

PROTOCOL

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# The HIV care and treatment cascade of adolescents and young adults living with HIV in sub-Saharan Africa: a systematic review and meta-analysis protocol

Patricia Silinda<sup>1\*</sup> , Alfred Musekiwa<sup>1</sup>  and Clarence Yah<sup>1</sup>

## Abstract

**Background** The Joint United Nations Programme on HIV/AIDS called for the end of the HIV pandemic by 2030 by setting the 95-95-95 HIV cascade targets. This cascade is used to monitor the progress of different populations in different settings. The progress of adolescents and young adults (AYA) living with HIV in sub-Saharan Africa (SSA) toward these targets remains unknown. We propose to conduct a systematic review and meta-analysis to assess the proportion of AYA retained at each step of the HIV care cascade in SSA.

**Method** Studies published between 2015 to date that reported on the HIV care cascade among AYA in SSA will be included. The following databases will be searched: PubMed/MEDLINE, Embase, Scopus, CINAHL, African Index Medicus (AIM), African Journals Online (AJOL), SABINET African Journals, HINARI (for institutional access to global journals) and University institutional repositories and gray literature sources will be searched. Two reviewers will independently screen titles and abstracts, assess the full texts for eligibility, and extract data. Disagreements will be resolved by consensus and consultation with a third reviewer. The number and proportion of AYA retained in the HIV care cascade from HIV diagnosis, initiation of ART, and viral suppression will be used for the meta-analysis. Random-effect statistical models will be used to estimate the pooled proportion of AYA retained at each step of the cascade. The results will be graphically represented via forest plots. Variability across studies will be assessed via heterogeneity test statistics ( $I^2$ ).

**Discussion** This systematic review aims to synthesize current evidence and identify gaps in the treatment cascade. The findings of this meta-analysis provide guidance for designing a framework to improve the care and treatment of AYA living with HIV.

**Systematic review registration** PROSPERO registration number CRD42024561024

**Keywords** HIV diagnosed, Antiretroviral therapy, Viral load suppression, HIV care continuum, 90-90, 95-95-95

## Introduction

The Joint United Nations Programme on HIV/AIDS (UNAIDS) set 95-95-95 goals to end the HIV pandemic by 2030 [1, 2]. These targets were introduced during the 2014 International AIDS Conference in Melbourne, when the UNAIDS proposed the 90-90-90 and 95-95-95 targets to accelerate the response to the AIDS epidemic by 2030 [2]. These targets recommend that by 2020 and 2030, at least 90% and 95% of all people living with HIV should be

\*Correspondence:

Patricia Silinda  
patsi2216@gmail.com

<sup>1</sup> School of Health Systems and Public Health, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa



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diagnosed, 90% and 95% of those diagnosed should be on antiretroviral therapy (ART), and 90% and 95% of those on ART should be virologically suppressed [2].

By the end of December 2022, 29.8 million people, accounting for 76% of all people living with HIV, were accessing ART; however, this progress remains uneven across regions and populations [3]. Although new HIV infections have decreased by 52% since their peak in 1997, adolescents and young adults (AYA) are the only group whose infection rate has not decreased, particularly adolescent girls and young women [4–6]. Eighty-five percent of the estimated 5.1 million HIV-positive AYA lived in sub-Saharan Africa (SSA) in 2022. SSA has the highest burden of HIV and the fastest-growing population of AYA in the world [7, 8]. Given that AYA transition biologically and cognitively into independent adults, their treatment challenges need to be addressed to reach the 2030 target of ending the AIDS pandemic, as defined in the Sustainable Development Goals [9–12].

The global progress toward the UNAIDS 95-95-95 targets among adults aged 15 years and older was 86%–89%–93%, and that among children aged 0–14 years was 66%–86%–84% [13]. The overall progress in Eastern and Southern Africa was 93%–83%–78%, whereas that in Western and Central Africa was 81%–76%–70% [14]. Botswana, Eswatini, Kenya, Malawi, Rwanda, Zambia, and Zimbabwe reported achieving their general population UNAIDS targets [14]. However, none of these countries has reported progress in their AYA populations. Evidently, routine data are not disaggregated to report on the AYA population, which limits the applicability of these findings to AYA [15]. Therefore, research is needed to understand the progress of AYA in the HIV care cascade in SSA. We plan to conduct a systematic review and meta-analysis to assess the proportion of AYA retained in each cascade step in SSA, which is home to most AYA living with HIV worldwide [16].

### Hypothesis

It is hypothesized that substantial attrition will occur at multiple stages of the HIV care cascade among AYA in SSA, with particularly pronounced losses observed between HIV diagnosis and ART initiation, and between retention in care and viral suppression. It is further hypothesized that cascade outcomes will differ by age subgroups (early adolescence, late adolescence, and young adulthood), geographic setting, and study quality.

### Methods

This protocol was planned according to the Preferred Reporting Items for Systematic Review and Meta-analysis Protocols (PRISMA-P) statement, and later the review report will be reported using either PRISMA or

PRISMA-prev and the review protocol was registered and published in PROSPERO [17–19].

### Electronic databases

We will conduct a thorough literature search with the assistance of an information specialist. We will limit our search to articles published in January 2015 to date. We will conduct a search in both international and regional databases to ensure comprehensive coverage, including gray and locally published literature. The following databases will be searched: PubMed/MEDLINE, Embase, Scopus, CINAHL, African Index Medicus (AIM), African Journals Online (AJOL), SABINET African Journals, HINARI (for institutional access to global journals) and University institutional repositories and gray literature sources. The regional databases were selected to ensure inclusion of studies conducted in or relevant to sub-Saharan Africa, particularly those not indexed in major international databases. The articles will be uploaded into EndNote reference management software. Data will be exported to Rayyan, where two reviewers will screen the articles.

### Search strategy

A standard search strategy will be used in PubMed and modified according to each database. The basic search strategy is built on the basis of the HIV care and treatment cascade. After the trial search, the search terms will be updated accordingly, and relevant search terms will be added if they are identified in the retrieved papers. We will modify the search strategy of Gueler et al., Additional file 1, who focused on the general population (> 15 years), while our search will concentrate on AYA aged 10–24 years [19]. The key terms “HIV cascade, HIV continuum of care, HIV testing and diagnosis, linkage to care, retention in care, ART initiation, and viral load suppression 90-90-90, 95-95-95” will be cross-referenced with terms associated with 62 African countries. Where appropriate, medical subject headings for HIV and AIDS will be used. The synonyms in each search will be grouped using the Boolean operator “OR.” The three search groups will be combined via the Boolean operator “AND.” Because the studies for this topic are limited, we will apply the age exclusion criteria during screening, as some studies stratify ages, with AYA as a separate group. Language, geographical location, and publication date will be applied as filters. We will update the search before publishing the review to include any additional eligible papers published after the initial search.

### Manual search

We will minimize bias by manually retrieving reports missed in the initial search. Reference lists of included studies and related or cited articles will be searched in PubMed and Google Scholar. PS and SB will conduct these searches independently. All potentially relevant articles will be screened by title, abstract, and full text. Articles meeting the inclusion criteria will be discussed by both reviewers and a third reviewer to reach consensus. The articles that are included will be documented in the PRISMA diagram.

### Preliminary research

With the information specialist’s help, we conducted a preliminary PubMed search to validate the proposal and confirm sufficient eligible articles for analysis. After several adjustments and discussions with the specialist and research team, we identified articles meeting the eligibility criteria. These results will be included in the systematic review (Table 1).

### Outcomes

The outcomes will include the number or proportion of people retained at each cascade step, which are HIV diagnosis (UNAIDS first 90/95 treatment target), initiation of ART (UNAIDS second 90/95 treatment target), and viral load suppression (UNAIDS third 90/95 treatment target).

### Selection of eligible studies

All records will be imported into one EndNote library, and duplicates will be removed. The remaining references will be imported into Rayyan software, which will be used to organize the screening and review process. We will screen the articles based on the criteria provided in the screening tool. Two reviewers, PS and SB, will screen potential studies independently, with the “blind on” activated in two phases. The first phase will include the title and abstract screening. The second phase will include full-text screening and the exclusion of non-relevant articles. If there are any conflicts, the reviewers will discuss the matter to reach a consensus. When necessary, a third reviewer will be consulted. Data will be extracted on study characteristics, population demographics, and cascade outcomes using a standardized, piloted data extraction form. All discrepancies and the reasons for inclusion or exclusion will be recorded in this Excel spreadsheet. The PRISMA study flow diagram reflects this process and explains why studies are excluded.

### Data elements

The data items for extraction will be informed by items reported in PRISMA statement [19, 20]. We will extract the following elements from the studies included (Table 2).

### Risk of bias assessment

To ensure the reliability and validity of the findings, we will conduct a thorough risk of bias assessment for each

**Table 1** Eligibility criteria

Criteria	Variables
Inclusion criteria	
Population	HIV-positive adolescents and young adults (AYA), aged 10–24 years, in SSA
Intervention	The HIV cascade (HIV diagnosed, started on ART, and retained on ART) UNAIDS first, second, and third 90 or 95 targets
Outcome	Reporting at least one step of the cascade, UNAIDS first 90 or 95 (HIV diagnosis), UNAIDS second 90 or 95 (ART initiation), and UNAIDS third 90 or 95 (Viral load suppression)
Design	Observational studies: cohort or cross-sectional studies
Period	Study period after 01 January 2015
Language	Studies published in English
Exclusion criteria	
Publication type	Studies without primary data will be excluded, including narrative reviews, letters to the editor, commentaries, conference abstracts, editorials, articles without full text, and theses.
Design	Non-empirical studies, studies with unreliable, duplicate, or overlapping data will be excluded.
Population	Children under 10 years old, adults over 25 years old, coinfecting patients (e.g., with tuberculosis), and specific subpopulations (e.g., sex workers, men who have sex with men, people who use or inject drugs) as these groups have unique risk profiles, care pathways, and structural challenges that differ significantly from the general AYA population and inclusion of such studies would introduce substantial heterogeneity and may obscure findings relevant to policy and practice for the broader AYA population.
Language	Non-English articles will be excluded. While we acknowledge the potential for language bias, resource constraints and the dominance of English as the language of publication in SSA limit our ability to include non-English studies. This approach is consistent with similar reviews in the field.

**Table 2** Data elements to be extracted from the included articles

Data element	Details
Details of the study	Authors, year of publication
Study characteristics	Study population, study design, aim of study, study period/year of data and key findings
Study setting	Geographic location
Characteristics of study populations	Sample size, age and sex, enrollment period
Laboratory baseline data	CD4 cell counts, WHO staging, and ART regimen
Cascade report	Number or proportion of persons diagnosed with HIV (UNAIDS first 90/95 treatment target), on ART (UNAIDS second 90/95 treatment target), virological suppression (UNAIDS third 90/95 treatment target)

included study based on the JBI Prevalence Studies Checklist. Studies will be categorized as having low, moderate, or high risk of bias, and this appraisal will inform the interpretation and sensitivity analyses of the findings. Two reviewers will assess risk of bias independently, and discrepancies will be resolved by discussion, and where necessary, a third reviewer will be consulted. Before risk of bias assessments begin, reviewers will complete calibration exercises on a sample of studies and reach consensus on how to apply tool items in our context. This process will increase consistency and reduce subjective differences between reviewers.

#### Data synthesis

Before analysis, the extracted data will be cleaned and formatted for analysis. Meta-analysis will be conducted using Stata version 18 (StataCorp, College Station, TX, USA). Proportions at each cascade step (e.g., % diagnosed, % on ART, % virally suppressed) will be synthesized using the metaprop command. Forest plots will be generated to visually display pooled estimates and confidence intervals for each cascade step. Between-study variance ( $\tau^2$ ) and  $p$  values for heterogeneity will be reported. We anticipate substantial between-study heterogeneity, and further analyses will focus on identifying these sources of heterogeneity. The  $I^2$  statistics will be calculated to indicate the proportion of variance due to true differences: 25% (low), 50% (medium), and 75% (high) [21, 22]. Associations between cascade proportions and age group (10–14; 15–19 and 20–24 y/o), country, setting, and study characteristics will be explored using random intercept logistic meta-regression (binomial-normal models), which avoids biases of normal-normal models, and will be applied to logit or arcsine-squared root transformed proportions. Studies deemed unsuitable for meta-analysis after team review will be excluded.

#### Dealing with missing data

For studies with missing key variables, authors will be contacted via email for clarification. Missing data will

be described for each study. If missing data cannot be retrieved, the study will be excluded from the meta-analyses. Sensitivity analysis will be used to assess the impact of missing data on the results and will be discussed in the final review.

#### Discussion

This systematic review will include studies from SSA reporting on at least one step of the UNAIDS HIV care cascade among AYA. Fewer studies are expected due to limited routine data for 10–24-year-olds. We anticipate variations in age definitions across settings. This systematic review and meta-analysis aim to improve understanding of the HIV care cascade and estimate the proportions of AYA retained at each stage. Findings will highlight gaps, inform future research, and guide strategies to improve HIV care for AYA in SSA and other low- and middle-income countries.

#### Strengths and limitations

Despite the review's value in tracking HIV care among AYA in SSA, challenges include heterogeneity from age band variations and evolving WHO ART guidelines. Country-level differences in viral suppression definitions and thresholds may also affect results. Including studies with small sample sizes may limit the precision of the meta-analysis. Statistical techniques will be applied to ensure robust findings. Application of country-specific filters in the search strategy to restrict results to SSA is another anticipated limitation. While this approach is intended to ensure geographic relevance, it may lead to the exclusion of eligible studies that do not explicitly mention the country/regional name in the title, abstract, or indexing metadata and potentially limiting the comprehensiveness of the evidence base and introducing geographic bias.

#### Conclusion

This systematic review will synthesize current evidence and identify gaps. These findings will inform more effective interventions to support HIV care and treatment for AYA in SSA.

## Abbreviations

ART	Antiretroviral therapy
AYA	Adolescents and young adults
HIV	Human immunodeficiency virus
PRISMA-P	Preferred Reporting Items for Systematic Review and Meta-analysis Protocol
PROSPERO	International Prospective Register of Systematic Reviews
SSA	Sub-Saharan Africa
UNAIDS	Joint United Nations Programme on HIV/AIDS
WHO	World Health Organization

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s13643-025-02941-w>.

Supplementary Material 1. PubMed search strategy.

Supplementary Material 2. PRISMA-P checklists.

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## Authors' contributions

Patricia Silinda: conceptualized the study, writing of the original draft, and edited the final draft. Alfred Musekiwa: conceptualized and designed the study, contributed to writing, reviewing, editing, and supervised the development of the protocol. Clarence Yah: contributed to reviewing, editing, and supervised the development of the protocol.

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## Declarations

### Ethics approval and consent to participate

Not applicable.

### Consent for publication

Not applicable.

### Competing interests

The authors declare that they have no competing interests.

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