

Reasons for Missed ART Doses and Health Workers' Perspectives on ART Adherence Among People Living with HIV in Southwestern Uganda: A Cross-Sectional Mixed-Methods Study.

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Abstract

Background: Missed antiretroviral therapy (ART) doses can compromise treatment outcomes among people living with HIV. This study explored reasons for missed ART doses among people living with HIV and health workers' perspectives on factors influencing ART adherence in southwestern Uganda.

Methods: A cross-sectional mixed-methods study was conducted among 386 adults receiving ART at Mbarara City Council Health Centre IV and Bwizibwera Health Centre IV. Quantitative data were collected using a structured interviewer-administered questionnaire and analysed using Stata version 18.0. Qualitative data were collected through nine key informant interviews with healthcare providers involved in HIV care and ART services and analysed thematically using Braun and Clarke's six-phase approach.

Results: The common reasons for missed doses were travel (38.9%) and forgetfulness (33.3%). Others included lack of medication (9.3%) and domestic conflicts or stress (6.2%). Healthcare providers described ART adherence being shaped by everyday life circumstances; mobility, distance and stigma creating barriers to accessing ART services; social relationships, stigma and beliefs influencing treatment behaviour; health-system organization affecting continuity of care; adherence-support strategies being implemented within resource constraints; and the need for more flexible, decentralized and adequately resourced ART services. Providers particularly described work-related mobility, alcohol use, treatment fatigue, non-disclosure, stigma, transport difficulties, waiting times, and difficulties accessing medication when away from the usual ART facility as challenges.

Missed ART doses were mainly related to travel and forgetfulness, within broader individual, social and health-system challenges. ART services should strengthen patient-centred adherence support through flexible refill options, community-based ART delivery, appointment reminders and timely management of treatment-related challenges.

Keywords: HIV; antiretroviral therapy; ART adherence; missed doses; PLHIV; Health workers.

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Introduction

Antiretroviral therapy (ART) has substantially improved the health and survival of people living with HIV and remains the cornerstone of HIV treatment. Sustained use of ART is essential for maintaining viral suppression, reducing HIV-related morbidity and mortality, and preventing onward transmission. Current HIV treatment guidance emphasizes continued adherence, retention in care, and timely access to ART as important components of successful HIV treatment. ^[1,2]

Despite the effectiveness of ART, maintaining consistent medication-taking behaviour remains challenging for many people living with HIV. Missed doses can occur because of individual circumstances, changes in daily routines, social and economic challenges, difficulties accessing health services, and treatment-related concerns. A systematic review and meta-analysis of 125 studies involving more than 17,000 adults found that commonly

reported barriers to ART adherence included forgetting, being away from home, changes in daily routine, alcohol or substance use, stigma or secrecy, feeling unwell, distance to health facilities, and medication stock-outs. The review concluded that barriers to adherence are multiple and that no single intervention is sufficient for all patients. ^[3]

Evidence from Uganda similarly indicates that missed ART doses are influenced by a combination of individual and health-service factors. In a study conducted across 15 health facilities in Uganda, travel was the most commonly reported reason for missed doses, followed by forgetfulness, while alcohol use was significantly associated with missed doses. The study also found an association between missed medication doses and missed clinic appointments, suggesting that medication adherence and continued engagement with HIV services are closely related. ^[4]

Travel and mobility can be particularly important barriers to sustained ART adherence. People who travel for employment, farming, family responsibilities, or other activities may run out of medication while away from their usual health facility or may avoid collecting medication from another facility because of concerns about confidentiality and stigma. Qualitative evidence from southwestern Uganda has also documented the importance of transportation costs and competing household needs in limiting sustained access to HIV treatment.^[5,6]

Stigma and concerns about disclosure may further affect medication-taking behaviour. People living with HIV may avoid taking their medicines in the presence of family members, friends, colleagues, or other community members because they fear that medication use will reveal their HIV status. Qualitative research in Uganda has described non-disclosure, stigma, treatment fatigue, mobility, and challenges associated with daily medication routines as important barriers to long-term ART adherence.^[6,7,13]

Treatment-related experiences may also contribute to missed doses. Side effects, feeling unwell, treatment fatigue, and the burden of taking medication over long periods have been reported among barriers to adherence. In addition, alcohol use may interfere with medication-taking routines and clinic attendance. These factors indicate that missed doses cannot always be understood as a simple failure to take medication but may reflect the circumstances in which individuals manage HIV treatment within their everyday lives.^[3,6]

Health-system factors are also important. Distance to health facilities, medication stock-outs, long waiting times, limited staffing, interruptions in services, and difficulties obtaining medication when patients are away from their usual facility can create conditions that make consistent ART use difficult. WHO guidance therefore emphasizes differentiated and person-centred HIV service delivery, including approaches that improve access, continuity of treatment, adherence support, and re-engagement in care.^[3,6,8,9]

Although quantitative studies can identify the frequency of missed doses and factors statistically associated with adherence, they may not fully explain how people experience these barriers in their everyday lives or how health workers understand the challenges faced by their patients. Qualitative evidence can provide additional insight into the social, behavioural, and health-system circumstances underlying missed doses. In Uganda, qualitative studies have highlighted the roles of mobility, stigma, disclosure, social support, treatment fatigue, food insecurity, alcohol use, and health-service challenges in shaping long-term ART adherence.^[6,7]

However, there remains a need for context-specific evidence that brings together patients' reported reasons for missed ART doses and health workers' perspectives on the challenges influencing adherence, particularly

within routine ART services in southwestern Uganda. Understanding these perspectives together can help explain why missed doses occur and identify opportunities for more flexible and patient-centred adherence support.

This study therefore explored the reasons for missed ART doses among people living with HIV and health workers' perspectives on factors influencing ART adherence at selected urban and peri-urban Health Centre IVs in southwestern Uganda.

Methods

A cross-sectional mixed-methods study was conducted from 22 July to 15 August 2026 at Mbarara City Council Health Centre IV (MMC HC IV) and Bwizibwera Health Centre IV in southwestern Uganda. The quantitative component described patient-reported reasons for missed ART doses among people living with HIV (PLHIV), while the qualitative component explored healthcare providers' perspectives on factors influencing ART adherence. The two components were implemented within the same study period and integrated during interpretation to provide complementary understanding of ART adherence challenges.

The study was conducted at two public Health Centre IV facilities that provide comprehensive HIV services. MMC HC IV is located in Mbarara City and serves a predominantly urban population, while Bwizibwera HC IV serves predominantly peri-urban and rural communities in Mbarara District. Both facilities provide HIV counselling and testing, ART initiation and refills, viral load monitoring, adherence counselling, and differentiated HIV service delivery. The facilities were purposively selected because they provide established ART services while representing different service and population contexts within the same geographical region. The quantitative study population comprised adults living with HIV who were receiving ART services at the two selected Health Centre IVs during the study period. Participants were eligible if they were aged 18 years or older, were receiving ART services at one of the selected Health Centre IVs, had attended at least one previous ART clinic visit at the study facility and provided written informed consent.

Participants were excluded if they were too ill to participate in the interview at the time of data collection or had a physical or cognitive impairment that prevented them from providing the required information or completing the interview.

The qualitative study population comprised healthcare providers directly involved in HIV care or ART service delivery at the two facilities. Participants included clinicians, ART clinic in-charges, counsellors, expert clients, and a drug dispenser, providing perspectives from different roles within HIV service delivery.

Healthcare providers were eligible if they: were directly involved in HIV care or ART service delivery at one of the study facilities, had worked in their current role for at

least one year; and provided written informed consent. Healthcare providers were excluded if they had less than one year of experience in their current role, had participated in the quantitative survey, or declined participation.

The quantitative sample size was determined using the Kish and Leslie formula for estimating a single population proportion. Assuming a 50% prevalence, a 95% confidence level, and a 5% margin of error, the minimum required sample size was 385 participants. A total of 386 people living with HIV were recruited for the study.

A proportionate stratified consecutive sampling approach was used. The two study facilities served as strata, and participants were allocated proportionately according to the adult ART population at each facility. Eligible participants attending routine ART clinics during the data collection period were consecutively recruited until the allocated sample size for each facility was achieved. Of the 386 participants recruited, 257 were enrolled from MMC HC IV and 129 from Bwizibwera HC IV. Purposive sampling was used to recruit healthcare providers with direct experience in HIV care and ART service delivery. Participants were selected from different professional cadres to obtain diverse perspectives on adherence counselling, clinical management, medicine dispensing, and programme implementation.

Approximately 18 eligible healthcare providers and facility-based personnel were identified across the two facilities. Recruitment continued until data saturation was reached, defined as the point at which additional interviews yielded no new information relevant to the study objectives. A total of nine key informant interviews were conducted.

Quantitative data were collected using a structured interviewer-administered questionnaire. The questionnaire was developed from the study objectives, conceptual framework, and relevant literature and included questions on socio-demographic characteristics, clinical information, ART-related experiences, and adherence.

Participants who reported missing at least one ART dose since their most recent refill were asked an additional question about the reason for missing their medication. Responses were recorded and later grouped into meaningful categories during analysis.

Qualitative data were collected using a semi-structured key informant interview guide. The guide explored healthcare providers' perspectives on: factors influencing ART adherence, reasons why patients miss ART doses, adherence counselling practices, patient follow-up, health-system challenges; and recommendations for improving ART adherence. Interviews were conducted in private rooms within the health facilities at times convenient for participants to minimise disruption of routine services. With participants' consent, interviews were audio-recorded, and field notes were taken to capture contextual observations and non-verbal cues.

Interviews were conducted in English or Runyankore, depending on participants' preference. Runyankore interviews were translated into English during transcription while preserving the intended meaning of participants' responses.

The credibility and dependability of the qualitative findings were strengthened through several measures. Interviews were conducted using a semi-structured guide to ensure consistency while allowing participants to elaborate on their experiences. Audio recordings were transcribed verbatim, and translated transcripts were checked against the original recordings to preserve meaning. The researcher repeatedly reviewed the transcripts during coding and theme development to ensure that the identified themes accurately reflected participants' accounts. Verbatim quotations were retained in the presentation of findings to enhance transparency and illustrate the interpretations drawn from the data.

Data quality was ensured through systematic development, review, pretesting, and standardised administration of the data collection tool. The structured questionnaire was developed based on the study objectives, conceptual framework, and relevant literature and was reviewed by the research supervisors. The questionnaire was pretested to assess the clarity, sequence, comprehension, and appropriateness of the questions. Necessary revisions were made before the final questionnaire was used for data collection. Research assistants were trained on the study objectives, research procedures, ethical conduct, interviewing techniques, and administration of the questionnaire. The principal investigator supervised data collection and reviewed completed records for completeness and consistency.

For the qualitative component, interviews were conducted using the same interview guide across participants, audio-recorded with consent, and transcribed verbatim to minimise loss of information.

Quantitative data were collected electronically using KoboToolbox and exported to Microsoft Excel for cleaning and organisation. The dataset was checked for missing values, inconsistencies, and out-of-range values before being imported into Stata version 18.0 for analysis. Qualitative recordings were transcribed verbatim and translated into English where necessary. Electronic transcripts and quantitative datasets were stored in password-protected files accessible only to the research team. Unique study identification numbers were used instead of participants' names to maintain confidentiality. Quantitative data were analysed using Stata version 18.0. For purposes of this paper analysis focused on participants who reported missing at least one ART dose since their most recent refill. Reported reasons for missed doses were grouped into meaningful categories, and frequencies and percentages were calculated to describe their distribution. Descriptive summaries were also used to compare the distribution of reported reasons across selected participant characteristics where appropriate.

Qualitative data were analysed using Braun and Clarke's six-phase thematic analysis approach. The researcher first familiarised themselves with the transcripts through repeated reading before generating initial codes. Related codes were grouped into categories and subsequently developed into broader themes that reflected healthcare providers' perspectives on factors influencing ART adherence.

The themes were reviewed against the original transcripts to ensure consistency and credibility. Findings are presented narratively and supported with verbatim quotations from participants.

Integration occurred during interpretation of the findings. Patient-reported reasons for missed ART doses were examined alongside healthcare providers' perspectives to identify areas of convergence and complementarity. The qualitative findings were used to explain how everyday circumstances, social relationships, mobility, stigma, and health-system experiences contributed to the reasons reported by participants in the quantitative component.

Potential interviewer and social desirability bias were addressed by training research assistants on interviewing techniques and study procedures and by using research assistants who were independent of routine healthcare providers at the study facilities. The questionnaire was pretested before the main study, translated into Runyankore and back-translated into English to improve clarity and conceptual equivalence. The principal investigator supervised data collection and reviewed completed records for completeness and consistency. For the qualitative component, interviews were conducted using a semi-structured guide, audio-recorded with consent, transcribed verbatim, and checked against the recordings to ensure accuracy.

Ethical approval was obtained from the Bishop Stuart University Research Ethics Committee (BSU-REC) under reference number BSU-REC-2026-2144 on 21 July 2026. Administrative permission to conduct the study was

obtained from the relevant district and facility authorities. Written informed consent was obtained from all participants before participation. Participants were informed that participation was voluntary and that they could withdraw from the study at any time without affecting their access to HIV services. Interviews were conducted in private settings to maintain confidentiality, and all study data were de-identified before analysis. Audio recordings and electronic datasets were stored securely, and access was restricted to authorised members of the research team.

Results

A total of 386 adults living with HIV participated in the quantitative component of the study, including 257 (66.6%) participants from Mbarara City Council Health Centre IV and 129 (33.4%) from Bwizibwera Health Centre IV. Nine healthcare providers participated in the qualitative component through key informant interviews. Participants represented different roles in HIV service delivery, including ART clinic in-charges, clinicians, counsellors, expert clients, and a drug dispenser.

Among the participants who reported missing at least one ART dose, travelling away from home was the most commonly reported reason, reported by 63 (38.9%) participants. This was followed by forgetting to take medication, reported by 54 (33.3%) participants. Lack of available medication was reported by 15 (9.3%) participants, while domestic conflicts or stress were reported by 10 (6.2%). Other reasons were reported by 20 (12.3%) participants. The other reported reasons included feeling unwell, fear of being seen taking medication, lack of food, ART side effects, reduced drug stock, imprisonment, and feeling tired of taking medication. Participants could report more than one reason for missing ART doses; therefore, the percentages were not expected to sum to 100%.

Figure 1

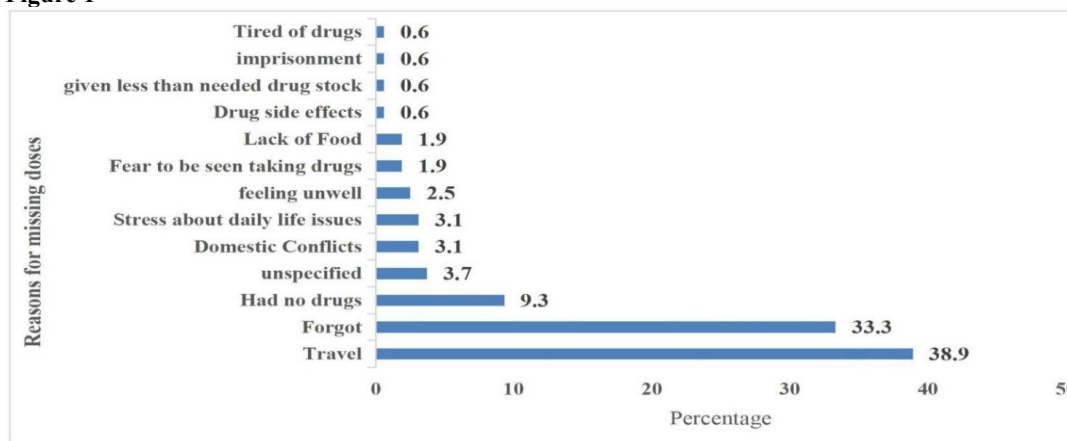


Figure 1. Patient-reported reasons for missing ART doses among participants

Travel was more commonly reported among males (42.9%) than females (35.9%) and among participants from Bwizibwera HC IV (41.0%) compared with those from MMC HC IV (34.2%). Forgetfulness was more commonly reported among females (35.9%) and participants attending MMC HC IV (34.2%). Travel was

also commonly reported among participants aged 18–29 years (48.2%), while forgetfulness was more commonly reported among participants aged 40–49 years (37.5%) and those aged 50 years or older (38.2%). Among rural residents, travel accounted for 41.5% of reported reasons for missed doses (Table 1)

Table 1

Patient-Reported Reasons for Missing ART Doses by Selected Participant Characteristics

Characteristic	Travel, n (%)	Forgot, n (%)	Had no drugs, n (%)	Domestic conflicts/stress, n (%)	Other reasons, n (%)	Total, n (%)
Overall	63 (38.9)	54 (33.3)	15 (9.3)	10 (6.2)	20 (12.3)	162 (100)
Sex						
Male	24 (42.9)	16 (28.6)	9 (16.1)	2 (3.6)	5 (8.9)	56 (100)
Female	39 (36.8)	38 (35.9)	6 (5.7)	8 (7.5)	15 (14.2)	106 (100)
Age in years						
18–29	13 (48.2)	9 (33.3)	0 (0.0)	0 (0.0)	5 (18.5)	27 (100)
30–39	21 (39.6)	14 (26.4)	5 (9.4)	3 (5.7)	10 (18.9)	53 (100)
40–49	16 (33.3)	18 (37.5)	6 (12.5)	5 (10.4)	3 (6.3)	48 (100)
≥50	13 (38.2)	13 (38.2)	4 (11.8)	1 (2.9)	3 (8.8)	34 (100)
Health facility						
Bwizibwera	16 (41.0)	12 (30.8)	2 (5.1)	1 (2.6)	8 (20.5)	39 (100)
MMC	47 (38.2)	42 (34.2)	13 (10.6)	9 (7.3)	12 (9.8)	123 (100)
Residence type						
Rural	34 (41.5)	27 (32.9)	7 (8.5)	6 (7.3)	8 (9.8)	82 (100)
Urban	29 (36.3)	27 (33.8)	8 (10.0)	4 (5.0)	12 (15.0)	80 (100)

Note. ART = antiretroviral therapy; MMC = Mbarara City Council Health Centre IV. Participants could report Six themes emerged from the nine key informant interviews: (1) ART adherence is shaped by everyday life circumstances; (2) mobility, distance and stigma create barriers to accessing ART services; (3) social relationships, stigma and beliefs influence treatment behaviour; (4) health-system organization can either support or undermine adherence; (5) multiple adherence-support strategies are implemented but remain resource constrained; and (6) future ART services should be flexible, decentralized and adequately resourced.

more than one reason for missing ART doses; therefore, reason-specific percentages are not mutually exclusive.

Healthcare providers described ART adherence as being influenced by the circumstances in which patients live and work. Forgetfulness, inconsistent medication routines, work and family responsibilities, bereavement, emotional stress, alcohol use, and prolonged periods away from home were described as common challenges. Providers particularly highlighted patients whose work or other responsibilities required them to move away from their usual place of residence. When patients travelled

without sufficient medication, they could exhaust their supply before returning to the facility.

“They move to work, so they don't take their drugs.

They finish their drugs when they are far.”

(KII02, Clinician, MMC HC IV)

Some providers also described treatment fatigue, including patients deliberately taking breaks from medication.

“Others give themselves drug holidays.”

(KII03, ART Counsellor, MMC HC IV)

Alcohol use was similarly described as disrupting medication-taking routines.

“Once you have taken alcohol...it becomes, 'I will take tomorrow.'”

(KII03, ART Counsellor, MMC HC IV)

Healthcare providers identified several groups whom they perceived to experience particular adherence challenges, including adolescents, boarding-school learners, highly mobile workers, commercial sex workers, taxi drivers, bar workers, older adults, and people with mental illness.

Healthcare providers described mobility and distance as important barriers to continued access to ART. Patients travelled for employment, farming and other activities and could run out of medication while away from their usual health facility. Transport costs and the physical distance to services were also described as challenges.

Stigma further complicated access for some patients. Providers reported that some patients preferred to obtain ART from facilities away from their homes because they did not want community members to know their HIV status.

“Most patients don't want to get drugs near their homes because of stigma.”

(KII06, Clinician, MMC HC IV)

Another provider described patients' preference for obtaining medication away from their communities:

“The person insists, 'I want here...because of stigma issues.'”

(KII03, ART Counsellor, MMC HC IV)

Providers indicated that limited connectivity of patient information across facilities could make movement between ART facilities difficult. One provider suggested a system that would allow patients to access medication from different facilities without interruption:

“I would make an in-person number in all facilities so that the patient can move to any facility and pick drugs comfortably.”

(KII07, Clinician, MMC HC IV)

Healthcare providers described disclosure and social support as important influences on medication-taking behaviour. Patients who had not disclosed their HIV status could find it difficult to take medication in settings where others might observe them. This was particularly described in schools and other shared living environments.

“Pulling out the drug...while fellow students are there becomes so hard because of stigma.”

(KII03, ART Counsellor, MMC HC IV)

In contrast, providers described treatment supporters and supportive household relationships as helpful for adherence.

“If they stay with someone and there's a real supporter, they always improve their adherence.”

(KII04, Clinician, Bwizibwera HC IV)

Some providers also reported that religious or traditional healing beliefs could influence treatment decisions. Although this was not described as a dominant issue, providers reported that some patients discontinued ART after being encouraged to rely on prayer or other forms of healing.

“They go there and they are told, 'When we pray, you will heal.' So they stop.”

(KII05, Clinician, MMC HC IV)

Healthcare providers described health-system organization as another factor influencing ART continuity. Staffing shortages and high workloads were reported to increase waiting times and reduce the time available for counselling and patient follow-up.

“We are only two people, and we are handling the same number of patients.”

(KII03, ART Counsellor, MMC HC IV)

Long waiting times were described as particularly problematic because some patients could leave the facility before receiving their medication.

“Patients wait for longer...Some even leave without their drugs.”

(KII07, Clinician, MMC HC IV)

Providers also described occasional challenges related to medicine availability and continuity of treatment. However, ART availability was generally described as adequate during the period discussed by some providers. Healthcare providers described several strategies used to support ART adherence. These included adherence counselling, reminder calls, appointment tracing, pill monitoring, treatment supporters, multi-month dispensing, community client-led ART delivery, and community-based medicine distribution.

Telephone follow-up was described as one way of reminding patients about appointments and encouraging them to return for care.

“That call encourages them to leave what they were supposed to commit themselves on, and then come.”

(KII06, Clinician, MMC HC IV)

Providers also described community-based approaches as a way of reaching several patients while reducing the burden on health facilities.

“One health worker can reach a number of clients at the same time.”

(KII01, ART In-charge, Bwizibwera HC IV)

When patients missed appointments, providers reported using telephone follow-up to re-engage them:

“We begin following them on the phone.”

(KII03, ART Counsellor, MMC HC IV)

Despite these strategies, providers described limitations related to staffing, unreliable telephone access, workload, and reduced resources for some programme activities.

Healthcare providers emphasized the need for ART services that accommodate patients' different circumstances. Suggested approaches included expanding community ART delivery, increasing multi-month dispensing, strengthening community pharmacies, improving staffing, increasing HIV education, engaging community and religious leaders, and improving continuity of care across facilities.

The value of bringing services closer to patients was emphasized by one provider:

"Why travel long distances to pick drugs that are at your doorstep?"

(KII05, Clinician, MMC HC IV)

Providers also highlighted the need for an interconnected system that would allow patients to obtain ART from different facilities when necessary.

"We need a countrywide interconnected system."

(KII06, Clinician, MMC HC IV)

Finally, providers emphasized that adherence interventions should be adapted to individual circumstances rather than applying a single approach to all patients.

"Every patient is an individual. What works for you may not work for me."

(KII05, Clinician, MMC HC IV)

The quantitative and qualitative findings showed substantial convergence regarding the circumstances underlying missed ART doses. Travel was the most frequently reported patient reason for missing ART doses, and healthcare providers similarly described mobility for work, farming and other responsibilities as a major challenge to maintaining medication supplies and routines. Providers further explained that patients who travelled could exhaust their medication while away from their usual ART facility.

Forgetfulness was the second most frequently reported reason in the quantitative component. Healthcare providers described forgetfulness within the broader context of disrupted medication routines, competing responsibilities, alcohol use, treatment fatigue, and prolonged periods away from home.

The quantitative finding that some participants missed doses because medication was unavailable was also reflected in healthcare providers' accounts of occasional medicine-supply challenges and difficulties obtaining ART when patients were away from their usual facility. Similarly, domestic conflict and stress reported by participants were consistent with providers' descriptions of bereavement, emotional stress, family responsibilities, and limited social support as factors that could interfere with adherence.

The qualitative findings additionally provided explanations for barriers that were less prominent in the quantitative responses. In particular, stigma and non-

disclosure could make patients reluctant to collect medication from facilities close to home or take medication in the presence of others. Healthcare providers also described health-facility workload, staffing shortages, waiting times, and limited continuity between facilities as system-level challenges that could contribute to interruptions in treatment.

Overall, the two strands indicated that missed ART doses occurred within a combination of individual, social, mobility-related, and health-system circumstances rather than from a single cause.

Discussion

This mixed-methods study examined patient-reported reasons for missed ART doses and health workers' perspectives on factors influencing ART adherence among people living with HIV attending two Health Centre IV facilities in southwestern Uganda. Travel was the most commonly reported reason for missed doses, followed by forgetfulness, lack of available medicines, and domestic conflicts or stress. The qualitative findings complemented these reports by showing that missed doses occurred within the broader context of mobility, competing daily responsibilities, stigma, social relationships, treatment fatigue, alcohol use, and health-system constraints.

Travel was the most commonly reported reason for missing ART doses in this study, accounting for 38.9% of reported reasons. This finding is consistent with evidence from Uganda and other sub-Saharan African settings showing that mobility and difficulties accessing ART while away from the usual treatment facility can disrupt medication-taking. A qualitative study conducted among people living with HIV in Mbarara found that transportation costs associated with monthly clinic visits were a major source of stress and contributed to missed ART doses and clinic appointments. Participants also described having to choose between transport costs and other household necessities, including food, housing, and school fees [5]. This is particularly relevant to the present study because both studies were conducted in southwestern Uganda and highlight the importance of patients' everyday mobility and financial circumstances in maintaining treatment continuity. Similar findings have been reported among Ugandan adults receiving long-term ART, where temporary economic migration and working away from home were described as important challenges to treatment access. Participants reported travelling for work, carrying insufficient quantities of ART, and sometimes avoiding taking medicines in front of others because doing so could reveal their HIV status [6]. A separate qualitative study among Ugandan adults with poor viral suppression also identified working away from home, stigma, and non-disclosure as important contributors to poor adherence [10].

The qualitative findings in the present study reinforce these observations. Health workers described patients travelling for employment and farming and sometimes

exhausting their medicines while away from their usual facility. They also explained that geographical distance alone did not account for difficulties accessing ART because some patients avoided facilities close to their homes because of concerns about stigma and unintended disclosure. These findings suggest that mobility-related adherence challenges involve both physical access to ART and the social acceptability of obtaining and taking treatment in different locations.

The findings support the importance of flexible ART delivery approaches that allow patients to maintain treatment when their daily circumstances require travel. Community-based ART delivery, multi-month dispensing for eligible patients, and mechanisms that facilitate continuity of treatment across facilities may reduce the need for patients to interrupt treatment when away from their usual clinic.

Forgetfulness was the second most commonly reported reason for missed ART doses, reported by 33.3% of participants who missed at least one dose. This finding is consistent with evidence from a multicountry study conducted in Tanzania, Uganda, and Zambia, in which forgetting was the most frequently reported reason among participants who had ever missed ART, accounting for 53% of reported reasons. Other commonly reported reasons in that study included hunger or insufficient food, ART-related symptoms, lack of transport, and being away from home^[11].

The high frequency of forgetfulness in both studies indicates that missed ART doses may occur even when patients have access to medication and intend to remain adherent. In the present study, health workers described inconsistent medication timing and competing work and family responsibilities as circumstances that could interfere with established medication routines. Forgetfulness should therefore not be interpreted simply as lack of commitment to treatment. Rather, it may reflect the difficulty of integrating lifelong medication use into changing daily routines. Health workers in the present study described reminders, follow-up calls, and counselling as strategies used to address this problem. Such strategies may be particularly useful when they are individualized to patients' routines and circumstances.

A systematic review and meta-analysis of patient-reported barriers to ART adherence similarly found that adherence barriers occur across individual, social, and health-service domains, supporting the need to identify the specific barrier experienced by each patient rather than relying on a single adherence intervention^[3].

Lack of available medicines accounted for 9.3% of reported reasons for missed doses in the present study. Although this was less frequent than travel or forgetfulness, it represents an important health-system-related barrier because missed medication resulting from supply or access problems cannot be addressed solely through patient-level counselling. The systematic review identified health-service barriers, including distance to

clinics and ART stock-outs, among commonly reported barriers to adherence^[3]. The multicountry study also identified food insecurity and symptoms as important reasons for missed ART^[11]. These findings demonstrate that medication-taking is affected not only by individual behaviour but also by the resources and circumstances within which patients manage treatment.

In the present study, health workers generally described ART medicines as available but reported occasional regimen shortages or short-dated supplies that could lead to shorter refill intervals and more frequent clinic visits. They also explained that patients who travelled could face difficulties obtaining ART from another facility. These accounts provide context for the patient-reported lack of available medicines.

Food-related circumstances were also reported among the less common "other" reasons for missed doses in this study. This is consistent with previous Ugandan and multicountry evidence showing that food insecurity may influence ART-taking behaviour. In the Tanzania–Uganda–Zambia study, 30% of participants who had ever missed ART reported hunger related to ART or insufficient food as a reason for missing medication^[11]. The qualitative findings therefore suggest that adherence counselling should also assess practical circumstances such as food availability rather than assuming that every missed dose results from forgetfulness.

Domestic conflicts or stress accounted for 6.2% of reported reasons for missed ART doses. Although this proportion was smaller than travel and forgetfulness, the qualitative findings indicated that stress and social relationships could influence treatment behaviour in several ways. Health workers described bereavement, emotional stress, family responsibilities, and limited social support as circumstances that could interfere with medication-taking. Conversely, trusted family members and treatment supporters were described as facilitators of adherence. One health worker explained that patients who had a genuine treatment supporter often demonstrated improved adherence.

These findings are consistent with qualitative research among people receiving ART through community client-led ART delivery groups in Lira District, where social support, counselling, and guidance were identified as important facilitators of adherence, while stress, stigma, forgetfulness, lack of food, and socio-cultural beliefs were identified as barriers^[7].

Similarly, studies among Ugandan patients receiving long-term ART have shown that social support and disclosure can influence patients' ability to maintain treatment routines, while stigma and non-disclosure may make it difficult to take medication openly or seek treatment close to home^[6,12,13].

The findings therefore suggest that adherence support should extend beyond medication counselling to include assessment of patients' social circumstances and availability of trusted support. However, disclosure

should remain voluntary and patient-centred because compulsory disclosure may expose patients to stigma or other social harms.

Although stigma was not one of the four most frequently reported quantitative reasons for missed doses, it emerged strongly in the qualitative interviews. Health workers reported that some patients avoided obtaining ART from facilities close to their homes because of fears that others would recognize them as people living with HIV. They also described challenges among patients who needed to take medication at school, workplaces, or in shared households. This finding is consistent with qualitative studies conducted in Uganda. A study of long-term ART adherence identified stigma, disclosure challenges, and treatment access among temporary economic migrants as important barriers to adherence [6]. Another qualitative study among people with poor viral suppression found that work-related mobility and stigma could interact, with some participants avoiding taking medication when away from home because of concerns that others would infer their HIV status [10]. Qualitative research among people receiving HIV treatment in Kampala similarly identified stigma, transportation and travel, food insecurity, and the burden of ART as interconnected challenges to adherence [14]. These findings are relevant to the present study because they demonstrate that a patient may have physical access to ART but still experience difficulty taking or collecting medication because of the social meaning attached to HIV treatment.

This has implications for differentiated service delivery. Expanding access points alone may not be sufficient if patients perceive nearby facilities as unsafe from a confidentiality or stigma perspective. ART delivery models should therefore maintain confidentiality and provide patients with reasonable flexibility in choosing where and how they receive services.

Health workers described treatment fatigue among some patients, including what they referred to as temporary “drug holidays.” Although treatment fatigue was not among the principal categories reported quantitatively, it emerged as an important qualitative explanation of occasional deliberate interruptions. This finding is consistent with qualitative evidence from Uganda showing that some patients experience declining motivation to maintain lifelong treatment over time. [6] identified unstructured treatment holidays among adolescents and treatment-access challenges among adults as important themes in long-term ART adherence. Treatment-related factors, diminishing clinical support, stigma, and disclosure challenges were also reported. Treatment fatigue has also been described more broadly as a reduced desire or motivation to maintain vigilance in long-term treatment-taking. Qualitative work on treatment-regimen fatigue has identified patient, provider, and health-system factors contributing to the burden of lifelong treatment [15].

The present findings suggest that long-term ART adherence support should not focus only on patients newly initiating treatment. Patients who have been taking ART for many years may also require periodic assessment of treatment fatigue, changing circumstances, motivation, and emerging barriers. Repeated counselling should therefore remain responsive rather than assuming that adherence difficulties occur only early in treatment.

Health workers described alcohol consumption as a circumstance that could lead patients to postpone medication-taking. This finding strengthens the interpretation that alcohol use represents an important context for some missed doses. Qualitative research among Ugandan adults with poor viral suppression has similarly identified alcohol use or misuse as a contributor to poor ART adherence [10]. The qualitative accounts in the present study suggested that some patients who consumed alcohol subsequently postponed taking ART until the following day. These findings indicate that adherence counselling should address alcohol use in a non-judgmental manner and explore the specific circumstances in which alcohol interferes with medication-taking. Rather than treating alcohol use solely as an individual behavioural problem, counselling may focus on practical strategies that help patients maintain medication routines while also addressing problematic alcohol use where appropriate.

The qualitative findings highlighted staffing shortages, workload, waiting times, limited follow-up, and occasional medicine supply challenges. Health workers described situations in which prolonged waiting could result in patients leaving before completing their clinic visit or collecting medicines. In Uganda [16] a study found that regular clinic attendance was associated with better ART adherence among adults receiving treatment. Their prospective study also found that travel and financial constraints were major reasons for missed clinic visits. The qualitative findings in the present study suggest that clinic attendance should not be viewed solely as a patient responsibility. Health-system organization may influence whether patients are able to complete their visits. Long waiting times, staffing shortages, and inconvenient service arrangements may create additional barriers, particularly for patients with employment, family, or transport constraints.

Health workers also described appointment tracing and telephone reminders as important strategies for maintaining engagement in care. This is consistent with evidence from Uganda that treatment-supporter interventions can improve clinic attendance and adherence. The implication is that missed appointments can be used as an early warning signal for adherence difficulties, but facilities also need sufficient staffing and functional follow-up systems to respond to patients who miss scheduled visits. The health workers described several strategies already used to support ART adherence, including counselling, reminder calls, appointment

tracing, treatment supporters, pill monitoring, multi-month dispensing, CCLAD, community pharmacies, and community medicine distribution. However, they emphasized that staffing, telephone access, and other resource constraints limited implementation. This finding is consistent with qualitative evidence from Uganda showing that community-based ART models can provide social support and improve access to medication, while also highlighting challenges related to implementation and health-worker support^[7]. It is also consistent with the broader systematic review by Shubber et al.^[3], which concluded that no single intervention is sufficient to address the range of barriers affecting ART adherence. The emphasis by health workers on individualized adherence support is therefore important. Patients who miss ART because of travel may require a different response from those who miss doses because of forgetfulness, adverse effects, stigma, alcohol use, or domestic stress. A patient-centred approach would first identify the dominant barrier and then match the intervention to that barrier.

The main contribution of the mixed-methods findings is that the patient-reported reasons and health workers' perspectives provide complementary rather than competing explanations of missed ART doses. Travel was the most commonly reported reason quantitatively, while health workers explained how employment, farming, stigma, distance, and lack of cross-facility continuity could make travel disruptive to treatment. Similarly, forgetfulness was commonly reported by patients, while health workers linked it to changing daily routines, work and family responsibilities, and treatment fatigue. The qualitative findings also identified factors that were less visible in the structured questionnaire, including fear of stigma when obtaining medicines near home, the effect of waiting times and staffing shortages, and the limitations of existing follow-up systems. This demonstrates the value of combining patient-level quantitative information with provider perspectives when examining a behaviour as complex as ART adherence. Overall, the findings support a view of ART adherence as a dynamic behaviour influenced by individual routines, social relationships, mobility, treatment experiences, and the organization of HIV services. Interventions that focus only on patient education may therefore have limited effect when the underlying barrier is structural or social.

Generalizability

The findings may be applicable to adults receiving ART in similar urban and peri-urban health facility settings in southwestern Uganda. However, generalization to other populations and settings should be made cautiously because the study was conducted in only two Health Centre IVs.

Strength of the study

This study had several strengths. First, it combined quantitative information from 386 people living with HIV with qualitative perspectives from healthcare providers,

allowing patient-reported reasons for missed ART doses to be interpreted alongside experiences from those directly involved in HIV service delivery.

Second, the study included two Health Centre IV facilities serving different urban and peri-urban/rural populations. This provided perspectives from different service-delivery contexts within the same geographical region. Third, the qualitative component included healthcare providers from different professional roles, providing perspectives on adherence counselling, clinical care, medicine dispensing, follow-up, and patient support. Finally, the use of direct quotations strengthened the qualitative interpretation by illustrating participants' experiences in their own words.

Limitations

This study had several limitations; missed ART doses were self-reported and therefore subject to recall and social desirability bias, the cross-sectional design limits the ability to establish temporal or causal relationships between the identified factors and missed ART doses. Third, the study was conducted in only two Health Centre IVs in southwestern Uganda, which limits the generalizability of the findings to other settings. Finally, the qualitative findings reflected healthcare providers' perspectives and did not capture all patient experiences of ART adherence.

Conclusion

Missed ART doses occurred in the context of individual, social, mobility-related, treatment-related, and health-system circumstances. Travel was the most commonly reported reason for missed doses, followed by forgetfulness, lack of available medicines, and domestic conflicts or stress. Health workers provided further context, identifying mobility, stigma and non-disclosure, competing responsibilities, treatment fatigue, alcohol use, adverse treatment effects, and health-system constraints as factors affecting treatment continuity. The findings support individualized, patient-centred adherence support, including flexible ART delivery, effective follow-up, management of treatment-related challenges, stigma-sensitive services, and strengthened community-based ART approaches.

Recommendations

The findings suggest several practical implications for HIV service delivery.

Health facilities should strengthen individualized adherence support by assessing the specific circumstances contributing to missed ART doses and providing appropriate counselling and follow-up.

ART services should provide flexible and decentralized medication access, including multi-month dispensing and community-based ART delivery, to reduce interruptions related to travel and mobility.

Health workers should strengthen appointment reminders and follow-up systems for clients who miss scheduled visits or are at risk of treatment interruption.

Health facilities should strengthen management of treatment-related challenges, including prompt identification and management of adverse ART effects and counselling on treatment fatigue.

HIV services should provide stigma-sensitive adherence support and encourage appropriate treatment disclosure and social support where acceptable to the client.

Further research should examine ART adherence longitudinally and include clients from a wider range of health facilities and geographical settings to better understand factors contributing to missed doses over time.

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List of Abbreviations

ART – Antiretroviral therapy

BSU-REC – Bishop Stuart University Research Ethics Committee

CCLAD – Community Client-Led ART Delivery

HC IV – Health Centre IV

HIV – Human immunodeficiency virus

IQR – Interquartile range

KII – Key informant interview

MMC – Mbarara City Council Health Centre IV

PLHIV – People living with HIV

REC – Research Ethics Committee

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Conflict of Interest

The authors declare that they have no conflict of interest.

Author Contributions

Elizabeth Ninsiima: Conceptualization, methodology, investigation, data collection, data curation, formal analysis, and writing—original draft.

Daniel Atwine: Supervision, methodology, statistical analysis, and writing—review and editing.

Caroline Birungi: Investigation, qualitative thematic analysis, and writing—review and editing.

Joanna Teta Ikiriza: Data collection, data curation, and writing—review and editing.

Bernard Ahimbisibwe: Data collection and writing—review and editing.

Elna Owembabazi: Writing—review and editing.

Nighty Sunday Atwine: Writing—review and editing.

Rachael Kanyana: Data collection and writing—review and editing.

Alex Rutebwa Rubarema: Conceptualization, investigation—review and editing

Jackson Selwano Musiime: Supervision, methodology, and writing—review and editing.

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All authors reviewed and approved the final manuscript and agreed to be accountable for all aspects of the work.

Data Availability

The data are available from the corresponding author upon reasonable request and subject to appropriate ethical and institutional approval.

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