrEP access to various communities and this was considered a best practice approach because the intervention was more accessible to many beneficiaries²¹. Similar trends have also been reported in a focused group discussion study involving HIV service delivery during Covid-19 among KPs in India⁴⁴. Gratitude for the door-to-door delivery of ART was expressed by service beneficiaries as the intervention enabled them to maintain treatment adherence⁴⁴.

The review also found discrepancies in some of the included studies, specifically on the WhatsApp app application. This intervention was accepted as a better interactive platform as it utilises less mobile data. However, the same technique was explained as not being conducive to reaching the targeted numbers of young women because it only allows six participants in a workshop³⁶. Similar findings were also illustrated in a study by Enyama et al⁴⁵, where the WhatsApp app was used for distance teaching during the Covid-19 pandemic in SSA. Learners had challenges in downloading the study materials as they contained large-size files⁴⁵. These contradictions can be explained by how the WhatsApp app was developed as well as its distinct features.

Another intention of this review was to assess the feasibility, accessibility, and sustainability elements. To achieve this, various questions were developed and utilized to evaluate if these elements were present within the developed and implemented interventions. However, the elements were not perceived as the same within various innovative interventions. The most significant element that was maintained in various interventions throughout the lockdown period was the accessibility of the PrEP interventions among AGYW. Because the lack of access had always been labelled as the contributing factor to the uptake and adherence of PrEP among the mentioned population¹¹. From the included studies, interventions like telehealth³⁷ and WhatsApp app³⁶ played a pivotal role in increasing continued access to various HIV services during the Covid-19 lockdown period. Additionally, it can be deduced that through the implementation of the included innovative interventions the accessibility element was well achieved because various platforms were utilized for service continuity.

The feasibility element was also important for the current review, as it is believed that the uptake of any given intervention by both service providers and beneficiaries depends significantly on how they perceive the intervention⁴⁶. The use of the WhatsApp app during the lockdown period was illustrated to be feasible because social distancing guidelines were maintained and connectivity among individuals continued. For instance, the conducted study in Zimbabwe showed that the WhatsApp app intervention enabled beneficiaries to report any adverse events about the PrEP side effects via the created group chat³⁷. Another feasibility element was indicated because young women were able to participate in an interactive workshop for PrEP uptake via the WhatsApp app since they had smartphones³⁶. Moreover, the feasibility of the implementation of these innovative interventions was noted in a study by Harkness et al⁴⁷, on the documentation of Covid-19-related disruptions and resilient innovations in HIV service delivery in Maimi-Dade County. Almost every service provider indicated that the disruptions of Covid-19 propelled their organizations to innovate interventions like telehealth services which were previously unavailable or had limited availability⁴⁷. As mentioned previously, the last intention of the

review was the evaluation of the sustainability element of the implemented innovative interventions. Because the sustainability of an effective intervention is important to improve health outcomes and reduce research waste⁴⁴. Therefore, the included innovative interventions showed that they can be sustained in the long term. For instance, the effectiveness of community-based service delivery proved to have increased the number of PrEP initiators compared to before the pandemic levels illustrating that the intervention can be adopted and used in the long-term³⁷. The sustainability element was also discovered in the use of telehealth and WhatsApp app interventions to improve PrEP continuation as they worked best for beneficiaries who were stable and adherent to the medicine³⁵. This element was also highlighted in other innovative interventions outside the SSA where constant meetings within the organizations led to more refined and sustained services. For example, during Covid-19 one sexual health clinic in Florida continually documented strategies and outcomes of the implemented innovative interventions among adolescents and young adults. These documentations illustrated the effectiveness of the interventions and produced various permanent changes such as the improvement of social media and online youth engagement⁴⁸. Additionally, this review showed that the different service delivery methods can and will improve the uptake and adherence of PrEP depending on the preferences of various beneficiaries.

Public health implications

Pre-exposure prophylaxis remains an effective prevention tool to reduce the high prevalence of new HIV infections among AGYW in SSA countries. However, it is well established that its uptake and adherence are lower among the above-mentioned populations. Contributing to this challenge was and is the lack of access to PrEP interventions. The Covid-19 lockdown period worsened its uptake but at the same time, brought opportunities to develop and implement innovative interventions that were previously thought to be unfeasible and costly. The significance of this review was to first identify and describe the implemented innovative PrEP interventions for service continuity among AGYW. Through these identifications and descriptions, success and challenges were illustrated to assist in

the adjustment of interventions that were not successful in improving the uptake and adherence of PrEP. The second attempt of this review was to evaluate whether these interventions were feasible and accessible as well as if they could be sustained in the long term. The findings have outlined prominent factors that proved the above elements with various innovative interventions. Furthermore, these outcomes can assist in the continuation of the implementation of these interventions aimed at improving PrEP uptake for the reduction of new HIV infections ahead of the 2030 targets.

Strength and limitations

The significant strength of this review was the application of rigorous analysis methods to provide a comprehensive overview of the retrieved records. Another strength was the inclusion of primary studies which led to the illustration of the lived experiences of the intervention implementers on the implementation of the innovative PrEP interventions. Moreover, the current review contains some limitations, for instance, the primary limitation is the lack of studies on the implemented innovative PrEP interventions during the Covid-19 lockdown period. Included papers were limited to only full-text articles published in English and excluded other language in the area. Another limitation was the inclusion of only articles that fall within the SSA countries which led to the exclusion of valuable contributions from other nations. To mitigate this limitation, future research is recommended where articles from broader perspectives can be included.

Conclusion

The findings have shown that the Covid-19 lockdown period has indeed disrupted the HIV services among KPs including AGYW. During this time, accessibility was highlighted as a significant element that hindered the uptake and adherence of PrEP which has also been the case even before the pandemic. However, through these disruptions, opportunities were provided to implement and upscale innovative interventions that were thought to be costly and unfeasible. These interventions improved services, particularly among KPs including AGYW and showed that they can potentially succeed if they can be continued across SSA countries. Irrespective of the highlighted

successes of these interventions, there is still a lack of literature in the existing studies on the innovative interventions implemented during Covid-19 lockdown period. Furthermore, this review recommends more research studies on the success and challenges of these interventions to prepare for future pandemics.

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Authors' contributions

LLO, RNP-M, and EP conceptualized the study and developed the protocol. LLO and EP conducted database searches and extracted the data from the eligible studies. RNP and EP assessed the quality of the review findings, and LLO wrote the first draft of the manuscript. RNP and EP were responsible for the supervision of the student (LLO). RNP provided technical and methodological feedback throughout the review process and assisted in writing the final manuscript. All authors read and approved the final manuscript.

Conflicts of interests

The authors have no conflicts of interest to declare.

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Appendix A: Sample search strategy in PubMed

Search	Query
# 1	Search: (AGYW OR adolescent female OR youths OR teens OR female adolescents OR teenagers OR young adults) "AGYW"[All Fields] OR ("adolescent"[MeSH Terms] OR "adolescent"[All Fields] OR ("adolescent"[All Fields] AND "female"[All Fields]) OR "adolescent female"[All Fields])
# 2	Search: (Pre-Exposure Prophylaxis OR PrEP OR methods OR delivery health care OR community distribution) "Pre exposure prophylaxis"[MeSH Terms] OR ("pre-exposure"[All Fields] AND "prophylaxis"[All Fields]) OR "pre-exposure prophylaxis"[All Fields] OR ("pre"[All Fields]
# 3	Search: (coronavirus disease 2019 OR SARS-CoV-2 infections OR covid-19 pandemic OR 2019 Novel coronavirus disease OR 2019-ncov disease) "Covid 19"[Supplementary Concept] OR "covid 19"[All Fields] OR "coronavirus disease 2019"[All Fields] OR "covid 19"[MeSH Terms] OR "covid 19"[Supplementary Concept] OR "covid 19"[All Fields] OR "Sars cov 2 infections"[All Fields] OR "covid 19"[MeSH Terms]
# 4	Search: (Sub-Saharan Africa OR SSA OR Africa OR South Africa OR Nigeria OR Congo OR Ethiopia OR Lesotho OR Botswana OR Cameroon OR Zimbabwe OR Rwanda OR Ghana OR Uganda OR Kenya) "Africa south of the Sahara"[MeSH Terms] OR ("Africa"[All Fields] AND "south"[All Fields] AND "Sahara"[All Fields]) OR "Africa south of the Sahara"[All Fields] OR ("sub"[All Fields] AND "Saharan"[All Fields] AND "Africa"[All Fields])
# 5	# 1 AND # 2 AND # 3 AND # 4

Appendix B: Results found in various databases

Databases	Search details	Results
Scopus	(pre-exposure prophylaxis OR prep) AND (intervention OR methods OR delivery service) AND (adolescent girls OR young women OR female adolescents) AND (covid-19 OR pandemic OR sars-cov-2 OR coronavirus AND disease 2019) AND (sub-Saharan Africa OR ssa OR South Africa OR Kenya OR Uganda)	68
Google Scholar	(pre-exposure prophylaxis OR prep) AND (intervention OR methods OR delivery of health care) AND (adolescent girls OR young women OR female adolescents) AND (covid-19 OR pandemic OR sars-cov-2 OR coronavirus disease 2019) AND (Sub-Saharan African countries)	978
MEDLINE	((((Pre-Exposure Prophylaxis OR PrEP OR methods OR delivery health care OR community distribution)) AND ((AGYW OR adolescent female OR youths OR teens OR female adolescents OR teenagers OR young adults))) AND ((coronavirus disease 2019 OR SARS-CoV-2 infections OR covid-19 pandemic OR 2019 Novel coronavirus disease OR 2019-ncov disease))) AND ((Sub-Saharan Africa OR SSA OR Africa OR South Africa OR Nigeria OR Congo OR Ethiopia OR Lesotho OR Botswana OR Cameroon OR Zimbabwe OR Rwanda OR Ghana OR Uganda OR Kenya))	88
PubMed	Search: (((((Pre-Exposure Prophylaxis OR PrEP OR methods OR delivery health care OR community distribution)) AND ((AGYW OR adolescent female OR youths OR teens OR female adolescents OR teenagers OR young adults))) AND ((coronavirus disease 2019 OR SARS-CoV-2 infections OR covid-19 pandemic OR 2019 Novel coronavirus disease OR 2019-ncov disease))) AND ((Sub-Saharan Africa OR SSA OR Africa OR South Africa OR Nigeria OR Congo OR Ethiopia OR Lesotho OR Botswana OR Cameroon OR Zimbabwe OR Rwanda OR Ghana OR Uganda OR Kenya)) Filters: Full text, Associated data, English, Female, Adolescent: 13-18 years, Young Adult: 19-24 years, from 2019/4/1 - 2023/7/31	128
Pre-Exposure HIV.gov	Prophylaxis– https://www.hiv.gov/search#query=innovative%20PrEP%20interventions%20implemented%20during%20covid-19&sortby=relevance	18
aidsmap.com/topic/prep	https://www.aidsmap.com/archive?keyword=innovative+PrEP+inteventions+implemented+during+covid-19	01
cdc.gov/hiv/basics/prep/about-prep.html	https://search.cdc.gov/search/?query=innovative%20PrEP%20interventions%20implemented%20during%20covid-19&dpage=1	10