

Mobile phone access, usage patterns and perceptions of adolescents living with HIV on the use of gamified interventions to improve ART adherence in Eswatini: Qualitative study

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Abstract

Background: Adolescents living with HIV (ALHIV) often experience poor anti-retroviral therapy (ART) outcomes due to multiple barriers affecting medication adherence. Effective self-care interventions are needed to address these challenges. Mobile phones are widely used by the adolescent population, thus present an opportunity to be used as a tool to enhance ART adherence using mobile phones as a targeted intervention. However, research on ALHIV's mobile phone access, usage patterns, and perceptions of mobile phone-based interventions is limited in Eswatini.

Objective: This study explored the mobile phone access, usage patterns, and perceptions of mobile phone-based interventions among ALHIV in Eswatini to inform effective mobile health strategies for enhancing ART adherence among ALHIV.

Methods: We conducted a qualitative study using in-depth interviews in the month of December 2023. A total of 29 ALHIV aged 10 to 19 years and enrolled on ART were purposively sampled and interviewed from five Teen Clubs in the Hhohho region in Eswatini. Topic areas covered were "mobile phone accessibility, usage patterns, and perceptions on the use of mobile phones to facilitate ART adherence."

Results: The study findings indicated high mobile phone access among participants, with primary usage focused on making and receiving calls, as well as engaging with social media. Three themes emerged regarding the use of gamified interventions to support ART adherence. Firstly, the use of gamified interventions aimed at ART adherence among ALHIV was deemed feasible, based on mobile phone access and past experiences with mobile game. Secondly, three main qualities of successful gamified interventions were identified as: being supportive, educational, and ensuring privacy in the design of the game. Lastly, confidentiality and mobile phone access factors were highlighted as potential concerns when designing gamified ART adherence interventions.

Conclusions: The findings suggest potentially high access and usage of mobile phones among ALHIV on ART in Eswatini. This provides an opportunity to leverage mobile technology to enhance ART adherence through gamified interventions. However, it is essential to carefully consider ALHIV-specific needs and concerns in the design of these interventions to ensure their successful uptake and sustainability.

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Mobile phone access, usage patterns and perceptions of adolescents living with HIV on the use of gamified interventions to improve ART adherence in Eswatini.

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Abstract

Background: Adolescents living with HIV (ALHIV) often experience poor anti-retroviral therapy (ART) outcomes due to multiple barriers affecting medication adherence. Effective self-care

interventions are needed to address these challenges. Mobile phones are widely used by the adolescent population, thus present an opportunity to be used as a tool to enhance ART adherence using mobile phones as a targeted intervention. However, research on ALHIV's mobile phone access, usage patterns, and perceptions of mobile phone-based interventions is limited in Eswatini. This study explored these aspects to inform effective mobile health strategies for enhancing ART adherence among ALHIV.

Methods: We conducted a qualitative study using in-depth interviews in the month of December 2023. A total of 29 ALHIV aged 10 to 19 years and enrolled on ART were purposively sampled and interviewed from five Teen Clubs in the Hhohho region in Eswatini. Topic areas covered were “mobile phone accessibility, usage patterns, and perceptions on the use of mobile phones to facilitate ART adherence.”

Results: The study findings indicated high mobile phone access among participants, with primary usage focused on making and receiving calls, as well as engaging with social media. Three themes emerged regarding the use of gamified interventions to support ART adherence. Firstly, the use of gamified interventions aimed at ART adherence among ALHIV was deemed feasible, based on mobile phone access and past experiences with mobile game. Secondly, three main qualities of successful gamified interventions were identified as: being supportive, educational, and ensuring privacy in the design of the game. Lastly, confidentiality and mobile phone access factors were highlighted as potential concerns when designing gamified ART adherence interventions.

Conclusion: The findings suggest potentially high access and usage of mobile phones among ALHIV on ART in Eswatini. This provides an opportunity to leverage mobile technology to enhance ART adherence through gamified interventions. However, it is essential to carefully consider ALHIV-specific needs and concerns in the design of these interventions to ensure their successful uptake and sustainability.

Keywords: adolescents living with HIV; ART adherence; mobile phones; mobile health; gamified interventions; Eswatini

Introduction

Eswatini's adolescents have consistently shown lower antiretroviral therapy (ART) outcomes, such as viral load suppression (VLS), compared to the adult population. In 2023, Eswatini recorded a 96% viral load suppression rate among adults, while adolescents aged 15 to 19 years reported a 77.8% viral suppression rate among those on ART [1,2]. Although there has been a very slight improvement compared to 2017 data where VLS was 76% among adolescents and young people, it remains below

the UNAIDS 90% VLS target for 2020 [3,4]. Low VLS is associated with poor ART adherence, leading to opportunistic infections and subsequently AIDS-related deaths [5–7].

Nonetheless, Eswatini has made tremendous progress in combating the HIV pandemic, despite having the highest prevalence of HIV globally at 24.8% [1]. This progress has positioned the country among the first to meet the 2030 UNAIDS targets ahead of the set date [1,2]. The UNAIDS targets aim for 95% of people living with HIV to know their status, 95% of those diagnosed to be on ART, and 95% of those on ART to achieve viral suppression by 2030 [8]. Eswatini has achieved these targets through successfully implemented interventions promoting ART adherence [2]. For instance, in 2017, the country adopted the universal test and treat guidelines and coupled them with interventions promoting ART adherence counselling, resulting in the implementation of a differential model of ART care [9].

However, globally, interventions aimed at improving ART adherence have proven to be more effective in the adult population, while adolescents remain behind [10]. A systematic review conducted in 2015 highlighted that few interventions have been implemented among younger population groups globally [10]. This discrepancy is particularly pronounced in sub-Saharan Africa (SSA), which is home to 70% of the global population living with HIV and where adolescents account for 90% of the global adolescents living with HIV [8,11]. ART outcomes are also poor among the adolescent age group, resulting in 65% ART adherence and 55% viral load suppression (VLS) among adolescents in the region [12]. Despite these challenges, interventions targeting ART adherence among adolescents living with HIV (ALHIV) are limited compared to those available for adults [13,14]. Only a few interventions, such as HIV counselling, community and facility-based support, and family-based economic empowerment programs, have been reported in previously conducted studies [10,15–17].

The potential of digital technology, particularly mobile health also known as mHealth, in supporting ART adherence among ALHIV remains largely unexplored [18]. Studies in other African countries have shown promising results, with mHealth significantly improving adherence rates and viral load suppression [18–23]. The positive influence of mobile phone-based interventions has been bolstered by the widespread accessibility and usage of phones among young people [18]. For instance, in 2023, global phone ownership reached 78%, with a total of 8.9 billion mobile phones subscribed to a network [24]. On the African continent, 63% of the population owned mobile phones, and of these, 33% were young people aged 15 to 24 years [24]. In 2022, Eswatini, a country with 1.3 million people, reported 1.5 million phone subscriptions [25]. Although specific data on phone ownership among adolescents is scant, a systematic review showed that young people and adolescents spend a

significant amount of time on their phones, leading to phone addictions [26]. Adolescents have been reported to be particularly addicted to social media and gaming [27,28]. Studies have also reported the positive effect of mobile games in promoting medication adherence [29]. However, there is a need for tailored interventions where the end user actively participates in the design of these interventions [30].

Therefore, the access to phones can be leveraged in settings like Eswatini, where adolescents have poor ART outcomes compared to adult population. However, there is limited data on phone ownership, accessibility, and usage among adolescents in the country. Additionally, studies have shown the importance of end-user participation in the design of health behaviour interventions. We explored the mobile phone access, usage patterns and perceptions of adolescents living with HIV on the use of gamified interventions aimed to improve ART adherence in Eswatini.

Methods

Study design

This was qualitative study conducted in December 2023 using in-depth interviews among 29 ALHIV in Eswatini. This approach provided valuable insights from ALHIV, who have a unique understanding of the types of interventions that may be most effective for them [31].

Study setting

The study was conducted among ALHIV accessing ART care through Teen Clubs from the Hhohho region in Eswatini. The Hhohho region is located in the north-western part of the country and houses the capital city, making up 30% of the total population [32]. This region is considered the most economically advanced in Eswatini, as it has the most urbanized population and is home to the headquarters of many corporations, as well as being dominated by the forestry industry, which is among the most important sectors of the country's economy [32]. The region comprises both urban and rural settings and has 71 health facilities, including private, public, military, faith-based, and not-for-profit hospitals, health centres, public health units, and clinics [33]. These health facilities play a critical role in HIV prevention and management through services offered from the community level to the tertiary level (hospitals). These services include the differentiated models of ART care, such as Teen Clubs [9].

Teen Clubs, a model of ART care for adolescents with disclosed HIV status, utilize lay healthcare workers also known as expert clients to provide support and education about ART and HIV [9,34]. In 2023, there were 99 Teen Clubs with 2308 members in the country [35]. Of these, 31 Clubs with

1464 members were from the Hhohho region [35]. With the assistance of the Ministry of Health, Swaziland National AIDS Program (SNAP), and the National Paediatrics HIV Care and Treatment department, five clubs from the Hhohho region that had been active for at least two years were conveniently chosen for data collection [31]. Within each club, at least 5 ALHIV were purposively selected using the maximum variation technique to ensure representativeness of perceptions and experiences of all ALHIV in Teen Clubs [31,36]. Maximum variation technique was used to ensure that participants included both males and females, both adolescents age group (10 to 14 years and 15 to 19 years), and at least one peer educator from each club [36]. Peer educators are also known as community adherence to treatment support (CATS) and are involved in educating and supporting their peers using door-to door campaigns especially for ALHIV lost to follow up or with poor ART outcome [37].

Participants' recruitment process

Adolescents aged 10 to 19 years, who had been members for at least six months by the data collection period were invited to participate in this study to ensure comprehensive ART history. Expert clients assisted in identification of potential participants and were referred to the researcher for further explanation of the study. Adolescents who were willing to be part of the study were given a detailed study information sheet in both siSwati and English. Adolescents aged below 18 years were given the information sheet, along with the researcher's contact information, consent, and assent forms to share with their guardians. Adolescents aged 18 years provided their voluntary consent to participate in the study. Interviews were scheduled to take place in December 2023 following the receipt of signed consent and assent forms. A total of 29 adolescents meeting our inclusion criteria were recruited. The sample size was guided by the principle of data saturation in conducting qualitative studies [36].

Data collection and management

An in-depth interview guide was used for data collection (Multimedia Appendix). The interview guide included topics on mobile phone accessibility, usage patterns, and perceptions on the use of mobile phones to facilitate medication compliance (ART adherence). The interview guide, along with all consent and assent supporting materials, were translated into siSwati to ensure comprehension by all participants. Consequently, the in-depth interviews (IDIs) were conducted in either siSwati or English, depending on the participants' preferences, and were audio-recorded. Two pilot interviews were conducted to check validity of the questions [31]. Each interview lasted about 45 minutes and interviews were conducted in private rooms provided by each health facility or other

locations of participants' preference.

The audio recordings were transcribed verbatim and those in siSwati translated into English. Personal identifiers of participants were not included in both the transcripts and audio files instead codes were used to identify participants to maintain confidentiality. Both the transcripts and audio recordings were securely stored on a password-protected computer.

Data analysis

Deductive coding approach was used for data analysis [38]. The initial code frames were developed based on the research question being "Can mobile games be used to facilitate ART adherence?" A code framework was developed and transcripts were coded manually [31,36]. The code book was reviewed by two independent investigators (LDH and CSS) for comprehensiveness and appropriateness [39].

Ethics consideration

Approval to conduct the study was sought from the Stellenbosch University Health Research Ethics Committee (Reference number: S24/02/037) and Eswatini Health and Human Research Review Board of the Ministry of Health (Protocol Reference Number: EHHRRB143/2023). Furthermore, a letter of support from hospital management teams was obtained from the Ministry of Health, department of health services. Lastly, all participants and guardians in case of participants below the age of 18 were given detailed information on the study and provided consent and assent. Participants were informed that participation in the study was voluntary and were free to withdraw from the study at any point.

Results

Demographic characteristics of participants

A total of 29 participants (14 males and 15 females) were included in the study. Majority (65.5%) of the participants were aged 15 and above. The mean age of the participants was 16.5 years, with an average of 10.8 years on ART and 5 years of Club membership. Majority (79%) of the participants were diagnosed with HIV from birth while only 7% were diagnosed later in life (Table 1).

Table 1. Characteristics of participants

Characteristics		Frequency	%
Age group	10-14 years	10	34.5%
	15 and above	19	65.5%

	15-19	19	65.5%
Sex	Female	15	51.7%
	Male	14	48.3%
Education level	Primary	9	31.0%
	High school	18	62.1%
	Tertiary	2	6.9%
Age at diagnosis	From birth	23	79.3%
	While young	4	13.8%
	Later in life	2	6.9%
Duration on ART	Less than 5 years	2	6.9%
	5 to 10 years	15	51.7%
	Above 10 years	12	41.4%
Duration in club	Less than 2 years	6	20.7%
	2 to 5 years	12	41.4%
	Above 5 years	11	37.9%

Phone ownership and usage.

A total of 28 participants (93.6%) either owned (19, 65.5%) or shared (9, 31%) a phone with their guardian or siblings. Among those who owned or had access to a phone, 16 (57.1%) used a smartphone, while 12 (42.9%) used a feature phone (Table 2). Majority (12/19; 63%) of those who owned phones were older adolescents (15 to 19 years old) and younger adolescents (7/9; 77.8%) were most likely to share the phone with either guardian or siblings. Only older adolescents reported uncontrolled time on the phone while younger adolescents had their phone usage controlled by guardians.

Table 2. Phone ownership and usage characteristics of participants.

Characteristics		Frequency	%
Phone ownership	Yes	19	65.5%
	No	1	3.4%
	Shared	9	31.0%
Type of phone	Smartphone	16	55.2%
	Feature/ basic phone	12	41.4%
	N/A	1	3.4%
Phone usage^b	Daily	25	89.3%
	Controlled time	3	10.7%
Time spent on phone^b	Uncontrolled time	13	46.4%
	Less than 1 hour per day	7	25%
	1 hour to 5 hours daily	5	17.9%
	Only on weekends and school holidays	3	10.7%

Activities^b	Calling and receiving	28	100%
	Social media (WhatsApp, TikTok, Instagram, Facebook)	21	75%
	Games	7	25%
	Researching	3	10.7%

^b Number of participants with phone access

Themes on ALHIV's perceptions on gamified interventions

Three themes reflecting the perceptions of ALHIV on the use of gamified interventions to improve ART adherence emerged in this study. These were 1) feasibility of gamified interventions, 2) qualities of gamified interventions and 3) concerns on the use of gamified interventions to enhance ART adherence (Table 3 below).

1. Gamified intervention feasibility

Most participants reported that the use of gamified interventions to support ART adherence among ALHIV was feasible, given their access to mobile phones and previous exposure to games. Thus, participants reported that the success of gamified interventions is not only based on mobile phone access, but also having prior experience of playing other mobile games.

“You see auntie, we play lots of games so this can work too but then like myself I can only play it once in a while you see because I don't own the phone... but it can help” Female ALHIV, aged 15.

Additionally, the practicality of a gamified intervention was perceived to be influenced by the participants' experiences with games, particularly when those experiences were positive. A participant also further noted that a gamified intervention might be more appealing to younger adolescents than older adolescents.

“I think it can work auntie especially among the young ones because those ones enjoy playing games... myself, I am not a game person but into blogs and other social media platforms because I don't find games interesting you see” Male ALHIV and peer educator, aged 19.

2. Qualities of gamified intervention

Participants reported that the gamified interventions should possess certain qualities for them to yield positive results being improved ART adherence among ALHIV. The qualities of a gamified intervention included being able to provide support to the players, being educational and lastly

ensuring user HIV status privacy.

a. Supportive

Firstly, most participants reported that a game aimed at improving ART adherence should offer support to the players, as they identified support as a key facilitator for ART adherence.

“You see auntie, some of us will benefit from a mobile game if it provides support as it’s hard to live with HIV especially where everyone else is negative...It will be like you have something you can do and like someone who understands you and when you play you are happy” Male ALHIV, aged 18.

A mobile game that acts as a reminder for taking their medication would be very vital, as participants indicated that they often forget to take their medication on time.

“You see auntie, a game where like when you play you learn in the process. Like when you play you can even remember to take your pill and know why it is important.” Female ALHIV, aged 18.

Lastly, some participants revealed that a multiplayer game could provide support through networking and sharing of experiences, especially if the game can be played in real-time with others.

“You know a game where I can be in my home and play with someone who is in Manzini, that one can work and even better if I know the person is also living with HIV and we can even chat outside the game even though we don’t know each other... sometimes talking to a stranger is better auntie because they won’t gossip about you” Male ALHIV, aged 19.

“You know those racing games auntie where you have more than one player and even better if you know the players are real... those games are the best” Male ALHIV, aged 17.

b. Educational

Participants reported that a mobile game with an educational component could benefit ALHIV on ART and improve adherence. They explained that the educational benefits would include information on the advantages of ART and guidance on living with HIV. This information would be critical in teaching players the importance of ART adherence and encouraging them to persevere despite life distractions.

“For me a game where you are fighting using a gun and when you shoot it’s an indication that what happens or the results of taking your pills” Female ALHIV, aged 17.

“the game can work for us like encourage us while teaching us about the pills That’s what I can say...it can be a game like avatar you see where if you fall at this point, even your life falls...yes auntie like reminds us that even if you forget your pill, don’t give up like the game when they shoot you lose a life but when you keep fighting you gain more lives, something

like that” Male ALHIV, aged 19.

Additionally, an educational game could be crucial in guiding ALHIV as they make life choices that influence their future. These choices include staying positive about life and teaching others that living with HIV does not mean a shortened lifespan; one can still live and enjoy their life.

“I think a game that will teach people when they play about life with HIV so that they know more and the things to do to make sure one stays well.” Female ALHIV, aged 14.

“sometimes you have questions about HIV in general and you have to wait for the day you go to the health facility, you see the game can be helpful if it can answer some of the questions and you can even play with other people like children so they know more about HIV because now it’s like HIV means one will die...like I use poetry to teach my friends and imagine if it’s a game and we play and they learn” Female ALHIV, aged 17.

c. Ensure privacy.

Another quality of a mobile game reported by participants was the provision of privacy, thus preventing unintended disclosure when playing, especially if the game is a multiplayer game. Participants preferred a game they could play with strangers as they felt this would protect their HIV status. However, they noted that if the game included an option for communication between players, they would prefer if the other player was also living with HIV. This would allow for sharing experiences without the fear of status disclosure and gossiping.

“You know a game where I can be in my home and play with someone who is in Manzini, that one can work and even better if I know the person is also living with HIV and we can even chat outside the game even though we don’t know each other... sometimes talking to a stranger is better auntie because they won’t gossip about you” Male ALHIV, aged 19.

3. Potential concerns about the gamified interventions

Participants reported concerns regarding a mobile game aimed at supporting ART adherence among ALHIV. These concerns were critical to consider in the design of the intervention to ensure its success. Participants highlighted two main concerns: the possibility of the intervention leading to unintended disclosure of their HIV status and factors associated with phone access and use which include the financial implications and network access.

a. Unintended disclosure

Most participants revealed that in as much as they believed a mobile game can assist in supporting ART adherence, there were concerns regarding unintended disclosure if the name or some of the information could be traced to HIV or people living with HIV.

“We play games like me I normally play games from my mom’s phone, and I enjoy it a lot (laughs) but then auntie what if someone sees the game and can tell that it’s about HIV and now, they will be talking about my status” Female ALHIV, aged 17.

“A game one I can play and even if someone can see but will not be able to tell it’s for people living with HIV... like my cousins can also play it without them knowing it’s for us” Female ALHIV, aged 14.

b. Mobile phone access factors

Mobile phone access factors were reported by participants as a concern in the success of gamified interventions. These included finances to access a smartphone and internet bundles. Some participants were concerned with the cost associated with smartphones as they had access to ordinal/feature phones.

“Mobile games can work auntie, but problem is like myself, I don’t have a phone and the one I use is not a smart phone so this will not benefit some of us” Female ALHIV, aged 15.

Secondly, participants expressed concerns that even if the games could work, the cost of internet bundles will deter their success. Most adolescents do not have income and would be unable to afford the cost of internet or data bundles that would be required for online games.

“You see auntie, some of the adolescents here cannot afford to buy internet bundles and you know some games need you to be online” Male ALHIV and peer educator, aged 19.

Lastly, participants cited limited mobile network coverage in some of the geographical locations in the country, as making it difficult to have access to a mobile phone. They believed that the lack of mobile network coverage would hinder some of them from taking part in the games.

“I don’t know auntie, but you know there are places where there is no network... (laughs) you see at my granny’s place, there is no network it’s just some odd area right (laughs)” Female ALHIV, aged 18.

Table 3. Themes and sub-themes including exemplary quotes on the use of gamified interventions to enhance ART adherence among ALHIV.

Themes	Sub-themes	Code	Example
1. Gamified interventions are feasible	1. Phone access and use	a. Previous game exposure	<i>“You see auntie, we play lots of games so this can work too but then like myself I can</i>

			<i>only play it once in a while you see because I don't own the phone... but it can help"</i> Female ALHIV, aged 15.
		b. Positive game experience	a. <i>"I play games in my mother's phone like always... I like Talking Angela [a videogame app] and my mom used to play it too (laughs)"</i> Female ALHIV, aged 10.
			b. <i>"I think it can work auntie especially among the young ones because those ones enjoy playing games... myself, I am not a game person but into blogs and other social media platforms you see"</i> Male ALHIV

			and peer educator, aged 19.
2. Qualities of gamified interventions	1. Supportive	a. Reminders	<i>“You see auntie, a game where like when you play you learn in the process. Like when you play you can even remember to take your pill and know why it is important.”</i> Female ALHIV, aged 18.
		b. Support group	<i>“It would be nice to have a game where you can meet others like a game with multiple players and you are able to support each other with things like taking your pills.”</i> Male ALHIV and peer educator, aged 19.
	2. Educational	a. Benefits of ART	<i>“For me a game where you are fighting using a gun and when you shoot it’s an indication that what happens or the results of taking your pills.”</i> Male ALHIV, aged 17.
		b. Living with HIV	<i>“I think a game that will teach people when they play about life with HIV so that they know more and the things to do to make sure</i>

			<i>one stays well.”</i> Female ALHIV, aged 14.
	3. Ensure privacy	a. Dependable/ trustworthy	<i>“You know a game where I can be in my home and play with someone who is in Manzini, that one can work and even better if I know the person is also living with HIV and we can even chat outside the game even though we don’t know each other... sometimes talking to a stranger is better auntie because they won’t gossip about you”</i> Male ALHIV, aged 19.
		b. Prevention of unintended disclosure	<i>“A game that does not have a name about HIV can work (laughs), that I can play auntie, and I can enjoy as long as no hint about my status (laughs)”</i> Female ALHIV, aged 17.
3. Potential concerns about gamified interventions	1. Confidentiality	Unintended disclosure	<i>“A game I can play and even if someone can see but will not be able to tell it’s for people living with HIV... like my cousins can also play it without them knowing it’s for us”</i> Female ALHIV, aged 14.
	2. Phone access factors	a. Phone costs	<i>“Mobile games can work auntie,</i>

			<i>but problem is like myself, I don't have a phone and the one I use is not a smart phone so this will not benefit some of us"</i> Female ALHIV, aged 15.
		b. Internet bundles cost	<i>"You see auntie, some of the adolescents here cannot afford to buy internet bundles and you know some games need you to be online"</i> Male ALHIV, aged 19.
		c. Network availability	<i>"I don't know auntie, but you know there are places where there is no network... (laughs) you see at my granny's place, there is no network it's just some odd area right... (laughs)"</i> Female ALHIV, aged 18.

Discussion

The study findings suggest that mobile phone access among ALHIV in Eswatini was significantly high compared to findings of studies conducted in similar setting in Zimbabwe and South Africa where phone accessibility was 62.6% and 84% respectively [40,41]. However, mobile phone accessibility among Swati ALHIV may generally be lower compared to the national mobile phone subscription rate of 129 phone connections per 100 inhabitants [42]. In 2023, there were 1.51 million active mobile phone connection in Eswatini, indicating multiple phone ownership per person [42]. Nevertheless, in Zimbabwe adolescents were found to often share their phones with family members,

and personal ownership rates increase with age, and were significantly associated with education level, with higher ownership among those in secondary school compared to those in primary school [41]. Similar patterns were observed in our study, where older adolescents were more likely to own mobile phones compared to younger adolescents. As adolescents grow, they spend less time with their caregivers due to decreasing parental dependency and more time with their peers [43]. This reduced dependency increases their need for mobile phones, which become essential for emergency communication, socializing with friends, and participating in after-school activities [43]. Consequently, phone access and ownership were higher among older adolescents than younger ones. Nevertheless, the past two decades have shown an increase in the availability and usage of mobile phones globally, especially among young people [24]. For instance, in 2023, 77% of the global population had access to phones, marking a 80% increase from ten years prior [24]. This surge in mobile phone availability is further driven by the introduction of cheaper and more convenient communication options compared to previous years [24,44]. Adolescents and young people from developing countries, such as Eswatini, are reported to be online daily due to reduced internet bundle costs [45]. In our study, only 55.5% of the ALHIV had access to smart phone and thus could have access to internet which is 67% in Africa [24].

In terms of usage, our study revealed all participants used their phones for calling, receiving calls, and texting. The findings are similar with a study conducted in South Africa, where the majority of participants reported to use their phone mainly for texting [40]. Additionally, in our study, only 25% reported spending much of their time playing games which is lower than findings of a study conducted in Zimbabwe [41]. This discrepancy could be attributed to the type of phones participants had access to and the cost of internet bundles in the country as explained in studies conducted in similar settings [40,41]. Additionally, access to phones was limited as some participants reported having their phone usage time controlled by their guardians especially younger adolescents which concurs with a study conducted in Zimbabwe [41]. A systematic review of literature conducted among young people found that guardians controlled phone time to avoid addiction and exposure to age-inappropriate content [26].

Importantly, participants indicated that they were convinced of the positive influence of mHealth, specifically mobile games, on ART adherence. In systematic review of studies mHealth was positively associated with ART adherence among young people in SSA [14]. Studies conducted in Uganda, Zimbabwe and Nigeria reported positive ART outcome some as improved ART adherence and viral suppression as a result of use of mHealth intervention group compared to controls [21,23,46,47].

Further, the study revealed that a gamified intervention aimed at promoting ART adherence can be effective if it provides a support system for players. Participants identified support in terms of reminders and networking with other adolescents as crucial. Support systems have been reported in multiple studies as key facilitators for ART adherence among ALHIV [48,49]. For example, in a study in Ghana, participants noted that reminders for pill schedules were critical in enhancing ART adherence [48]. Similarly, a study conducted in Uganda found that using reminders such as alarms or short message services (SMS) increased ART adherence among ALHIV [22]. The presence of a supportive structure, such as peer groups, has also been associated with increased ART adherence in numerous studies. For instance, a study examining the effects of Teen Clubs or peer groups found a positive association with ART adherence, as these groups provided a support structure, allowing adolescents to share experiences and encourage each other [50]. In Namibia, peer groups provided ALHIV with a sense of belonging, thereby improving ART adherence [51]. The study, therefore, emphasized the need for a support system to ensure ART adherence among ALHIV.

Moreover, the study highlighted the importance of the gamified intervention providing educational information as players engage with it. Educational content could include the benefits of ART or information about living with HIV. This finding aligns with a study conducted among adolescents living with HIV in the USA, which found that games incorporating disease information were effective in educating adolescents while they enjoyed playing [52]. This underscores the need for games that are not only recreational but also informative to promote medication adherence.

Additionally, the study revealed that privacy and confidentiality are crucial in the design of the game, as participants expressed concerns about the risk of unintended disclosure. According to a study conducted in Zambia among ALHIV and their caregivers, unintended disclosure was associated with stigma and discrimination, identified in multiple studies as major barriers to ART adherence among ALHIV [53]. Therefore, the game's features and name must be carefully considered to prevent unintended disclosure, which could negatively impact ART adherence if not addressed [54].

Lastly, in our study, adolescents expressed concerns about the financial strain associated with mobile games and the access to network. This concern highlights the need for a critical evaluation of the economic implications of such interventions, as they require participants to have not only a phone, specifically a smartphone, but also network access and internet bundles. These economic factors are particularly critical in settings like Eswatini, where they could lead to low coverage of the intervention. Network coverage remains an issue in some areas, especially in developing countries or low-economic settings [41]. Additionally, mHealth-based interventions have been associated with poor outcomes due to the financial demands of both the phone and internet bundles. However,

innovations on offline games have shown promise in addressing these challenges. Offline games have been associated with higher uptake and positive intervention outcomes, as they reduce the financial burden on participants and increase accessibility [55]. This suggests that developing offline mobile games could be a viable solution to enhance the feasibility and effectiveness of mHealth interventions in resource-limited settings [56].

Limitations and strengths

A key limitation of this study is that it only included adolescents from one region of the country, specifically those who are members of Teen Clubs. Additionally, the small sample size is not representative of all adolescents living with HIV (ALHIV) in the country or even within the Hhohho region. As a result, the findings cannot be generalized to all adolescents in Eswatini. Despite these limitations, this study is the first to explore and describe mobile phone access, usage patterns, and perspectives on gamified interventions among Swati ALHIV. The findings provide valuable baseline data and serve as a foundation for future research aimed at developing and evaluating gamified interventions to enhance ART adherence among ALHIV.

Conclusion

The study indicates that mobile phone access may be high among adolescents living with HIV (ALHIV) in Eswatini, with the majority utilizing their phones daily for various purposes. A considerable proportion of participants expressed a belief in the feasibility of gamified interventions to support ART adherence, highlighting the importance of supportive, educational, and privacy-assured features. However, concerns regarding confidentiality and economic factors must be addressed to ensure the successful implementation and sustainability of such interventions. These findings underscore the potential of leveraging mobile technology to enhance ART adherence among ALHIV, provided that their specific needs and concerns are carefully considered in the design of these interventions.

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Conflict of interest

The authors report that there was no conflict of interest in this work.

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Authors' contribution

LDH: conceptualization, methodology, data curation, formal analysis, and drafting the manuscript.
PSN & CSS: conceptualization, methodology, supervision, and critical review.

Multimedia Appendix

The interview guide

[PDF file (Adobe Acrobat), 545 kB]

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Supplementary Files

Multimedia Appendixes

The interview guide.

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