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Interventions to Improve Adolescent HIV Care Outcomes

Marta I Mulawa, PhD, MHS[1,2], **Elizabeth T Knippler, MPH**[1], **Maryam Al-Mujtaba, MS**[1], **T. Harper Wilkinson**[3], **Venkata K. Ravi**[3], **Leila S. Ledbetter, MLIS**[4]

[1]School of Nursing, Duke University, Durham, NC, United States

[2]Duke Global Health Institute, Duke University, Durham, NC, United States

[3]Duke University, Durham, NC, United States

[4]Duke University Medical Center Library and Archives, Durham, NC, USA

Abstract

Purpose of review: This review of recent studies evaluating interventions to improve HIV care outcomes among adolescents with HIV (AHIV) was conducted to provide a comprehensive overview of the recent evidence, highlight promising approaches, and suggest directions for future research.

Recent findings: Our scoping review revealed 65 studies evaluating a variety of interventions and using a range of study designs at various stages of research. Effective approaches included community-based, integrated service delivery models with case management, trained community adolescent treatment supporters, and consideration of social determinants of health. Recent evidence also supports the feasibility, acceptability, and preliminary efficacy of other innovative approaches, including mental health interventions as well as technology-delivered approaches, however, more research is needed to build the evidence base for these interventions.

Summary: Our review's findings suggest that interventions providing comprehensive, individualized support are essential to improving HIV care outcomes among adolescents. More research is needed to build the evidence base for such interventions and ensure effective, equitable implementation to support the global target of ending the AIDS epidemic by 2030.

Keywords

Adolescents; HIV/AIDS; HIV care outcomes; interventions; adherence; care engagement

Corresponding Author: Marta I Mulawa, PhD, MHS, School of Nursing, Duke University, DUMC 3322, Durham, NC 27710, Phone: (919) 684-9555, marta.mulawa@duke.edu.

Conflict of interest

Marta Mulawa, Elizabeth Knippler, Maryam Al-Mujtaba, T. Harper Wilkinson, Venkata Ravi, and Leila Ledbetter declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

Disclaimer

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Supplementary Information

The complete reproducible search strategy, including date ranges and search filters, is provided.

Introduction

Despite the significant progress made in the global response to HIV/AIDS, the epidemic continues to disproportionately affect adolescents [1]. Adolescents with HIV (AHIV) face unique challenges, including adjusting to developmental changes, complex social transitions, and the stigma and discrimination associated with HIV/AIDS. These challenges can lead to delayed diagnosis, poor adherence to treatment, and a higher risk of being lost to care. The transition from pediatric to adult care is also a challenge for many AHIV, who must simultaneously adapt to managing their own healthcare and cope with other social and emotional changes. There is a growing need to identify effective interventions that can improve HIV care outcomes for AHIV, which is critical to achieving the global target of ending the AIDS epidemic by 2030 [2].

Although several reviews have investigated interventions to improve HIV care outcomes among AHIV in recent years, the evidence base remains fragmented. Most recent reviews have synthesized evidence from interventions targeting only one or two specific HIV care outcomes. For example, three reviews focused solely on ART adherence interventions [3–5] and two reviews focused on ART adherence and retention interventions [6,7]. Some recent reviews have provided evidence on the effectiveness of specific types of interventions (e.g., mental health or psychosocial support interventions [8–11••], self-management interventions [12], mHealth interventions [13–15], interventions supporting transition from pediatric to adult healthcare [16]). Other reviews have been limited to specific geographical settings (e.g., sub-Saharan Africa [5–7,14] or low-middle income countries [4,8,13]).

This scoping review aims to synthesize and evaluate recently published studies (i.e., those published within the last 5 years) evaluating a wide range of interventions designed to improve various HIV care outcomes for adolescents with HIV (10–24 years of age). Multiple HIV care outcomes are considered, including linkage to care, adherence to ART, retention in care, and viral suppression. By reviewing and synthesizing the recent evidence, this review aims to provide a comprehensive overview of current interventions and study designs, highlight promising approaches, and suggest directions for future research.

Methods

Search strategy

The search was developed and conducted by a professional medical librarian in consultation with the author team and included a mix of keywords and subject headings representing adolescents and HIV.

The search was conducted in Medline via PubMed. A search hedge was used to narrow publications to those using study designs appropriate for establishing a cause-and-effect relationship between the intervention and HIV care outcomes (e.g., randomized controlled trials and quasi-experimental designs inclusive of non-equivalent group designs and one-group pretest-posttest designs). The search was limited to the past 5 years and conducted on January 24, 2023. The complete reproducible search strategy, including date ranges and search filters, is detailed in the Supplementary Materials.

Eligibility Criteria

The eligibility criteria for this review were intentionally broad to capture a comprehensive range of interventions, study designs, and settings. We used an expanded definition of adolescence (10–24 years) considered to correspond more closely to current patterns of adolescent development and social role transitions [17]. We included interventions that broadly aimed to improve any HIV care outcomes, including linkage to care, ART uptake, ART adherence (e.g., self-report, electronic pill monitoring, pharmacy records, pill counts, biomarker measures), care engagement, CD4 count, viral load or viral suppression, and retention in care.

Studies were included if they met each of the following criteria: (1) mean or median age of sample at baseline within the range of 10–24 years, (2) quantitative HIV care measures reported, (3) study evaluated a relevant intervention, and (4) study design met criteria. We excluded studies that (1) reported solely on outcomes related to HIV prevention (e.g., PrEP uptake) or testing, (2) evaluated exclusively pharmacological differences in ART regimens (e.g., dosage or medication type), (3) evaluated the implementation of evidence-based policies and guidelines (e.g., “test and treat”) without further intervention, or (4) had a sample size of less than 10. Review papers were excluded from our scoping review but were systematically flagged to inform the background literature for the paper. Only publications in English were included in this review.

Selection Process

After the search, all identified studies were uploaded into Covidence, a software system for managing systematic reviews [18]. Duplicates were removed by the software. Study screening was carried out independently by two authors. Studies were excluded if they did not clearly meet inclusion criteria based on title and/or abstract review. All disagreements were resolved through discussion and consensus.

For the full-text assessment of study eligibility, papers were reviewed in detail by two independent reviewers and excluded if they did not meet the inclusion criteria. Any conflicts between the two independent reviewers were resolved through discussion at each stage of the selection process.

A total of 1,658 citations, grouped as 1,650 studies, were identified from the database search. Following the removal of duplicates (n = 1), 1,649 studies were screened in the title/abstract phase. Ninety-four studies were included in the full-text assessment of study eligibility. Sixty-five studies (73 citations) met the inclusion criteria (Fig 1).

Data Extraction and Analysis

Data from the 65 included studies were extracted using a standardized data extraction form implemented in Covidence. One extraction form was completed for each study, which could include data from multiple citations reporting on the same intervention. Extracted items included information about the study setting and sample (i.e., country, age of participants, number of relevant participants, sub-populations of AHIV targeted by the intervention), intervention characteristics (i.e., name and description, intervention component[s], and

setting[s] of intervention), study design and phase of research, and HIV care outcome[s] reported. Response options for extracted characteristics, including sub-populations targeted, intervention components, and intervention settings, were derived by consensus during the team's review of included studies in the study selection process and reflected the most common elements or categories observed during review. Interventions were then categorized by our team as "effective" if they had a statistically significant positive effect on at least one HIV care outcome reported at any time point of follow-up, regardless of the phase of research or study design employed. Interventions were considered promising if results were not statistically significant but had a positive trend toward desired outcomes. In any instance in which mean or median age was not directly reported, the team calculated an estimate based on the data provided. In studies that included both HIV prevention and care outcomes, the number of relevant participants was recorded as the number of participants with HIV. Data for each study were extracted by one reviewer, then reviewed by a second reviewer. Questions arising during extraction were discussed among team members to reach consensus. The final data were analyzed to generate descriptive statistics using R [19].

Results

Overview of Included Interventions

The characteristics of the interventions evaluated in the included studies are described in Table 1. Forty-two studies (64.6%) were conducted in sub-Saharan Africa [20–68], and fourteen (21.5%) were conducted in Northern America [69–83]. Five studies (7.7%) were conducted in Latin America and the Caribbean [84–88]. Only two studies (3.1%) were conducted in Southern Asia [89,90], and only one was conducted in South-eastern Asia [91]. Only one study [92] was conducted in more than one region.

Most of the studies evaluated interventions that did not target any specific sub-population but rather focused on the general population of AHIV or AHIV needing adherence support; however, some studies did focus on interventions that were narrower in focus. For example, eight studies (12.3%) focused on AHIV who were recently diagnosed, five (7.7%) focused on AHIV with mental health needs, and four (6.2%) focused on AHIV with perinatally-acquired HIV. Three studies (4.6%) focused broadly on adolescent girls and young women, and three studies (4.6%) focused on pregnant or postpartum AHIV or those who were teen mothers.

Support groups and individual counseling were the two most used (each used in 36.9% of studies) intervention components. Support groups often involved a group of AHIV coming together to share their experiences, provide emotional support, and learn coping strategies from one another but operated in varied ways with different types of facilitators. For example, effective interventions (i.e., interventions that reported a statistically significant effect on at least one HIV care outcome reported at any time point of follow-up) that used support groups included support groups facilitated by youth ambassadors [47], co-facilitated by a mental health professional and HIV-positive peer [72], and co-facilitated by a support group leader (e.g., volunteer nurse, teacher, or social worker) and a community adolescent treatment supporter [38]. Individual counseling or coaching interventions involved one-on-one interaction between the adolescent and the individual offering counseling. There

were several effective/promising interventions with individual counseling components, which often utilized evidence-based approaches, including structured problem-solving and motivational interviewing [71,76,81,83], or were described as providing general psychosocial support or adherence counseling. Counseling was provided by various types of individuals, including HIV clinic staff, community-based health/support workers [36,53,71], peer counsellors [38], or other types of study team members (e.g., clinical social workers or staff unrelated to the clinical care sites) [76,83].

Technology-based interventions, family support interventions, and peer support (defined as individuals with similar experiences supporting one another outside a support group) were the next commonly used interventions, with each being used in 26.2%, 26.2%, and 24.6% of studies, respectively. Effective/promising technology-based interventions included remote coaching sessions informed by real-time adherence data [83]; a comprehensive mobile application including a community forum, topical blogs, medication reminders, and private chat [77]; interactive and tailored SMS reminders [26]; and two-way/interactive SMS plus peer navigation [57]. Family support interventions involved approaches to offer family members and caregivers support to better meet the needs of their AHIV. Effective/promising interventions providing family support included one that provided caregiver support groups during AHIV clinic days [42], and one that engaged primary caregivers in parenting and economic strengthening activities [29]. Another effective family support intervention used a home visitation model to increase family supportiveness to improve uptake of health and social services [37]. Peer support approaches included support provided by peer counselors trained to deliver adherence and psychosocial support in their communities [53].

Nearly a quarter (21.5%) of interventions could be described as constituting a new care delivery model (e.g., a new approach to providing care, often with an explicit acknowledgement of the unique needs of AHIV). One such intervention involved creating youth-only spaces, training youth-friendly counsellors, and integrating primary healthcare services into youth adherence clubs [62]. Another effective intervention, designed to improve uptake of HIV testing and linkage to care, comprised a “comprehensive package of services” which included building health worker capacity, decentralizing services, implementing an adolescent-focused HIV risk screening tool, and offering adolescent-friendly hours on evenings and weekends [56]. Another study examined retaining AHIV in pediatric clinics rather than transitioning them to adult care when they turn 12 years old [30].

Case management was used in 18.5% of interventions. Case management involves having an individual, usually a healthcare professional, helping a patient navigate the healthcare system and access necessary resources and social services. One example of a promising case management intervention employed an outreach coordinator who provided assistance navigating the health system and connected AHIV to services such as housing, transportation, health insurance, and food assistance [76]. Other effective/promising interventions used clinical and community volunteer networks to improve case management [29] or engaged community-based support workers to provide one-on-one counseling regarding adherence as well as support and referral for psychosocial problems and nutrition security [36].

Notably, only 14 interventions (21.5%) were characterized by our team as using a single intervention component (e.g., support groups, individual counseling, technology-based intervention). Most interventions were composed of multiple components: specifically, 35.4% used two intervention components, and 43.1% used three or more.

A large majority of the studies (73.8%) evaluated interventions that had at least one component delivered in a health facility. Over one-third (35.4%) used technology to deliver at least one component of the intervention. Nearly one quarter of the studies (21.5%) had a home-based component, and 25% had a community-based component that extended beyond the home setting. School-based interventions were the least common, with only 6.2% of studies containing interventions conducted in this setting. Although most interventions (60%) were implemented in only one setting, 23.1% of interventions had components in two settings, and the remaining 15.4% of interventions had components in three or more settings.

HIV Care Outcomes Measured

The HIV care outcomes used to evaluate interventions are described in Table 2. The most common HIV care outcome reported was viral load or viral suppression (70.8% of studies), and the next frequent was self-reported adherence (41.5%). Although less common, some studies used other measures of adherence, including electronic monitoring (e.g., Medication Event Monitoring System [MEMS] bottle cap), pharmacy records, pill counts, or biomarkers (e.g., measurement of ART present in hair samples); several studies also reported on multiple measures of adherence. One-third of studies (33.8%) reported outcomes related to retention in care or care engagement, and 17 studies (26.2%) presented CD4 results. The majority of interventions targeted AHIV in care, but some broader interventions focused on the HIV care cascade, including HIV prevention, testing, and linkage to care; nine studies (13.8%) reported outcomes related to linkage to care or ART uptake. Other reported outcomes included mortality (two studies) and maternal-to-child transmission of HIV (one study).

Overview of Evaluation Designs and Significant Findings

The characteristics of the studies used to evaluate interventions are described in Table 3. Evaluation designs varied in terms of the phase of research (e.g., real-world implementation, effectiveness, or feasibility/efficacy) as well as the study designs used in each phase of research, which impacted the reliability, validity, and risk of bias of the findings. The included studies are presented according to their study design and phase of research in Table 4. Over one-quarter of the studies (17 studies; 26.2%) were categorized by our team as evaluating the real-world implementation of larger-scale interventions, with an average sample size of 1,480 AHIV. Of these studies, 52.9% of interventions (9 out of 17 studies) were categorized by our team as effective. Two of the effective interventions were evaluated with rigorous pre-post quasi-experimental designs that included a comparison group, including the home visitation model to increase family supportiveness, which increased the proportion of adolescent mothers with HIV whose viral load was suppressed [37]. The other study demonstrated that receipt of a community-based, integrated service delivery model to strengthen household capacity was associated with significant improvements in current

ART use [29]. Notably, both studies included case management to ensure that adolescent participants were able to access needed services.

Five of the effective real-world implementation studies were evaluated with slightly less rigorous quasi-experimental designs that included a comparison group but examined post-only data. One of these studies demonstrated that a combination HIV prevention and care intervention for adolescents incorporating HIV testing and linkage to HIV prevention and care services resulted in significant increase in AHIV on ART [34]. Another found that participants who were exposed to two or more components of a layered intervention including HIV testing, sexual reproductive health services, social-asset building, and other approaches were more likely start ART [32]. One study showed that creating youth-only spaces and training youth-friendly counsellors was associated with lower attrition among AHIV [62]. Another study revealed that adherence counseling home visits conducted by community-based health workers, who also provided support and referral for psychosocial problems and nutrition security, were associated with significantly improved retention in adolescents and youth receiving ART [36]. Finally, one study showed that community interventions that included a combination of peer support, caregiver involvement, and other activities focused on disclosure, stigma reduction, and discrimination could significantly improve retention, although retention was only significantly improved among the younger (10–14 years) age group [47].

Sixteen studies (24.6%) were smaller-scale studies that rigorously evaluated the effectiveness of interventions, with an average sample size of 479 AHIV. Of these studies, 43.8% (7 out of 16 studies) were found to be effective. One effective intervention was evaluated using a cluster randomized controlled trial (RCT); the study found that trained community adolescent treatment supporters led to a significant reduction in virological failure among AHIV at 96 weeks compared to those receiving standard care [38]. Three other effective studies were evaluated by individual randomized controlled trials, including one which found that community adolescent treatment supporters improved linkage to services, retention in care, self-reported adherence, and psychosocial well-being among adolescents living with HIV in rural Zimbabwe [53]. The second RCT demonstrated improvements in viral load and alcohol use among AHIV when they received a motivational intervention in the clinic setting [71]. The third RCT provided evidence that a brief problem-solving and psychoeducation intervention was effective in reducing depressive symptoms and improving adherence in AHIV in Botswana [33]. The last effectiveness study demonstrating a positive effect on HIV care outcomes used a time series design study and showed that a multi-pronged strategy that included youth-focused coalitions who advocated for system-level changes (e.g. improvement to transportation and health insurance post-diagnosis) improved timely linkage to care among newly diagnosed HIV-infected youth [73].

Finally, nearly half (49.2%) of the studies were focused on evaluating the feasibility and/or efficacy of interventions, with an average sample size of 79. Of these, 40.6% (13 out of 32 studies) were considered “effective” given their statistically significant results, though all studies in this category were in early phases of research examining feasibility and/or efficacy. Seven of these studies used RCTs, including one that found improved

pharmacy refill rates among adolescents and young adults newly initiating ART who received a 3-session behavioral problem-solving and motivational interviewing intervention targeting medication adherence [81]. Another RCT found that a 9-session mindfulness-based stress reduction program was associated with improvements in HIV viral load but not changes in self-reported medication adherence or CD4 counts [82]. An RCT with newly diagnosed AHIV found that a gender-specific, group-based intervention was associated with greater likelihood of ART use and viral load decline compared to a health education control condition [72]. An RCT of a remote coaching mHealth intervention found that 12 weeks of a triggered escalating remote coaching intervention improved electronic dose monitoring indicators of adherence but had no effect on viral load suppression [83]. A multicenter RCT demonstrated the feasibility and efficacy of interactive and tailored SMS reminders on improving viral load but not adherence among AHIV [26]. A multi-country RCT demonstrated the non-inferiority of short cycle therapy (i.e., weekends off treatment) for maintaining virological suppression compared to continuous (i.e., daily) therapy over a median 3.6-year follow-up [92]. Another small pilot RCT reported that an active visualization intervention led to lower viral loads among intervention participants [74].

Six additional feasibility/efficacy studies using quasi-experimental designs demonstrated significant findings on at least one outcome. One that used a non-randomized comparison group with a pre-post design to study the impact of motivational interviewing and intensive case management intervention reported that the proportion of participants who had an undetectable viral load after one year was higher in the intervention compared to the standard of care arm [76]. One of the two studies with significant effects using a non-randomized comparison group with post-only analysis found that the Positive Peers App, a muti-functional tool enhanced by a social media support network, improved clinical outcomes for young people with HIV, with PPA participants more likely to obtain laboratory tests and achieve viral suppression [77]; the second reported that vitamin D supplementation was associated with improved CD4 counts among AHIV with suboptimal vitamin D levels [90]. Three studies without comparison groups also had significant pre-post effects: One focused on the feasibility and acceptability of support groups during clinic hours, showing improved clinic attendance but no changes in viral suppression or CD4 count [44]; the second revealed a significant increase in viral suppression and ART adherence following daily two-way text messaging and peer navigation [57]; and the third found that a 1-month yoga intervention was associated with improvement in immune parameters and viral load reduction. Notably, 25% of the feasibility/efficacy studies (8 studies) did not test for statistical significance because they were underpowered. Many of these studies reported promising findings, including one study of a pilot group-based mental health intervention with promising trends of ART adherence and viral suppression outcomes [63]. Another such study evaluating the combination of five individual counseling sessions with daily text message reminders and video vignettes found trends of increased ART adherence in the intervention condition as well as improvements in mediators including adherence self-efficacy and social support [75].

Discussion

Our review of recent literature describing interventions to improve HIV care outcomes among AHIV revealed 65 studies evaluating a variety of interventions and using a range of study designs at various stages of research. The review included 17 studies focused on evaluating real-world implementation of interventions for AHIV. Although this is a promising increase, these types of implementation studies must continue to be prioritized in order to assess the impact of these interventions in diverse populations and settings [93•]. The results from these studies provide valuable information on the outcomes of interventions when they are implemented in less controlled, non-research-intensive conditions. Among these studies, community-based, integrated service delivery models with case management were consistently found to be effective in improving viral load suppression and ART adherence among AHIV. This finding is consistent with calls to prioritize the development and evaluation of differentiated service delivery models tailored to the needs of AHIV [94•]. To increase our understanding of contextual factors that may influence outcomes when interventions are implemented in real-world settings, it is essential for future research to collect and analyze process evaluation data as well. Such process evaluation data can inform continuous program improvement [95] and can help identify resources, training, and support needed for successful implementation and sustainability of intervention programs.

Our review identified several recent effectiveness studies, which had smaller sample sizes but used rigorous evaluation designs, often in more controlled conditions. These studies highlighted the importance of training youth-friendly counselors and offering youth-only spaces, engaging community adolescent treatment supporters, and providing problem-solving and mindfulness in improving HIV care outcomes among AHIV. The findings from these studies emphasize the importance of tailored and targeted interventions that address the specific needs and challenges faced by AHIV. To maximize the relevance and potential impact of interventions, it is critical to meaningfully engage adolescents and youth throughout the research process, including the use of participatory research methods [96••].

Several promising approaches were identified, yet notably few studies were able to rigorously evaluate intervention effects. A substantial amount of research published within the past 5 years has focused on evaluating the feasibility and/or efficacy of interventions. Several of these studies highlighted the feasibility, acceptability, and preliminary efficacy of technology-based interventions, including comprehensive multifunctional apps, remote coaching, and daily 2-day text messages and peer navigation. Although many of these studies showed promising effects and trends towards improvement in HIV care outcomes for AHIV, more research is needed to build the evidence base for these interventions. As technology becomes more affordable and internet access continues to expand globally, future research should leverage the potential scalability of existing interventions while also recognizing the need for adaptation to local cultural contexts and responsiveness to unique needs of specific sub-populations. Development of nimble technology-based interventions that can keep up with rapid technological advancements (e.g., growing use of artificial intelligence and large language models) while maintaining robust confidentiality and data security protocols is needed.

We observed that few interventions were evaluated outside of Africa and the United States. Notably, regions such as East Asia, the Middle East, Europe, and Oceania were not represented in the recent literature at all. Although thoughtful cultural adaptation can lead to successful implementation of evidence-based interventions across geographic settings, it is important that intervention development draw on the unique strengths of a region, leverage local resources, and address context-specific barriers that may impact HIV care outcomes for AHIV.

Our review highlights the need for comprehensive, multi-level interventions that target multiple determinants of HIV care outcomes, including social determinants of health. The majority of studies (nearly 80%) used more than one intervention component, and several took a broad approach to their interventions by addressing factors including housing, transportation, and food security; this is consistent with previous calls to provide social protection services or other economic strengthening interventions in combination with psychosocial and parenting support to most effectively support AHIV, particularly in a context of extreme poverty [11••]. To inform the development of novel multi-level interventions, it is important for future intervention research to collect data on social determinants of health and use a holistic lens in the analysis of intervention effects; exploring the extent to which intervention effects are moderated by social determinants of health may inform future intervention effects. Research examining the mechanisms through which social determinants of health shape inequities in HIV care outcomes among adolescents may also reveal novel intervention opportunities [97•].

Mental health also emerged as an important pathway to improved HIV care outcomes. Effective intervention approaches included mindfulness-based stress reduction interventions as well as problem-solving and cognitive behavioral therapies; however, we observed that our review included interventions that improved mental health outcomes yet did not improve HIV care outcomes. For example, one study evaluating a cognitive-behavioral therapy and medication management algorithm for treating depression among youth with HIV found significant improvements in common mental health outcomes but no differences in viral suppression [69]. Another study evaluating an intervention based on problem-solving therapy found a substantial improvement in mental health but no impact on viral suppression [39]. These studies suggest that mental health challenges are an important contributor to HIV care outcomes, but treatment of mental health conditions alone may not be sufficient to improve overall health outcomes.

Although less common than using multiple intervention components, nearly 40% of studies had interventions delivered in two or more settings. We observed that even when technology was not a focus of the intervention itself, it was often used to support the delivery of a component, such as a booster counseling session via telephone. Technology-facilitated intervention delivery and the use of community-based workers provide the potential to reach a wider range of AHIV, particularly those who may not be engaged in care at a health facility. These findings speak to the importance of implementation science research to systematically examine the effectiveness of various implementation strategies. Such research can inform the most efficient and potentially effective strategies to maximize the reach, effectiveness, and sustainability of intervention efforts. It is also essential for implementation

research to move beyond focusing on acceptability and feasibility outcomes to address penetration, cost, sustainability, and scale-up [98]. As the evidence base of effective interventions to support HIV outcomes for AHIV builds, implementation science and knowledge utilization will be critical to ensure the translation of evidence-based intervention into practice. Researchers must also be able to effectively communicate their findings to policymakers, public health practitioners, and the general public [99].

Finally, it is essential that future research and programs employ an equity lens and recognize systems of oppression that contribute to health disparities [100]. HIV disproportionately impacts certain groups of adolescents; there are significant disparities in HIV prevention and care outcomes related to factors such as socioeconomic inequalities, racism, discrimination based on sexual orientation and gender identity, stigma, and legacies of colonialism [101]. Researchers must prioritize equitable solutions to advance care for AHIV and consider who may be excluded from their interventions or research process. Bringing an equity lens to existing programs may include studying the extent to which intervention effects differed among sub-groups of AHIV, prioritizing community voices at all stages of research, examining potential sources of bias in methods or measurement, reducing barriers to participation in research, examining and addressing power dynamics within research partnerships, and ensuring the accessibility of research findings.

Conclusion

Our review of the recent literature on interventions to improve HIV care outcomes among AHIV found robust evidence supporting several intervention approaches, including community-based, integrated service delivery models with case management, trained community adolescent treatment supporters, problem-solving and psychoeducation, and interventions that address social determinants of health. Recent evidence also supports the feasibility, acceptability, and preliminary efficacy of other innovative approaches, including mental health interventions as well as technology-delivered approaches, however, more research is needed to build the evidence base for these interventions. Overall, the findings suggest that providing comprehensive, individualized support to AHIV is essential to improving their HIV care outcomes. Bringing an equity lens and investing in implementation science research is essential as we strive to develop and effectively implement interventions to reduce disparities in HIV care outcomes for adolescents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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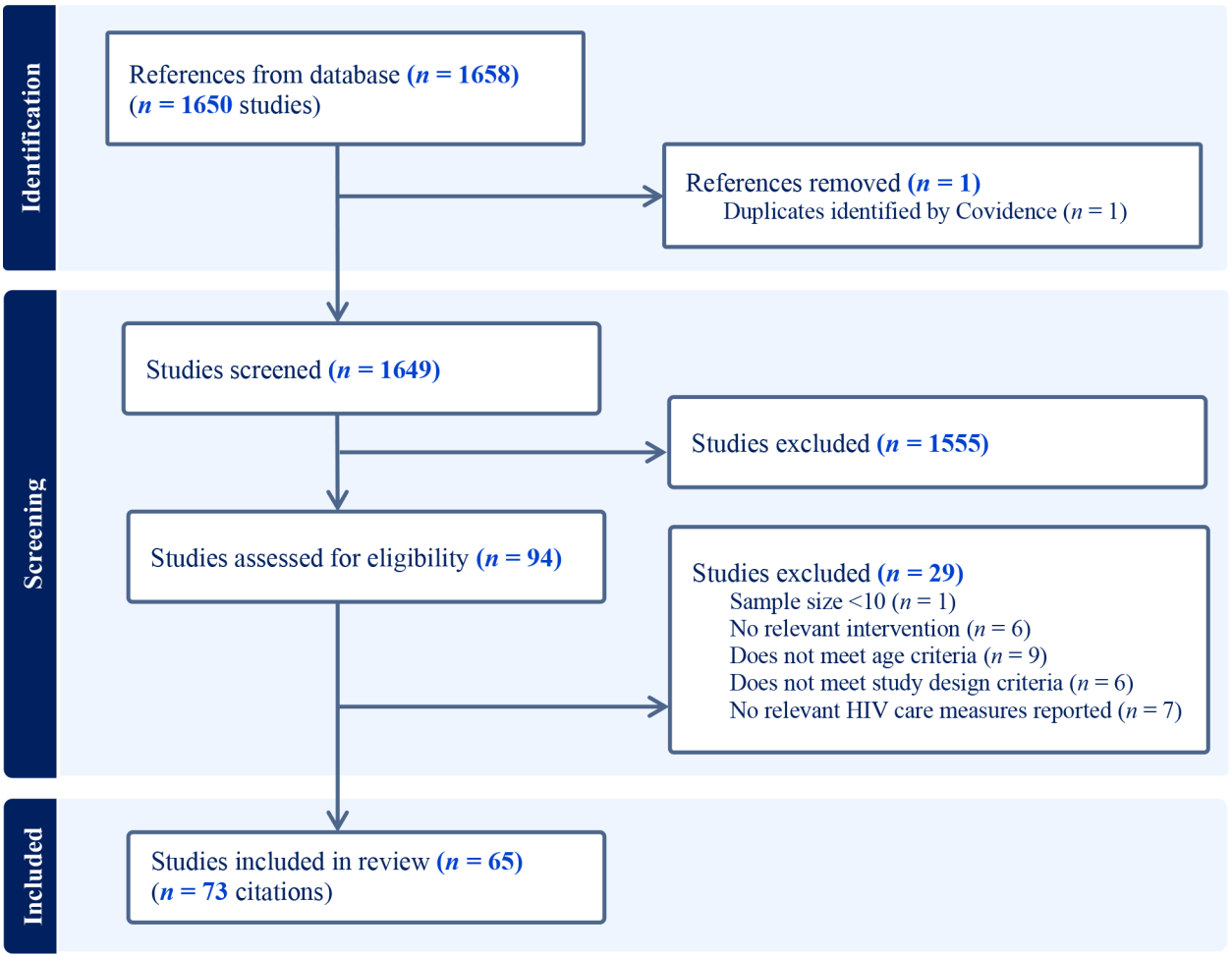

Fig 1.
Flowchart of the study selection process.

Table 1.

Characteristics of included interventions (n = 65)

Characteristic		n (%)
Region of the world		
	Sub-Saharan Africa	42 (64.6%)
	Northern America	14 (21.5%)
	Latin America and the Caribbean	5 (7.7%)
	Southern Asia	2 (3.1%)
	South-eastern Asia	1 (1.5%)
	Multiple regions	1 (1.5%)
Sub-population targeted		
	AHIV needing adherence support	12 (18.5%)
	Recently diagnosed	8 (12.3%)
	AHIV with mental health needs	5 (7.7%)
	AHIV with perinatally-acquired HIV	4 (6.2%)
	Adolescent girls and young women	3 (4.6%)
	Pregnant, postpartum, or teen mothers	3 (4.6%)
Intervention component(s)		
	Support groups	24 (36.9%)
	Individual counseling	24 (36.9%)
	Technology-based intervention	17 (26.2%)
	Family support	17 (26.2%)
	Peer support	16 (24.6%)
	Care delivery model	14 (21.5%)
	Case management	12 (18.5%)
	Adherence monitoring	9 (13.8%)
	Economic/cash intervention	6 (9.2%)
	Mental health treatment	5 (7.7%)
	Provider training	4 (6.2%)
	Holistic approaches (e.g., yoga, mindfulness)	4 (6.2%)
Intervention setting(s)		
	Facility-based	48 (73.8%)
	Technology-delivered	23 (35.4%)
	Community-based	16 (24.6%)
	Home-based	14 (21.5%)
	School-based	4 (6.2%)

Table 2.

Characteristics of HIV care outcome measures in included studies (n = 65)

Characteristic		n (%)
HIV care outcomes		
	Viral load or viral suppression	46 (70.8%)
	Adherence self-reported	27 (41.5%)
	Retention in care	22 (33.8%)
	CD4 Count	17 (26.2%)
	Linkage to care	9 (13.8%)
	Adherence with electronic bottle measure	5 (7.7%)
	Adherence with pharmacy records	3 (4.6%)
	Adherence with pill counts	4 (6.2%)
	Adherence with biomarker measure	2 (3.1%)
	Mortality	2 (3.1%)
	Maternal to child transmission	1 (1.5%)

Table 3.

Characteristics of study designs and phase of research (n = 65)

Characteristic		n (%)
Phase of research		
	Real-world implementation	17 (26.2%)
	Effectiveness	16 (24.6%)
	Feasibility/efficacy	32 (49.2%)
Study design		
	Cluster randomized controlled trial	8 (12.3%)
	Randomized controlled trial	21 (32.3%)
	Non-randomized with comparison group, pre-post	5 (7.7%)
	Non-randomized with comparison group, post only	10 (15.4%)
	Pre-post or time series, no comparison	21 (32.3%)

Table 4.

Included studies (n = 65) (first author, year) according to the study design and phase of research.

Study design	Phase of research		
	Real-world implementation	**Effectiveness**	**Feasibility or efficacy**
Cluster RCT	None	Brathwaite 2022 Brown, 2021 Ekwunife, 2022 Kopo, 2023 Mavhu, 2020 * Njuguna, 2022 Shanaube, 2021 Simms, 2022	None
Randomized controlled trial (RCT)	None	Denison, 2020 Dulli, 2020 Lyon, 2018 Naar, 2020 * Olashore, 2023 * Reif, 2022 Willis, 2019 *	Abiodun, 2021 * Amico, 2022 * Christodoulou, 2020 * Denison, 2022 Donenberg, 2022 Dow, 2022 Hosek, 2018 * Ingerski, 2021 * MacCarthy, 2020 Mimiaga, 2019 Ndhlovu, 2021 Sibinga, 2022 Turkova, 2018 * Webb, 2018 *
Non-randomized with comparison group, pre-post	Levy, 2021 * Rosen, 2021 *	None	Frieson Bonaparte, 2020 * Hacking, 2019 Ness, 2021
Non-randomized with comparison group, post only	Amzel, 2018 * Cassidy, 2022 * Fatti, 2018 * Govender, 2022 * Jubilee, 2019 Mathews, 2021 * Mthiyane, 2022 Munyayi, 2020	None	Step, 2022 * Verma, 2022 *
Pre-post or time series, no comparison	Dougherty, 2022 Izudi, 2018 Kose, 2018 * Masaba, 2022 * Mburu, 2019 Teasdale, 2022 Zanoni, 2020 *	Miller, 2019 *	Barker, 2019 * Chory, 2022 Evans-Gilbert, 2018 Fee, 2022 Galárraga, 2020 Hari Chandra, 2019 * Ivanova, 2019 Stangl, 2021 Stankievich, 2018 Sudjaritruk, 2021 Reif, 2019 Taiwo, 2021 * Vargas, 2022

* Intervention had a statistically significant positive effect on at least one HIV care outcome reported at any time point of follow-up