BMC Health Services Research

RESEARCH Open Access

Patient perceptions and predictors of intention to use telehealth for follow-up care: a mixed methods study among adults living with HIV in Kampala, Uganda

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Abstract

Background The human immunodeficiency virus (HIV) remains a significant global public health challenge. Despite progress in addressing the pandemic, people living with HIV continue to report challenges in accessing HIV testing, care, and treatment services. Telehealth presents a promising solution to some of these barriers. However, its potential remains unrealized, particularly in low- and middle-income settings, partly due to insufficient supporting evidence.

Methods Our mixed methods study investigated patient perceptions and predictors of intention to use telehealth for follow-up HIV care in Uganda. Quantitative data were collected from 266 participants using a questionnaire, followed by one-on-one interviews with 12 people living with HIV. Quantitative analysis involved Chi-square tests, t-tests, and binary logistic regression, while qualitative data were analyzed using conventional content analysis.

Results Our findings show that the intention to use telehealth was significantly associated with effort expectancy (aOR 1.26, CI 1.13–1.41), facilitating conditions (aOR 1.44, CI 1.19–1.73), estimated monthly income (aOR 2.94, CI 1.05–8.23; aOR 7.29, CI 1.12–47.49), and antiretroviral medication adherence (aOR 1.93, CI 1.12–3.33). Qualitative insights underscore the importance of digital literacy and availability of support services to enhance the utilization of telehealth. While performance expectation and stigma score did not significantly predict intention to use telehealth, participants perceived telehealth to be beneficial in combating stigma and improving access to HIV care services.

Conclusions To optimize the utilization of telehealth, we recommend measures aimed at addressing economic disparities and enhancing digital literacy among people living with HIV. Future research should explore the effectiveness of economic empowerment programs in promoting telehealth use and investigate the impact of telehealth on HIV care models, stigma reduction, and linkage and retention in HIV care.

Keywords Perceptions, Predictors, Telehealth, HIV, Mixed methods, Uganda

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Background

Globally, about 39 million people were living with HIV by the end of 2022 [1]. Eastern and Southern Africa continue to be the most affected region, with about 20.8 million people infected with HIV [1]. Overall mortality from AIDS-related causes and new HIV infections has decreased substantially compared to a decade ago. In addition, about three-quarters of all people living with HIV (PLWH) were accessing antiretroviral therapy (ART) by the end of 2021, almost a four-fold increase compared to 2010 [2]. Despite these important gains in scaling-up HIV responses worldwide, PLWH continue to report several challenges in accessing HIV testing, care, and treatment services [3]. Some obstacles cited by PLWH include expensive and unreliable transportation, insufficient insurance coverage, depression, and competing life events [4]. Also, stigma, discrimination, and fear of serostatus disclosure discourage PLWH from seeking care and treatment, thus negatively impacting their quality of life [5]. Disruptions caused by the emergence of severe acute respiratory syndrome coronavirus 2 – the cause of coronavirus disease (COVID-19), such as lockdown measures, further exacerbated obstacles to care and treatment and challenged traditional approaches to delivering HIV care [6]. In many parts of the world, the rapid adoption of telehealth was initiated to maintain the engagement of patients in care [6–9].

Telehealth, defined as "the use of electronic information and telecommunication technologies to support long-distance clinical health care, patient and professional health-related education, health administration, and public health" [10], has the potential to address some of the obstacles to HIV care. In this study, telehealth is defined as synchronous telecommunication that includes audio and video equipment by the patient and the healthcare provider to receive and deliver patient care [11]. Advantages associated with the use of telehealth for HIV care include elimination of transportation costs, increased convenience [12], reductions in no-show appointments and healthcare costs [13–15] and increased access to specialty care [16, 17]. Importantly, researchers argue that the use of telehealth in HIV care may help in addressing stigma-related delays in accessing HIV care [11, 18, 19].

As the impact of COVID-19 continues to subside, there is widespread recognition of the role that telehealth will continue to play in the delivery of HIV care services in the post-pandemic era [18, 20–22]. However, in some regions, such as sub-Saharan Africa, individual, organizational, and policy-level obstacles continue to hinder the extensive adoption of telehealth. For instance, recent reviews show that at the personal level, there is a perceived threat to professional control, insufficient training and skills, and resistance to change; while from a patient perspective commonly reported obstacles include digital illiteracy and lack of access to telehealth-compatible devices [23, 24]. At the organizational level, bottlenecks include a lack of expertise, inadequate infrastructure, low-level commitment, and buy-in [23, 24]. Additionally, the adoption of telehealth faces several operational obstacles, such as a lack of context-specific policies and regulatory frameworks, limited government support, and inadequate access to and high cost of internet services [23, 24]. Despite the challenges noted above, Sub-Saharan Africa continues to be a hot spot for digital innovations [25], and the advent of COVID-19 catalyzed increased utilization of telehealth technologies in the region [24, 26, 27]. In addition, the pandemic energized initiatives to address impediments to widespread telehealth adoption. For example, a recent publication from Africa Telehealth Collaborations (ATC) identifies five focus areas to eliminate barriers to telehealth adoption in South Africa and Africa [28]. The collaboration aims to build a research repository and gather user perspectives about telehealth to guide the evidence-based deployment of telehealth in the region [28]. Presently, a limited pool of local evidence exists to feed into the above efforts underscoring the importance of conducting more research to generate context-specific information to guide judicious application of telehealth in the region.

Studies conducted in high-income settings suggest that videoconferencing is generally acceptable to PLWH [29, 30], and it is linked with improved adherence to HIV medication [31, 32] and in some instances viral load suppression. However, due to differences in contexts, findings from high-income countries may not be transferrable to low-income settings such as Uganda. Evidence from low- and middle-income countries suggests that telehealth may be useful in improving HIV pre-exposure prophylaxis, psychosocial support, and care and treatment for people living with HIV [33]. However, there is a need for more evidence to guide development of locally relevant telehealth interventions. In addition, few existing studies have applied theory in understanding the adoption of telehealth among PLWH, particularly in resource-limited settings [34]. Thus, using a two-phased, mixed method design, the purpose of this study was to identify predictors of intention to use telehealth and perceptions of patients in Uganda regarding the use of this innovative approach to delivering care.

Guiding theory, description of mixed methods study phases, & research questions

The quantitative phase of this mixed methods study was guided by the Unified Theory of Acceptance and Use of Technology (UTAUT) [35]. The UTAUT posits that behavioral intention (BI) is influenced by performance expectation (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). In this study,

behavioral intention is defined as the degree to which an individual intends to use telehealth for follow-up HIV care. Performance expectation means the degree to which an individual believes that telehealth will help them improve their health quality [36]. Effort expectancy implies the degree of ease associated with the use of telehealth, social influence is defined as the influence of peers and colleagues' opinions about telehealth use, and facilitating conditions refers to individual beliefs that support exists for the use of telehealth [36]. The UTAUT was developed following a synthesis of eight models that sought to explain determinants of intention and usage of information technology [35]. However, the theory is usually supplemented with additional variables that take into consideration contextual factors that may influence intentions to enact a particular behavior [36]. In this study, sociodemographic and HIV-related variables were also considered as potential covariates. Thus, phase one of the present study sought to answer the following research questions: (1) does intention to use telehealth differ by sociodemographic and HIV-related characteristics of the patients? and (2) which constructs from the UTAUT function as predictors of intention to use telehealth?

Furthermore, knowing that the UTAUT constructs do not entirely explain all the variance in usage intention [35], it was essential to consider other determinants that influence the adoption of telehealth that the model does not address [37]. Although sociodemographic and HIV-related variables were included in the quantitative model, a qualitative phase was added to explore further issues that would not be measured using survey data and gain a deeper and broader insight into the phenomenon. Specifically, the qualitative component of the study aimed at answering the following research question: what are the perceptions of PLWH about using telehealth for follow-up HIV care? Taken together, findings from this mixed methods study may contribute to the initial body of evidence that can guide the development of efficacious telehealth interventions to positively influence the health outcomes of patients living with HIV in resource-limited settings.

Methods

Study design and study sites

This explanatory sequential mixed methods study [38] was conducted in Kisenyi and Komamboga Health Centres in Kampala City Council, Uganda. The study design consisted of two phases: (1) a quantitative phase which involved a survey among adults living with HIV, followed by (2) a qualitative phase which involved one-on-one interviews with PLWH who were receiving care and treatment from the health facilities mentioned above. The health facilities were selected by simple random sampling from a list of six health centres that provide HIV care and treatment services in the Kampala City Council Authority. The names of all the health facilities were written on small pieces of paper which were folded and mixed well in a small box. Two pieces of paper were selected from the box without replacement. The papers which were picked were opened revealing the names of the health facilities where the study was going to be conducted. The selected health facilities offer various curative, preventive, and health promotion services. The services offered include reproductive health care, immunizations, dental and oral health, tuberculosis management, laboratory diagnostics, cervical cancer screening, and comprehensive HIV care and treatment services. Each week more than 600 patients receive HIV care and treatment from both Kisenyi and Komamboga health facilities, with clinics operating from Monday to Thursday. HIV services include HIV counseling and testing, male medical circumcision, prevention of mother-to-child HIV transmission, medication refills, and routine viral load checks.

Sample

For the quantitative phase of the study, participants were drawn from patients attending the outpatient HIV clinic at each study site. To be included, patients had to meet the following inclusion criteria: aged 18 years and older, living with HIV for at least a month, receiving care and treatment from the selected health facilities, able to speak Luganda or English, willing to participate in the study, able to provide consent, and on ART for at least 30 days. Patients were excluded from the study if they were severely sick, blind, or could not communicate verbally.

Prior to the quantitative study, a power calculation resulted in a minimum sample size of 266 using the G*Power software program [39] version 3.1.9.7. Data were collected from 150 patients from Kisenyi Health Centre and 116 from Komamboga Health Centre. Initially, the goal was to split the sample size between the two health facilities, but it was later realized that Kisenyi Health Centre received more patients than Komamboga. Thus, more participants were enrolled in Kisenyi Health Centre.

To be interviewed during the second qualitative phase of the study, patients had to meet eligibility criteria for the Phase 1 survey data collection and live within five kilometers of Kampala. During the implementation of Phase 1, a total of 82 participants agreed to participate in further data collection. Forty patients were then contacted using their telephone numbers provided during survey data collection. These participants were systematically identified from the list compiled from the first phase of the study, starting from the top of the list and progressively moving downwards. Twelve patients could not be contacted either because the telephone number

they provided was no longer in service or it was switched off. Of the 28 participants who answered their phones, 16 agreed to be interviewed. However, some could not participate because they were too ill to travel for the interview or lacked funds to enable them to travel to the study site. Of the 16 patients who agreed to be interviewed, three did not show up because of unknown reasons, and one canceled the appointment because of illness. Although we initially planned to conduct 15–20 interviews, data saturation was attained [40] by the ninth interview. However, three more interviews were conducted to confirm whether we had reached data saturation. After completing 12 interviews, data collection was stopped because no more new information was being elicited.

Data collection procedures

Quantitative data collection

Survey data were collected from March to May 2022 by two trained research assistants who were nurses who were not working in the selected health facilities. The research assistants worked in collaboration with the staff managing the clinics to identify and recruit patients who met the eligibility criteria. Patients were approached in the out-patients' waiting area after checking into their appointment at the health centers. Research assistants consecutively enrolled and surveyed participants at each site until a sample size of 266 was attained. On each day of data collection, 15–23 patients were surveyed. The surveys were conducted in enclosed tents which were normally used for counseling patients requiring HIV testing services. After obtaining informed consent from each of the participants, the research assistants read each survey aloud from a hard copy, and the participant responded. The survey for each participant lasted between 20 and 30 min. At the end of each day, the first author (CPO) gathered all the filled surveys and checked them for completeness and accuracy. Data from completed surveys were entered into a password-protected computer.

Survey measures

A survey questionnaire was used to collect data about participants' sociodemographic and HIV-related variables. The sociodemographic characteristics included were age, biological sex, level of education, marital status, religion, occupation, estimated monthly income [41], mobile phone ownership, and type of mobile phone owned. Based on hypothesized relationships and a review of the literature, the following HIV-related variables were included in the questionnaire: HIV disclosure status, HIV medication adherence [42], duration spent on HIV treatment, time spent living with HIV and perceptions about HIV stigma. HIV disclosure status was measured using a single item with response options recorded as yes (1) or no (0) item, and medication adherence was assessed using a three-item adherence scale adapted from Wilson and colleagues [43, 44]. Each self-report item on the adherence scale had different response options, which were transformed to a standardized, linear 0–100 scale. One summary self-report adherence score was calculated by averaging responses to the three adherence scales.

Time lived with HIV and duration of treatment were estimated in months. Perceptions about HIV-related stigma were measured using a validated 12-item scale [45], developed from the HIV stigma scale by Berger [46]. The scale comprises four subscales with good psychometric properties (Cronbach's alphas ranging from 0.8 to 0.88). Response options ranged from 1 = strongly disagree to 5 = strongly agree. Responses from each participant were summed up, resulting in a score ranging from 12 to 60, with higher scores indicating a high level of perceived stigma.

The questionnaire also included items to assess the five constructs of the UTAUT [35]: behavioral intention, performance expectation, effort expectancy, social influence, and facilitating conditions. Behavioral intention to use telehealth technology (the outcome variable) was measured using a four-item Likert scale adapted from studies by Cimperman and colleagues and Chao [35, 36, 47]. Performance expectation was assessed using a five-item Likert scale adapted from previous telehealth studies [36, 48, 49]. Effort expectancy was measured using a four-item Likert scale by Huang [48] and Davis [49]. Social influence was assessed using a three-item Likert scale adapted from Huang's subjective norm scale [48] and Cimperman and colleagues [36]. Facilitating conditions was evaluated using a three-item Likert scale by Cimperman and colleagues [36]. Response options for all five scales ranged from 1 = strongly disagree to 7 = strongly agree, and for each scale, responses from each participant were summed to create a score for the five UTAUT constructs. The scales had good psychometric properties, with Cronbach's alphas ranging from 0.85 to 0.92. Before data collection began, the survey was translated into Luganda by an expert fluent in both Luganda and English. The translated survey was then piloted with twenty patients living with HIV who were receiving care at health facilities different from those where the actual data collection took place. Based on the findings from the pilot test, minor adjustments were made to improve the instrument. The final version of the instrument is included as a Supplementary file.

Qualitative data collection

Qualitative data were collected using a semi-structured interview guide developed after a review of the literature. The interview guide was divided into two sections. The first section consisted of six questions to collect

sociodemographic information from participants, such as age, sex, marital status, level of education, and religion. The second section of the interview consisted of five questions that delved into perceptions of patients about the use of telehealth for follow-up HIV care and treatment, categories of patients for whom telehealth would be suitable, types of health services that would be suitable to be delivered using video visits, and barriers that would be solved by using this approach of care. Other issues explored included the impact of telehealth on existing health services and challenges that need to be addressed to empower patients and health providers. Before data collection commenced, an expert proficient in both Luganda and English translated the interview guide into Luganda. The translated interview guide was piloted with two patients living with HIV at a different site than Kisenyi and Komamboga Health Centres. Based on these two pilot interviews, adjustments were made in the way questions were formulated and sequenced in both the English and Luganda interview guides.

One-on-one interviews

The interviews were conducted by a trained research assistant with extensive experience in conducting one-on-one interviews and were undertaken from August to September 2022. All the interviews were conducted in Luganda (the language spoken in the study area) at either Kisenyi or Komamboga health centres. Informed consent was sought for each participant before the commencement of the interview. Interviews lasted between 31 and 60 min, and all conversations were audio recorded with participants' permission. The interviews were transcribed verbatim and translated into English by a native Luganda speaker who was proficient in English.

Analysis strategies

Quantitative data analysis

Survey data were analyzed using the IBM Statistical Package for Social Sciences (SPSS) version 27. Categorical variables were analyzed using descriptive methods, and results were presented using frequencies and percentages. Continuous data were summarized using means (standard deviation [SD]) and medians (range). The distribution of the outcome variable - behavioral intention (BI) to use telehealth - was examined, and both Kolmogorov-Smirnov and Shapiro-Wilk tests revealed that the data were not normally distributed. Transformations using logarithms and square root techniques failed to normalize the data. Thus, the outcome variable was dichotomized based on a median split to form two categories: low BI score (score ≤ median) and high BI score (score > median). A previous study by Pagaling and colleagues similarly converted the dependent variable from a 5-point Likert scale to binomial responses (i.e., 0-neutral or disagree; 1-agree) [50].

Chi-square tests were conducted to examine the association between the outcome variable and categorical independent variables. For continuous predictor variables, independent sample t-tests were conducted to investigate the difference in means by the two categories of BI to use telehealth. Binary logistic regression analysis was applied to determine predictors of intention to use telehealth. Predictors were tested in three separate blocks: (1) UTAUT predictors, (2) sociodemographic and HIV-related variables, and (3) UTAUT, sociodemographic, and HIV-related predictors. Only variables with $p \leq 0.15$ at the bivariate level were included in the logistic regression models (with the exception of age and sex which were included because they are known covariates moderators of the relationship between UTAUT predictors and behavioral intention). Statistical significance in the multivariable logistic models was determined at an alpha level of < 0.05. The strength of the association between the outcome and independent variables was evaluated using odds ratios and 95% confidence intervals.

Qualitative data analysis

The in-depth interviews were transcribed from Luganda to English by a native Luganda speaker who was also proficient in English. The first author (CPO) read all the transcripts to obtain a sense of all the qualitative data. Each of the transcripts was given a unique identifier, and all identifying information, such as names of participants and places, was removed from the documents. The deidentified documents were imported to Atlas.ti software version 22.2.5.0 (ATLAS.ti, Berlin, Germany) for analysis. The qualitative analysis process was conducted following conventional content analysis procedures described by Hsieh and Shannon [51]. The first three transcripts were read line by line by CPO, and sections of the text relevant to the research question were noted, resulting in an initial coding scheme. The coding scheme was shared with CMP who advised on ways to refine the coding process. The refined coding scheme was then applied to all the remaining documents, and during this process, some codes were merged and others discarded. The codes generated were sorted into categories based on similarities and differences. In addition, comparisons were made between the perspectives of male and female participants to gain a deeper insight into the data.

Categories generated were organized into meaningful clusters based on the Socioecological Model [52, 53]. The Socioecological Model was chosen as the organizing framework because it suggests that an individual's health behavior is influenced by multi-level factors operating at intrapersonal, interpersonal, organizational, community, and public policy levels [52, 53]. In addition,

previous scholars have used this framework to identify and map interventions to promote digital health equity [54]. Other investigators recommend using this model to research digital technologies in health [55]. Therefore, an individual's intention to use telehealth was assumed to be influenced by factors operating at individual, family, community, health facility, and public policy levels. The findings are presented using a narrative approach with examples of illustrative quotes.

Table 1 Sociodemographic and HIV-related characteristics of participants ($N = 266$)

Variable	*n* (%) or mean (SD), median [range]
Age [mean (SD)]	35.4 (9.6)
Biological Sex	
Female	179 (67.3)
Male	87 (32.7)
Marital Status	
Married/cohabiting	127 (47.7)
Un-married	139 (52.3)
Highest Education Level	
Primary or below	127 (47.7)
Secondary or tertiary	139 (52.3)
Religion	
Christian	211 (79.3)
Muslim	55 (20.7)
Occupation	
Unemployed	89 (33.5)
Formal employment	28 (10.5)
Runs own business	149 (56.0)
Estimated Monthly Income	
≤10,000 UGX	38 (14.3)
10,001–50,000 UGX	32 (12.0)
50,001–100,000 UGX	46 (17.3.)
100,001- 500,000 UGX	138 (51.9)
>500,000 UGX	12 (4.5)
Owns a Mobile Phone	
Yes	260 (97.7)
No	6 (2.3)
Type of Mobile Phone	
Basic phone	137 (52.7)
Smartphone	77 (29.6)
Smart and Basic phone	46 (17.7)
Ever Disclosed HIV Status	
Yes	253 (95.1)
No	13 (4.9)
Adherence to HIV Medication	
≤ 95% (Poor adherence)	169 (63.5)
> 95% (Good adherence)	97 (36.5)
Duration Lived with HIV (Months) (median [range])	85 [1- 420]
Duration on ART (Months) (median [range])	72 [1- 360]
Stigma Score (median [range])	38 [12–60]

UGX Uganda Shillings, *ART* Antiretroviral therapy

Integration and mixing of methods

Mixing of methods occurred at methods, interpretation, and discussion levels [38]. At the methods level, participants who were interviewed were derived from the population of patients who were surveyed. Additionally, findings from the quantitative part of the study informed the questions asked during the qualitative phase of the study. Furthermore, mixing of methods occurred at the stage of data interpretation and discussion of results through the process of weaving which involves writing both quantitative and qualitative findings together on concept-by-concept basis [56]. Additionally, although quantitative and qualitative data were initially analyzed separately in keeping with the principles of explanatory mixed method design [38, 56, 57], quantitative and qualitative data are jointly displayed in a table to identify points of convergence and divergence between the two data sets.

Results

Quantitative results

The quantitative phase of the study focused on a sample of 266 participants; 179 (67.3%) were female. The mean age of participants was 35.4 years (SD = 9.6). Almost 98% owned mobile phones, with over half (52.7%) reporting owning only a basic phone and less than a third (29.6%) owning only a smartphone. Most (95%) participants had disclosed their HIV status, and about 64% had poor HIV medication adherence levels. The median number of months individuals lived with HIV was 85 months (range 1–420), and the median duration spent on ART was 72 months (range 1–360). Perceived stigma scores ranged from a low of 12 to a high of 60 points, with a median of 38. Other sociodemographic variables are presented in Table 1.

Bivariate analysis

Bivariate analysis of sociodemographic and categorical HIV-related variables and intention to use telehealth are shown in Table 2. Greater levels of estimated monthly income ($p = 0.009$) and adherence to HIV medication ($p = 0.011$) were significantly associated with a higher score on the behavioral intention to use telehealth measure. There was also a trend toward significance for the association between HIV disclosure and intention to use ($p = 0.051$).

In Table 3, bivariate analysis using t-tests indicates that all the UTAUT predictors were significantly associated with intention to use telehealth ($p < 0.001$). For example, participants with a high behavioral intention score also had higher mean scores on the performance expectation scale compared to those with low behavioral intention scores. Neither age nor perceptions about stigma

Table 2 Bivariate associations between sociodemographic and HIV-related variables and behavioral intention to use telehealth

Variable	Low behavioral intention score (≤ 26) *n*, row %	High behavioral intention score (> 26) *n*, row %	*P*-value
Biological Sex			
Female	106 (59.2)	73 (40.8)	0.786
Male	50 (57.5)	37 (42.5	
Marital Status			
Married/cohabiting	73 (57.5)	54 (42.5)	0.712
Un-married	83 (59.7)	56 (40.3)	
Highest Education Level			
Primary or below	77 (60.6)	50 (39.4)	0.530
Secondary or tertiary	79 (56.8)	60 (43.2)	
Religion			
Christian	129 (61.1)	82 (38.9)	0.106
Muslim	27 (49.1)	28 (50.9)	
Occupation			
Unemployed	57 (64.0)	32 (36.0)	0.352
Formal employment	14 (50.0)	14 (50.0)	
Runs own business	85 (57.0)	64 (43.0)	
Estimated Monthly Income			
≤10,000 UGX	29 (76.3)	9 (23.7)	0.009
10,001–50,000 UGX	24 (75.0)	8 (25.0)	
50,001–100,000 UGX	26 (56.5)	20 (43.5)	
100,001- 500,000 UGX	73 (52.9)	65 (47.1)	
>500,000 UGX	4 (33.3)	8 (66.7)	
Owns a Mobile Phone			
Yes	153 (58.8)	107 (41.2)	0.664
No	3 (50.0)	3 (50.0)	
Type of Mobile Phone			
Basic phone	47 (61.0)	30 (39.0)	0.457
Smartphone	76 (55.5)	61 (44.5)	
Smart and Basic phone	30 (65.2)	16 (34.8)	
Ever Disclosed HIV Status			
Yes	145 (57.3)	108 (42.7)	0.051
No	11 (84.6)	2 (15.4)	
Adherence to HIV Medication			
≤ 95% (Poor adherence)	109 (64.5)	60 (35.5)	0.011
> 95% (Good adherence)	47 (48.5)	50 (51.5)	

Table 3 Bivariate associations between continuous variables and behavioral intention to use telehealth

Variable	Low behavioral intention score (≤ 26) Mean (SD)	High behavioral intention score (> 26) Mean (SD)	*P*-value
Age	35.53 (10.02)	35.11 (8.89)	0.727
Stigma Score	37.40 (11.06)	37.19 (12.32)	0.883
Performance Expectation (PE)	30.32 (4.25)	33.28 (2.79)	< 0.001
Effort Expectancy (EE)	22.61 (4.38)	26.28 (2.54)	< 0.001
Social Influence (SI)	16.06 (4.22)	18.63 (3.01)	< 0.001
Facilitating Conditions (FC)	17.65 (2.99)	20.13 (1.67)	< 0.001

were significantly associated with the intention to use telehealth.

Multivariable analysis

Table 4 presents the results of the three logistic regression models testing blocks of variables with a *p*-value of ≤ 0.1 and their associations with behavioral intention to use telehealth. In Model 1, two of the four UTAUT variables were significant predictors of intention to use telehealth. For a unit increase in effort expectancy scores, the odds of a participant scoring high on intention to use telehealth were 1.25 times the odds of a low score while adjusting for age and sex (95% CI, 1.13–1.40). Similarly, for a unit increase in facilitating conditions scores, the odds of a participant scoring high on intention to use telehealth were 1.42 (95% CI, 1.21–1.68) times the odds of a low score, adjusting for age and sex.

Model 2 estimates the effects of other sociodemographic and HIV-related variables on behavioral intention to use telehealth. Significant associations were found for income and HIV medication adherence status. Specifically, the odds of scoring high on intention to use telehealth among participants who earn an estimated monthly income of 100,001–500,000 UGX (approximately $27–135) were 2.97 (95% CI, 1.26–6.99) times greater than those of participants who earned 10,000 UGX (about $2.70) and less, adjusting for age, sex, religion, HIV disclosure status, and HIV medication adherence levels. Similarly, the odds of scoring high on intention to use telehealth among participants who earn an estimated monthly income of 500,000 UGX or more (more than $135) were 6.57 (95% CI,1.49–29.02) times those of participants who earned 10,000 UGX ($ 2.7 US) and less, adjusting for all other variables in the model. Furthermore, the odds of having a high score on intention to use telehealth among participants with good HIV medication adherence were 1.93 (95% CI,1.12–3.33) times those of participants with poor HIV medication adherence adjusting for age, sex, religion, HIV disclosure status, and estimated monthly income.

Model 3 includes all variables in the same model. Effort expectancy, facilitating conditions, and income remained significantly associated with the intention to use telehealth in this final adjusted model, with few changes to their coefficients. However, HIV medication adherence was no longer associated with the intention to use telehealth, with the addition of the UTAUT measures.

Qualitative results

The second phase of the study involved one-on-one interviews with 12 people living with HIV who filled out a survey during the first phase. More than half of the participants were female; the ages ranged from 19 to 54 years, 67% identified as Christians, and there was an even split by health care centre site. The sociodemographic characteristics of the interviewed participants are shown in Table 5.

Table 4 Logistic regression results of associations of UTAUT, sociodemographic, and HIV-related variables with odds of high behavioral intention to use telehealth score

Variable	Model 1 aOR (95%CI)	Model 2 aOR (95%CI)	Model 3 aOR (95%CI)
UTAUT Measures			
Performance Expectation (PE)	1.12 (1.00–1.24)	----------	1.11 (0.99–1.24)
Effort Expectancy (EE)	1.25 (1.13–1.40)*	----------	1.26 (1.13–1.41)*
Social Influence (SI)	1.06 (0.97–1.17)	----------	1.05 (0.95–1.17)
Facilitating Conditions (FC)	1.42 (1.21–1.68)*	----------	1.44 (1.19–1.73)*
Sociodemographic Factors			
Estimated Monthly Income (ref = ≤ 10,000 UGX)		1.00	1.00
10,001–50,000 UGX		0.93 (0.30–2.93)	0.73 (0.19–2.78)
50,001–100,000 UGX		2.39 (0.90–6.34)	1.57 (0.48–5.17)
100,001- 500,000 UGX		2.97 (1.26–6.99)*	2.94 (1.05–8.23)*
>500,000 UGX		6.57 (1.49–29.02)*	7.29 (1.12–47.49)*
Religion (ref = Christian™)		1.00	1.00
Muslim		1.61 (0.85–3.07)	1.7 (0.76–3.78)
HIV-related Variables			
Ever Disclosed HIV Status (ref = No)		1.00	1.00
Yes		4.45 (0.92–21.54)	5.40 (0.88–33.08)
Adherence to HIV Medication (Ref = ≤ 95 (Poor Adherence)		1.00	1.00
> 95 (Good Adherence)		1.93 (1.12–3.33)*	1.34 (0.67–2.68)

UGX = Uganda shillings, *UTAUT* = Unified Theory of Acceptance and Use of Technology, TM = Christian included Pentecostal, protestants, Catholics and Seventh Day Adventists and other Christian denominations, *aOR* = Adjusted odds ratio. All three models controlled for sex and age

*Statistically significant findings $p < 0.05$

Table 5 Sociodemographic characteristics of participants for one-on-one interviews

No.	Age (Years)	Sex	Marital Status	Highest Level of Education	Religion
1.	37	Female	Married	Tertiary	Muslim
2.	22	Female	Married	Secondary	Christian
3.	34	Male	Married	Primary	Christian
4.	48	Female	Separated	Primary	Muslim
5.	33	Female	Separated	Secondary	Christian
6.	48	Female	Separated	Secondary	Christian
7.	49	Female	Widow	Primary	Christian
8.	33	Male	Separated	Secondary	Muslim
9.	45	Male	Married	Tertiary	Christian
10.	19	Female	Single	Secondary	Muslim
11.	26	Male	Single	Tertiary	Christian
12.	54	Male	Married	Secondary	Christian

Perceptions about the use of telehealth for follow-up care

Themes about participants' perceptions about using telehealth for follow-up HIV care are organized using the socioecological model.

Individual level

At the individual level, the results were categorized into perceptions about the benefits of telehealth, barriers or challenges impeding the adoption of telehealth, and the category of patients who would benefit from telehealth.

Perceived benefits of using telehealth for follow-up HIV care

Participants cited several benefits of using telehealth, including flexibility and convenience in accessing health services, and saving the cost of transport and time spent traveling and waiting for health services. Perceptions about convenience and the possibility of saving the cost of transport were the most cited benefits of using telehealth; they were mentioned to almost equal extents by both male and female participants.

> *"So, this can save your time and money for transport you have used to come to hospital to see the doctor. However, using a video-call you can easily explain to him/her whatever you want to say enabling you to remain doing other work."* **(IDI02_Female, age 33)**

> *"It makes your life easy. It helps you to get to your doctor at any time anywhere when you need to talk to him. It's very helpful and easy."* **(IDI06_Female, age 48)**

Additional benefits mentioned include flexibility in accessing health services, privacy, minimal interruptions to work or business, and the possibility of telehealth helping address perceived stigma.

> *"It helps me not to interrupt my daily income because if you have a [business] stall, the time you leave, just know you are losing. If you were to get 30,000 shillings you are likely to get 10,000 or 5,000 shillings. Yet in… [name of city] our gardens are in working, if you don't work, everything will be hard for you."* **(IDI01_Female, age 48)**

> *"… some other thing I think is stigma to some extent because most patients fear to sit in the tent [waiting area] when there are many people. Because as for me, there is a time I met a client here who is our neighbor. So, you get to see the shying away… And as you know that HIV is not like a mark on your face, so maybe he thought that for me I didn't have it yet makes him to feel shy. So, stigma to some extent will be solved."* **(IDI10_Male, age 26)**

Perceived barriers to utilization of telehealth for follow-up HIV care

Factors that were mainly mentioned as possible barriers to the utilization of telehealth included lack of access to smartphones, inability to afford internet data, and low digital literacy. There were no notable sex differences in perceptions of participants about the limited access to smartphones, low digital literacy, and high cost of the internet as possible barriers to the utilization of telehealth.

> *"… the problem we have is these phones for touch are expensive and we are low-income earners so to get three hundred thousand to buy a phone it may be difficult. Yet on thirty thousand you can get a pressing phone."* **(IDI05_Male, age 45)**

> *"What can hinder me is when I fail to get someone who can teach me how to use that phone because there are so many things on that phone which we are ignorant about. But when you get someone to teach you or we get a lecture on how to use the smart phone like if you want this and this you do like this, if you want to send a picture you do like this, if want to send messages you do like this. It would have been of help to me if we had someone to teach us how to use it."* **(IDI09_Female, age 37)**

> *"The issue of data can be a challenge to some, it's the other issue I told you about concerning money, that some of us, the kind of jobs we do and the money we earn is not even enough. I may say it's just enough for our basic needs, but it's actually not enough."* **(ID09_Female, age 37)**.

Other challenges that were mentioned include concerns about privacy and confidentiality, fears about the inability of patients to express themselves well during video visits, and the need to pick up medicines from health facilities.

> *"... what may be bad is when he/she (health provider) deliberately saved what transpired during the video-call and then some other person gets to access that video and gets to know what took place... especially that person who did not know your status and gets to use that information to tell others... That's the only problem I see if we are to use this form of communication... time may come and the doctor can use this information to alert a person you want to go into a relationship that he should not start a relationship with you because you are HIV positive."* **(IDI02_Female, age 33)**

Category of patients for whom telehealth would be a suitable way of delivering care

The participants also identified the client categories for whom telehealth would be more suitable, including young clients, truck drivers, persons newly diagnosed with HIV, patients who are stable on treatment, patients with busy schedules, and patients experiencing stigma. Female participants mostly mentioned individuals experiencing stigma as patients who would benefit from telehealth. The views of the participants are captured in the following quotes:

> *"These youth have a lot of fear... they fear to talk, and they don't open up on so many issues like they say I will not tell the health worker, let me just go and get Panadol [pain medication]... that age needs special care because they like it [technology] so much."* **(IDI04_Female, age 49)**

> *"... it is us who are HIV positive that would benefit from that arrangement because whenever you frequently visit this place, people get to notice you. Now like us who work with parents, when a parent finds you seated among the sick people, he says that "eh eh! Even that teacher is sick too! Isn't that place for sick people!" Ok, us who are HIV positive would have been benefited from that arrangement mostly."* **(IDI09_Female, age 37)**

> *"I think there are these kinds of people doesn't stay in one place, are some who may be busy that's to say the truck drivers, you will not call that person, that sir, come to clinic... definitely he will tell you that am in... [far place]."* **(IDI10_Male, age 26)**

However, telehealth was not perceived to be a suitable approach for delivering care for patients with opportunistic infections or patients with other comorbidities such as diabetes and high blood pressure.

> *"There are those with some sickness like pressure, diabetes. Let's take an example like pressure. A pressure victim is so delicate you may have HIV with pressure, but when the pressure rises someone may not realize it but think it's the HIV which has affected yet even pressure can lead to the death of someone."* **(IDI01_Female, age 48)**

> *"The people with TB because people with TB suffer a lot for example, I had my brother who had TB, he suffered, and he had to go to the hospital daily."* **(IDI12_Male, age 54)**

The other patients for whom telehealth would not be suitable include children living with HIV, the elderly, people with various disabilities, and those with poor medication adherence.

> *"The elderly from 50 years... I have a stepmother, we brought her a smart phone but even using WhatsApp may be difficult, even her calling or receive a call is very difficult."* **(IDI10_Male, age 26)**

> *"There are also some people who don't take well the medicine and its needs to come every month to get a checkup... that one also does not need to use a video call because she/he has to come for a checkup."* **(IDI11_Female, age 19)**

Interpersonal level

At the interpersonal level, telehealth was perceived to be an opportunity to involve family and significant others in the care of the person living with HIV, thus expanding the social support network.

> *"Our people most especially that we stay with will know the person we deal with because it doesn't stop me when am talking to my doctor on video call as my wife is there. Even when I happen to send her for my medicine, she will know that person, how she looks like, because she saw the person on video call as I was talking to him."* **(IDI05_Male, age 45)**

However, implementing virtual care was perceived to limit prospects for individuals to create relationships with potential future partners, share experiences, network with friends and gain opportunities for jobs and other social events. The challenge of missing friends and networking opportunities were mainly mentioned by male interviewees.

"... I am HIV positive, I don't want to stress myself, I want to get a partner who is also HIV positive. Here when you gather you get chance of seeing each other... that is when you go ahead with your friendship... continue from there..." **(IDI02_Female, age 33)**

"When we come to get medicine, you sit with someone you don't know, so when you sit with this person obviously you converse, and you tell him something, the problem you find, and he guides you on how to go about them. You tell him I don't have a job and he asks which type of job that you know. And you are able to tell him this and that and you never know that person can connect you." **(IDI05_Male, age 45)**

"For me here before, I was working with the peers. Now for the case of video calls, how would I have interacted with them? Sometimes we even we have different opportunities where we go for competitions for pageants. Like people with HIV usually have competitions for beauty pageants. So, we shall have missed all those opportunities because now when we come here, they tell us about such opportunities of such things. But now if we were on video calls, how would they tell us about such? It will not be possible." **(IDI10_Male, age 26)**

Health facility level

Interviewed HIV patients perceived telehealth would result in several facility-level benefits, and this modality of delivering care would be suitable for providing certain categories of health services. Among the most cited benefits was the possibility of telehealth improving patient-health provider relationships; female participants mostly expressed this. Other benefits were reduced workload and congestion at health facilities, increased utilization of health services, and improved reporting of medication side effects.

"The relationship which can be built up with your doctor... that is when you are using a voice only call, he/she does not get to know you... however, using a video-call, he/she gets to know you... when he/she meets you anywhere he/she can easily identify you." **(IDI02_Female, age 33)**

"... the overcrowdings in the hospitals. You can come here and find very many people in the hospital. But when you use the video, it's easier but in the hospital, you come one by one in the line. So, we shall have reduced on the high numbers of people coming to the hospital." **(IDI06_Female, age 48)**

"When you have any complaint... for example like when you swallow drugs and you get side effects, you can easily show what side effect you got from taking the drugs... you can share or show the doctor anything you want." **(IDI02_Female, age 33)**

Health services that can be delivered through telehealth

Interviewed participants believed telehealth was suitable for providing certain health services, including counseling about medication adherence and side effects, monitoring medication adherence, consultations for minor complaints, and providing health education.

"Counseling maybe about the use of drugs... maybe you get side effects as a result of swallowing that medicine... you consult the doctor whether it is okay to take another type of medicine... what is most important is being counseled by the doctor on how to take the drugs." **(IDI02_Female, age 33)**

"They can teach you using it, call like they gather you and they teach you... or what they normally tell us that they are going to check for cancer, they can explain all that on video call." **(IDI11_Female, age 19)**

However, there were concerns that some health services would be missed, including health education conducted at in-person visits, home visits, physical assessment, and the physical touch from the doctor.

"... weighing... coming and they weigh you, for the viral load I will not consider it much because for it takes time but weighing is for every time you come here you step on to the weighing machine and they weigh your kilograms, your height and even on the hands they examine." **(IDI01_Female, age 48)**

"... most people want so much to be near the doctor because when you are with the doctor it's like your God he is bringing your life back and that is the case. Most people want to be touched which will not be done on video call. For example, if am suffering from a fever of mumps, a doctor can touch you and see what's wrong with you to see the temperature so things like that as a patient they give me comfort and believe that I will be fine even if the doctor doesn't give me medicine there is a way that situation really relieves us." **(IDI_Male, age 45)**

Table 6 Joint display of quantitative and qualitative findings

Significant quantitative findings	Concordant qualitative findings
Income: Participants whose estimated monthly income was > 100,000UGX (≥ $27) had increased odds of having a high score of intention to use telehealth	"The issue of data can be a challenge to some, it's the other issue I told you about concerning money, that some of us, the kind of jobs we do and the money we earn is not even enough. I may say it's just enough for our basic needs, but it's actually not enough." **(ID09_Female, age 37)** "… the problem we have is these phones for touch are expensive and we are low-income earners so to get three hundred thousand to buy a phone it may be difficult. Yet on thirty thousand you can get a pressing phone." **(IDI05_Male, age 45)**
Adherence to HIV Medication: Participants with good adherence (> 95) had increased odds of having a high behavioral intention score	"The patients that deserve are the one who have spent a lot of time on drugs… when one is used with it(medicine) and even when she/he has taken it (medicine) very well … when his file has been showing progress, not like the people who are ever falling sick …" **(IDI04_Female, age 49)**
Facilitating Conditions: Participants with higher scores on the facilitating conditions scale (i.e., believes that support exists for the use of telehealth) had increased odds of scoring high on intention to use telehealth	"What can hinder me is when I fail to get someone who can teach me how to use that phone because there are so many things on that phone which we are ignorant about. But when you get someone to teach you or we get a lecture on how to use the smart phone like if you want this and this you do like this, if you want to send a picture you do like this, if want to send messages you do like this. It would have been of help to me if we had someone to teach us how to use it." **(IDI09_Female, age 37)**
Effort Expectancy: Participants with higher effort expectancy scores had increased odds of having a high behavioral intention score.	"… our people don't know computers and yet a phone is alike a computer. We need to teach them that if you have a smart phone, you have everything in hand. So, you can forego and be with a smart phone." **(IDI05_Male, age 45)**
Nonsignificant quantitative findings	**Discordant qualitative findings**
No association between perceptions of stigma mean scores and behavioral intention to use telehealth.	"… some other thing I think is stigma to some extent because most clients fear to sit in the tent when there are many people. So, stigma to some extent will be solved." **(IDI10_Male, age 26)**
No association between performance expectation scale (i.e., the degree to which an individual believes that telehealth will help them improve their health quality) and intention to use telehealth.	"It makes your life easy. It helps you to get to your doctor at any time anywhere when you need to talk to him. It's very helpful and easy." (**IDI06_Female, age 48)**

Community level

Participants expressed limited opinions about how telehealth could be deployed at the community level. However, one indicated that virtual care might be used to reach out to patients living in remote locations.

> *"Maybe even that service can also be extended to villages because most of the time, patients in the villages don't receive proper services."* **(IDI07_Male, age 34)**

Public policy level

There was a scarcity of thoughts at the public policy level, except for the view that government should expand access to the internet so that the network covers the whole country.

> *"It's for the government to enlarge the network in the country. To make sure in each part of the country one can access the internet." (***IDI05_Male, age 45)**

Mixing of quantitative and qualitative results

As shown in Table 6, the statistically significant associations of income, facilitating conditions, and HIV medication adherence with intention to use telehealth are congruent with findings from the qualitative strand of the study. The voices of patients expressing financial constraints in affording internet data and smartphones reinforce the quantitative finding that income significantly predicts intention to use telehealth. Furthermore, the articulated need for clients to receive instruction on smartphone usage underscores the importance of support services in promoting telehealth utilization. The latter point is further reinforced by the statistically significant association between effort expectancy and intention to use telehealth, highlighting that familiarity and comfort with smartphones are crucial for promoting telehealth adoption. In addition, although performance expectation was not a significant predictor of intention to use telehealth in the statistical model, participants cited many benefits resulting from using virtual services during their interviews. A possible inference that can be drawn from this is that while individuals may perceive telehealth as helpful and convenient, this perception alone may not strongly influence their intention to use it. Thus, to facilitate adoption of telehealth, there is a need to address other factors beyond perceived benefits.

Discussion

This mixed methods study aimed to describe predictors of intention to use telehealth and perceptions of Ugandan patients living with HIV towards the use of this modality for follow-up care. Specifically, we sought to determine whether the intention to use telehealth differed by

sociodemographic and HIV-related factors of the survey responders, and what UTAUT constructs were associated with the intention to use telehealth. Furthermore, we explored patients' perceptions about using this innovative technological modality for follow-up HIV care using qualitative analysis of interviews.

In the survey data, we found that participants with lower monthly incomes had decreased odds of attaining a high score of intention to use telehealth. Findings from the qualitative part of the study were in congruence, as participants expressed views about the inability to afford internet data or smartphones as potential barriers to the use of telehealth. These results are consistent with findings from other investigators who have examined the use of telehealth among patients with other chronic conditions. For example, Eberly and colleagues analyzed data about the utilization of telemedicine for outpatient cardiovascular care. They found that a median household income of less than $50,000 was associated with lower video use [58]. Similarly, studies conducted among people living with HIV found holders of public insurance, a proxy measure for low-income status, were less likely to complete a video visit compared to their counterparts with private insurance [59, 60]. Therefore, there is a need to address the challenge of poverty among people living with HIV so that implementation of telehealth does not further exacerbate existing health disparities, a concern that has been expressed by other authors [8, 61, 62]. Although access to smartphones is on the rise in developing countries [25, 63], more needs to be done to ensure that such devices are affordable for low-income earners, and these efforts need to be matched with availability of reliable internet. Several strategies have been suggested to help address the challenge of equitable access to digital technology. These include the distribution of free cell phones [64], establishing digital telehealth pods in centralized community locations [59], and offering microcredit [65] or device stipend [54].

Furthermore, this study found that patients with good medication adherence levels had increased odds of attaining a high behavioral intention score. This result is concordant with the qualitative finding that telehealth would suit patients who have been in treatment for a long time and are taking their medicines as prescribed. Our findings point to the potential benefit of integrating telehealth interventions to support patients adhering well to their ART medications. Guaraldi and colleagues provide practical guidance about the type of telehealth follow-up assessment that can be accomplished in PLWH, including evaluating how patients take their medications [66]. However, it is important to note that in model 3, the relationship between medication adherence and intention to use telehealth was not statistically significant and this could be because of confounding which was not explored in the present study.

In this study, effort expectancy and facilitating conditions were the only UTAUT variables that significantly predicted behavioral intention, after adjusting for other variables. Perhaps it is not surprising that both quantitative and qualitative findings signal participants' expectations that providing guidance and support would facilitate the utilization of telehealth services. In addition, it was interesting to note that the quantitative results around effort expectancy lend credence to the qualitative finding that suggests that a lack of knowledge about computers may be a possible barrier to telehealth adoption. Thus, a significant relationship between ease associated with the use of telehealth and behavioral intention may be related to high digital literacy or skills among participants who attained high intention to use scores. This finding aligns with results from previous studies that have identified low digital literacy as one of the determinants of telehealth adoption [6, 7, 55, 64, 67]. The results underscore the need to invest in creating awareness about digital health solutions and equipping patients with the necessary skills to optimize the use of these innovations.

Surprisingly, this study did not find a significant association between performance expectation and behavioral intention. This finding is noteworthy because of two reasons. First, it contradicts results from previous studies that have employed the UTAUT model and consistently reported performance expectation as a strong predictor of behavioral intention [36, 68, 69]. Second, interviewed respondents believed that the use of telehealth would be beneficial in several ways, a finding consistent with extant literature [8, 11, 15, 19, 61]. In this case, the discrepancy between quantitative and qualitative findings may signal the limitations pointed out by Addotey-Delove and colleagues [37] about the challenge of using the UTAUT model to predict the adoption of technology in potential rather than actual users. The other UTAUT construct that was not found to be a predictor of behavioral intention to use telehealth for adults in Uganda was social influence. Perhaps this is less surprising given that an individual's decision to use telehealth may be informed by multiple factors [37] beyond what is assessed by the three items used to measure social influence. Therefore, future studies may need to evaluate this construct using a more comprehensive tool or adopt a more robust theoretical model that accounts for broader contextual issues that influence the adoption of a specific health behavior.

Additionally, unique qualitative findings from the present study indicated that telehealth was perceived to be suitable for young clients, people newly diagnosed with HIV, patients with low viral load, and patients with unfavorable work schedules. Regarding the suitability

of telehealth for young people, it is important to note that, unlike other studies that identify age as a significant social determinant of telemedicine readiness [70], this study found no significant association between age and the intention to use telehealth. In this, participants did not recommend the use of telehealth for the elderly, children living with HIV, patients with opportunistic infections, and patients with comorbidities. Our results help to provide guidance about specific populations of patients for whom telehealth would be helpful, and by doing so, this study contributes to the existing literature in two ways. First, it responds to the gap identified by previous research regarding the need to identify groups of patients that could benefit the most from telehealth intervention [11]. Second, our finding paves the way for a differentiated approach to using telehealth to provide individually-tailored care for PLWH [29, 61].

Interestingly, interviewed participants in this study also believed that individuals newly diagnosed with HIV might benefit from telehealth. This qualitative finding contradicts suggestions by other scholars about prioritizing in-person visits for this category of patients [7, 61]. This discrepancy may stem from the understanding that patients newly diagnosed with HIV struggle with disclosure issues and may fear being seen in HIV clinics. Thus, they would need frequent follow-up and counseling, which can be provided through virtual visits.

We also found that virtual care was perceived to be appropriate for counseling, health education, monitoring adherence, reporting medication side effects, and providing teleconsultations for managing minor ailments. Previous studies have found videoconferencing to be acceptable and feasible for providing medication adherence counseling among young people living with HIV [71, 72]. Given that the populations of most developing countries consist of a large proportion of young people with high uptake of smartphones [63], telehealth deployment in these settings can potentially pay high dividends in helping to address barriers to HIV care in this subpopulation.

Nevertheless, participants expressed fears that telehealth would result in several missed services, including routine clinical evaluations, physical examination involving touch by the health provider, the loss of networking opportunities which result in the inability to share experiences, loss of job connections, and missing the possibility of finding spouses. Our qualitative findings resonate with questions raised about virtual care quality compared to in-person care [61] and the worries expressed by both PLWH and providers about decreased personal connection in relationships that occur with telehealth use [73]. In his article "A Touch of Sense," Verghese articulates the importance of touch in strengthening the relationship between a health provider and a patient [74]. And Fronczek voices concern about whether virtual care would compromise the concept of presence, which is essential in nursing care [75]. However, in a recent article by Koppel and colleagues, evidence suggests that it is possible to establish rapport through video visits [76]. Nevertheless, more research is needed in this area, particularly in the HIV population. Moreover, it is important to strike a balance between telehealth use and human touch which is not only important in some societies [23], but also conveys caring in the nursing profession [77].

Limitations and strengths

Findings from this study should be considered in light of several limitations. First, we relied on only self-reports to survey measures, which may have introduced information bias. Second, we measured the intention to use telehealth rather than actual use. An individual's intention to carry out a particular behavior may not lead to actual behavior. Thus, future studies should examine the actual usage of telehealth and possibly compare users and non-users. Third, non-probability sampling methods were used to select participants from the two health care centres. Thus, there is a possibility of selection bias which may have impacted the results. Finally, because nonprobability sampling methods were used, the sample may not be representative of the Ugandan population of PLWH.

Despite the above limitations, our study adds to the existing literature about determinants of intention to use telehealth in the care of PLWH residing in a resource-limited setting. The mixed methods design provides a broader understanding of the phenomenon beyond what would have been gained by using a single approach [38]. Additionally, we believe that the use of both the UTAUT to guide the quantitative strand of the research and the socioecological model to organize qualitative findings, is yet another strength of the present study. Finally, our findings provide useful insights that can form a basis for designing interventions to boost the utilization of telehealth by PLWH.

Conclusions

In summary, this mixed methods study sheds light on the associations between the intentions of people living with HIV (PLWH) to use telehealth and various sociodemographic factors, HIV-related variables, and the Unified Theory of Acceptance and Use of Technology (UTAUT) measures. Our findings underscore the importance of addressing income disparities and digital literacy barriers to enhance telehealth adoption among PLWH, thereby optimizing health outcomes. For future research, we recommend evaluating the impact of economic empowerment initiatives on telehealth utilization and assessing the impact of telehealth on existing HIV care models, and stigma reduction.

Abbreviations

HIV	Human Immunodeficiency Virus
ART	Antiretroviral therapy
PLWH	People Living with HIV
COVID	Coronavirus disease
ATC	African Telehealth Collaboration
UTAUT	Unified Theory of Acceptance and Use of Technology
BI	Behavioral Intention
PE	Performance Expectation
EE	Effort Expectancy
SI	Social Influence
FC	Facilitating Conditions
UGX	Uganda Shillings

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12913-025-12636-6.

Supplementary Material 1.

Supplementary Material 2.

Acknowledgements

The authors wish to acknowledge the participants of this study for their generous contribution of time and invaluable perspectives. Additionally, the authors would like to thank Ms. Allen Nabisere and Ms. Racheal Nabunya for their assistance with data collection.

Author' contributions

CPO. conceptualized the study, collected, and analyzed data, and drafted the manuscript. BJM. supported data collection and analysis, and reviewed and edited the manuscript. MFT reviewed and edited the manuscript. NN and TDN. supported during data collection and reviewed the draft manuscript. CMP supported the conceptualization of the study, data collection, and analysis, and reviewed and edited the manuscript.

Funding

Research reported in this publication was supported by the Office of Behavioral and Social Sciences Research (OBSSR) and Fogarty International Center of the National Institutes of Health under grant 3D43TW009345-10S5 awarded to the Northern Pacific Global Health Fellows Program. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.
Additional financial support was received from the University of Minnesota Graduate School Doctoral Dissertation Fellowship.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in compliance with the Helsinki Declaration (https://www.wma.net/policies-post/wma-declaration-of-helsinki/). Ethics approval was obtained from the Makerere University School of Health Sciences Research Ethics Committee (MAKSHSREC-2021-212), University of Minnesota Institutional Review Board (STUDY00014094), the Uganda National Council for Science and Technology (HS2028ES) and permission to conduct the study was obtained from Kampala City Council Authority. Informed consent was obtained from all the participants before being involved in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 11 April 2024 / Accepted: 21 March 2025
Published online: 02 April 2025

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