Acceptability of introducing a patient portal for people living with HIV and their healthcare providers

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Abstract

Opal (opalmedapps.com), a patient portal in use at the Cedars Cancer Centre of the McGill University Health Centre (MUHC) (Montreal, Canada), gives cancer patients access to their medical records, collects information on questionnaires/patient-reported outcome measures (PROMs), and has demonstrated high levels of patient satisfaction. This acceptability study aims to evaluate a patient portal, based on Opal, and its potential acceptability in the context of HIV care. People living with HIV (PLWH) and their healthcare providers (HCPs) completed cross-sectional surveys from August 2019 to February 2020 at large HIV centers in Montreal (Canada), including the Chronic Viral Illness Service of the MUHC, the Centre Hospitalier de l'Université de Montréal, Clinique Médicale du Quartier Latin, and Clinique Médicale l'Actuel and in Paris (France) Hôpital Saint-Antoine. This study included 114 PLWH (mean age 48 years old, SD=12.4), including 84 (74%) men, 27 (24%) women, and 2 (2%) transgender or identified as other; and 31 HCPs (mean age 46.5 years old, SD=11.4), including 10 (32%) men, 20 (65%) women and 1 (3%) identified as other. Ownership of smartphones or tablets was high (106 (93%) PLWH, 30 (96%) HCPs), and participants were willing to use a patient portal (84 (74%) PLWH, 21 (68%) HCPs). Participants were interested in most patient portal functions and PROMs; particularly PROMs capturing quality of life (101 (89%) PLWH, 24 (77%) HCPs), experience of healthcare (98 (86%) PLWH, 30 (97%) HCPs), and HIV self-management (105 (92%) PLWH, 30 (97%) HCPs). Random forest analysis demonstrated high variable importance of the variables gender, income, and comfort accessing personal health information as predictors of willingness to use a patient portal. This descriptive cross-sectional survey study suggests considerable acceptability of introducing a patient portal for PLWH and their HCPs.

Résumé

Opal (opalmedapps.com), un portail patient utilisé au Centre des Cèdres du cancer du Centre universitaire de santé McGill (CUSM) (Montréal, Canada), permet aux patients atteints du cancer d'accéder à leur dossier médical, recueille des informations à partir de questionnaires et de mesures patients (PROMS en anglais) et a démontré la satisfaction des patients à l'égard de son utilisation. Cette étude de faisabilité vise à évaluer l'acceptabilité potentielle de l'Opal dans le contexte des soins aux personnes atteintes du VIH. Les personnes vivant avec le VIH (PVVIH) et leurs professionnels de santé (PDS) ont répondu à des enquêtes transversales d'août 2019 à février 2020 dans de grands centres VIH à Montréal (Canada), dont le Service des maladies virales chroniques du CUSM, au Centre Hospitalier de l'Université de Montréal, la Clinique Médicale du Quartier Latin, et la Clinique Médicale l'Actuel et à Paris (France) dans le Service des Maladies Infectieuses de l'Hôpital Saint-Antoine. Cette étude a porté sur 114 PVVIH (âge moyen de 48 ans, écart-type = 12,4), dont 84 (74 %) d'hommes, 27 (24 %) de femmes et 2 (2 %) de transgenres ou autres ; et 31 PSS (âge moyen de 46,5 ans, écart-type = 11,4), dont 10 (32 %) d'hommes, 20 (65 %) de femmes et 1 (3 %) d'autres. Le taux de possession de smartphones et de tablettes était élevé (106 (93 %) de PVVIH, 30 (96 %) de PDS), et les participants étaient prêts à utiliser le portail patient Opal (74 % de PVVIH, 68 % de PDS). Les participants étaient intéressés par la plupart des fonctions d'Opal et des PROMs, en particulier les PROMs qui permettent de saisir la qualité de vie (101 (89 %) des PVVIH, 24 (77 %) des PDS), l'expérience des soins de santé (98 (86 %) des PVVIH, 30 (97 %) des PDS) et l'autogestion du VIH (105 (92 %) des PVVIH, 30 (97 %) des PDS). Notre analyse de forêt aléatoire a démontré une importance variable élevée du sexe, du revenu et de l'aisance à accéder aux informations de santé personnelles comme prédicteurs de la volonté

d’utiliser un portail patient. Cette étude suggère que l’utilisation d’un portail patient serait très bien acceptée et potentiellement utile, selon les retours des PVVIH et des professionnels de santé.

List of abbreviations

AP-HP – Assistance Publique – Hôpitaux de Paris

ART – Antiretroviral therapy

CVIS – Chronic Viral Illness Service

EMR – Electronic medical record

HCP – Healthcare providers

HIV – Human Immunodeficiency Virus

HT – Health technology

MUHC – McGill University Health Centre

PHI – Personal health information

PLWH – People living with HIV

PROMs – Patient-reported outcome measures

REB – Research Ethics Board

SMIT – Service des Maladies Infectieuses et Tropicales

UHRESS – Unité hospitalière de recherche, d'enseignment et de soins sur le sida

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Manuscript publication

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In addition to the published manuscript, this thesis also includes a comprehensive review of the literature and a random forest analysis described in the methods, results, discussion, limitations, and conclusion.

Contribution of authors

I, Dominic Chu, have contributed to the recruitment of PLWH and administration of surveys at the CVIS, collection of results, analysis of results, and manuscript and thesis writing. However, this study was only made possible as a result of the contributions of several co-authors.

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Introduction

Human Immunodeficiency Virus (HIV), like other chronic conditions, requires consistent, long-term self-management by people living with HIV (PLWH), including engagement in care and adherence to antiretroviral therapy (ART) [1]. Increasing age, co-morbidities, and disabilities can increase the burden on PLWH and their multidisciplinary healthcare providers (HCPs) [2, 3]. Additionally, PLWH may experience diverse psychosocial issues such as depression (34-42% of PLWH on ART), anxiety (21-40%), stigma or discrimination (42-83%), as well as unemployment, and limited formal education [2, 4]. In turn, these factors can negatively affect access to and engagement in care as well as ART uptake [2, 3, 5].

To support PLWH and their HCPs in the management of HIV, a solution is a patient portal, which is an extension of the electronic medical record system which provides patients secure access to their lab results, progress notes, and appointment schedules [6]. Patient portals can also include features to enhance communication with HCPs (e.g., text messaging), facilitate treatment access (e.g., medication refill request processing), and provide appointment and medication reminders. The functionalities and services of patient portals are relevant for clinical practice, as they have been reported to empower patients, improve engagement in care, and allow patients to make shared informed decisions with their HCPs, and promote communication between PLWH and HCPs [6-17]. Moreover, some patient portals allow for convenient electronic administration of questionnaires and patient-reported outcome measures (PROMs) [11, 18] which provide health information from the patients' perspective, without revision or interpretation by a clinician [19]. PROMs can improve the clinical management of symptoms, side-effects, adherence, and psychosocial needs, among others [20, 21], and are thus relevant in the context of HIV care [2, 10, 22].

Opal (opalmedapps.com), an innovative and award-winning person-centered portal, was first piloted in 2018 at the Cedars Cancer Centre of the McGill University Health Centre (MUHC) [6]. The patient-facing component of Opal is a smartphone application that gives patients access to their appointment schedules, personal health information (including clinical notes and laboratory test results), personalized educational material tailored to diagnosis and stage of treatment, and administration of PROMs. Opal is unique given that it was designed through a participatory stakeholder co-design approach, patients and HCPs were engaged in all stages of Opal's development. In fact, it was a breast cancer patient and a McGill University computer science professor, the late Laurie Hendren, who identified the needs of patients that spurred the development of Opal [23]. Our goal is to configure a patient portal, based on Opal, to HIV care, as there is currently no HIV-specific patient portal in Canada.

Opal was designed with oncology patients and thus may not be directly transferable to other health conditions, such as HIV. Oncology and HIV care differ greatly in terms of affected populations, treatments, and care providers involved. Considering these differences, garnering the perspectives of end-users for using a patient portal was important, as the lack of stakeholder involvement was noted as a central reason for the failure of other early patient portals [12, 24, 25]. To ensure a patient portal's uptake in HIV care [13], consistent with the approach initiated in oncology, HIV-specific stakeholder input was essential before offering a patient portal to PLWH [26]. Additionally, considering the inequity PLWH experience regarding access to healthcare [27] and smart devices, the inclusion of PLWH without smart devices was considered in this study. The research question for this acceptability study is "How acceptable is a patient portal for stakeholders in HIV care, our PLWH, and HCPs?". Feasibility studies that do not pilot aspects of an intervention or study methodology, as is the case here, attempt to answer questions about whether some aspect of a future trial is achievable [28]. This can include determining the acceptability of an intervention or the perceived importance of types of outcomes [26], which were among the study objectives. Acceptability can be considered as the agreeable or interested views of stakeholders towards a specified innovation, such as a patient portal and its functions [29]. Acceptability captures one's personal perspective; this may differ between two people who can view the same innovation or treatment, yet form contrasting judgements regarding whether it meets their needs or preferences [29].

The overarching study hypothesis is that the majority of people living with HIV and their health care providers perceive patient portals as useful innovative technologies that have potential to improve their shared care experience and positively affect HIV care.

The general objective of this descriptive cross-sectional survey study was to evaluate the acceptability of introducing a patient portal for PLWH and their HCPs. The specific objectives entailed the assessment of the following five complementing facets:
1) the experience of PLWH and HCPs with healthcare applications and smart device ownership, 2) PLWH and HCPs interest in using a patient portal and their preferences for sharing their personal health information, 3) their anticipated benefits and inconveniences, 4) PLWH and HCPs' preferences among different PROMs implemented through the patient portal, and 5) the factors associated with PLWH willingness to use a patient portal.

Literature Review

HIV, a chronic disease

With the advent of novel and extremely potent ART, the previously fatal diagnosis of HIV is now a chronic condition, with the life expectancy of PLWH having a near-normal lifespan, once HIV is diagnosed and treated with HIV RNA levels below 200 copies per millimeter [30]. However, increased longevity requires prolonged self-management from PLWH who are at greater risk of several comorbidities and psycho-behavioral problems [31], many of which rely on patient reports for detection [32]. It is also important to consider the prevalence of age-related, treatment side-effects, and co-morbidities arising with HIV [33]. For example, PLWH are at higher risk for cardiovascular disease, diabetes, renal impairment, mental health and substance use [34], and osteoporosis, and experience these events at an earlier age compared to the general population [35, 36]. The burden of these co-morbidities in conjunction with psycho-social inequity and vulnerability presents a foreboding challenge to HIV self-care and further complicates treatment [34, 35]. PLWHs' co-morbidities are not always clearly communicated to their HCPs in HIV care, for example, mental health, alcohol and substance use, cognitive function, or HIV stigma [37]. These miscommunications have been attributed to differences in prioritization of PLWH healthcare or assessment of PLWH symptoms [22, 37], which have led to delays in the delivery of much-needed care. Hence, there is a need for screening tools to highlight patient-reported problems to bring attention to the needs of PLWH and offer patient-centered care[38]. PROMs are a form of screening tool that can report on the patients' health condition, reported directly from the patient, without clinician or others' interpretation [39]. PROMs can measure a variety of patients' perspectives of their own health, that may not be obvious or easy to highlight within the patient encounter, including depression, quality of life, fatigue, adherence, or activities of daily living. Clinicians can measure several subjective measures, to supplement other objective findings, such as laboratory reports or diagnostic imaging. This concept of utilizing PROMs encompasses a holistic view of healthcare, placing the patients' priorities and needs first, and goes beyond the physical ailments experienced, by also considering the patients' illness and subjective experiences.

PLWH often report symptoms centered around mental health, such as depression and anxiety, which can lead to worsened clinical outcomes [40]. Such outcomes include diminished quality of life, mental health, and adherence to ART [40]. There is evidence that the use of PROMs in HIV care can improve some of these outcomes, including clinical decision-making [41], identifying patient symptoms [42], and facilitate patient-provider communication [43]. Additionally, prior literature highlights that PLWHs' experiences with ART and its side-effects are more effectively recorded than with physicians' clinical encounter notes alone [44]. Thus, PROMs can be implemented prior to the clinical encounter to provide the HCPs a direction and focus on PLWHs' current and most pressing needs. The use of PROMs can trigger specific clinical assessments and guide the clinical encounter to efficiently meet the needs of PLWH [45].

I-Score Study

The I-Score study (clinicaltrials.gov identifier: NCT02586584) has been led by Drs. Bertrand Lebouché and Kim Engler since January 2016 [46]. This study aims to develop and validate an electronically administered PROM's assessment of PLWH's perceived barriers to adherence to antiretroviral medication. Adherence refers to a person's uptake of a medication, corresponding to his or her clinician's prescription [47]. The I-Score involves an exploratory mixed-methods design and with the inclusion of multiple clinical sites in Canada and France. The conceptual framework of the PROM has been developed [3], however, the final selection and generation of items are yet to be finalized. The I-Score study is ongoing and requires the implementation of a patient portal (Opal) to provide accessible electronic administration of the I-Score PROMs. Thus, this acceptability study was carried out at the CVIS, MUHC, other Montreal-based HIV clinics, and AP-HP, Hôpital Saint-Antoine (Paris, France) prior to the pilot of the patient portal to other clinical sites.

Challenges of maintaining adherence, the importance of a patient-centered tool

Many PLWH still experience challenges with maintaining a high level of adherence [4]. These challenges are often missed within the clinical encounter between clinician and patient, and therefore, such barriers to ART are insufficiently addressed [48, 49]. There are several barriers for PLWH to adhere to ART [3]. Many of these barriers were identified by Engler et al. (2018), which included broad themes such as cognitive and emotional aspects, lifestyle factors, characteristics of ART, health experience and state, social and material context, as well as healthcare services and systems [27]. These barriers can be temporary and/or transient for PLWH and vary between patients, thus, regular follow-up and communication must be conducted to continue to engage the patient and identify these barriers [3]. A separate meta-analysis of qualitative studies also highlighted the life demands and needs of one's family and expectations within the workplace as a barrier to linkage with healthcare services and patient retention [50]. Quality of care was also a prevalent concern, in the context of limited clinic hours, communication barriers involving language barriers, and explanations of complex medical information in lay-terms [50].

Therefore, to support PLWH through identifying and addressing such barriers, a patient-centered approach to HIV care should be considered. Such an approach engages PLWH in their care and enables PLWH to form shared decision-making with their clinicians. Thus, consideration is for the use of a patient portal and patient portal-administered PROM (I-Score) that can optimize communication, barriers to adherence, and patient-reported adherence to complement the in-person patient assessment. However, the healthcare team at the CVIS understands that many PLWH experience inequity with care and smart device ownership, and thus, during the implementation of a patient portal, HIV care at the CVIS will include paper-based PROMs and education material. To optimize our healthcare delivery and communication, there needs to be a patient-oriented approach with stakeholder engagement, in which the perspectives of PLWH are taken into consideration to address the barriers affecting PLWH.

Stakeholder engagement

Patient engagement can be defined as patients' meaningful and active involvement in their care, in which their experiences, perspectives, and expertise with regards to their healthcare and treatment are accounted for [13, 51]. This process involves patients, caregivers, HCPs, and researchers, and can occur at any, if not all, stages of care [46]. Patient engagement emphasizes patients' values, shared decision-making [52], patient autonomy [53], accountability for patients' individual circumstances [46], and partnerships to co-construct knowledge. To optimize HIV healthcare delivery and communication between PLWH and HCPs, PLWH and other key stakeholders (including HCPs) must be engaged within their care. Key stakeholders are individuals who are accountable for or are impacted by healthcare decisions. There is an increasing trend of the health system toward awareness of the importance of engaging key stakeholders in order to not only heighten the standard of care of PLWH but also to ensure that interventions, such as a patient portal, retain a high uptake and satisfaction amongst all users [54]. PLWH and their HCPs, henceforth, referred to as stakeholders, can be engaged through an establishment of a collaborative relationship, as individuals or as a group through the use of a patient portal [55]. Through stakeholder engagement, shared decision-making can result regarding the selection, conduct, and use of research [55]. Thus, PLWH should be meaningfully involved through potentially all steps of research, where their perspective and experiences, concerning their health condition, treatment, or care can be accounted for [56]. This process of stakeholder engagement also highlights the importance of principles and discussion of shared healthcare decision-making [52, 53], patient autonomy [57], attentive listening, and the development of the participant-researcher relationship [58].

Stakeholder engagement requires collaborative co-construction of knowledge to empower patients, share information, and diminish paternalism within healthcare [59-62]. The conduct and use of stakeholder engagement have been documented in numerous frameworks [55, 59, 61, 63-68]; these include: 1) educating stakeholders; 2) obtaining stakeholder input through consultation; 3) accounting for stakeholders' concerns with decision-making; 4) collaborating within decision-making; or 5) empowering stakeholders' decision-making capabilities [67, 69, 70]. Considering these principles, the research team under Dr. Lebouché has involved PLWH and their HCPs in his research program and has incorporated feedback from key stakeholders to ensure integrated knowledge translation and exchange throughout the study's methods and protocol [46]. For example, within the I-Score study, stakeholders were involved in the decision-making process, by which stakeholders were involved in in-person meetings consisting of deliberative discussion[71] to offer recommendations on problems perceived within the study. There was also close collaboration with investigators and stakeholders to ensure knowledge dissemination and effective presentation of research results.

An electronic patient portal to support the I-Score PROM

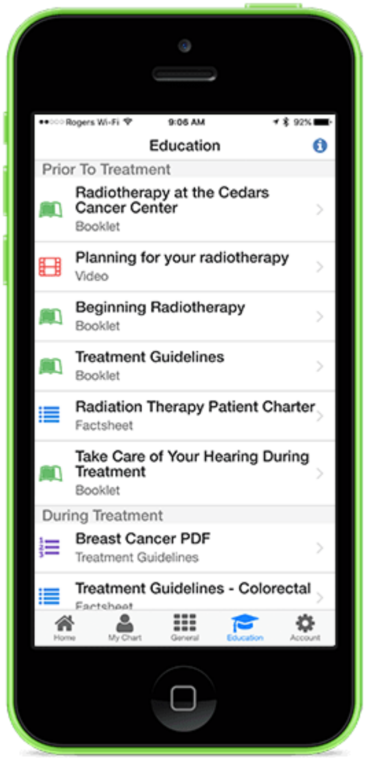
PROMs may be employed prior to the patient encounter, and during the appointment as a screening tool to highlight patients' highest priority needs [72]. Through electronic administration of PROMs, the clinician or researcher can avoid data entry errors, receive data in real-time, and send notifications to patients to complete PROMs and limit missing data [19]. PROMs are growing as a tool to provide holistic care which addresses the overall health and well-being of PLWH. PROMs can target a variety of issues, including patient perceptions of their health (including issues that are not always captured, such as depression, quality of life, or stigma), perceptions of their treatment and side effects, and ability to perform daily activities of living. Furthermore, PROMs may support HIV clinical practice through identifying and bringing attention to PLWHs' perceived barriers to care, while also accurately relaying PLWHs' ART adherence and experience of side-effects [73, 74]. This not only engages PLWH in their care, but also informs clinicians of key patient issues prior to the clinical encounter. Additionally, PROMs have also been found to be useful for improving clinical decision making [41], highlighting patient symptoms [42], facilitate clinician-patient dialogue [43], and identify quality of life-related challenges [75].

Currently, there is a shift towards the use of an electronic medical record, as well as an increasing use of mobile devices, such as smartphones, with advanced computational capabilities. Thus, a patient portal may be integrated within such mobile devices to offer PLWH accessible, real-time sharing of health information [76]. For those with access to smartphones, a patient portal can promote patient engagement and patient-centered care by offering patients access to their personal health records, consultation notes, appointment schedules, and even PROMs, and personalized education material.

However, it is pivotal that the design of the patient portal be well-adapted to the specific needs of the stakeholders using the software. Stakeholders' needs may influence the functionality of the patient portal, highlight needs for improvement, and the content of the material within the patient portal. Their consideration is critical to facilitate the utility of the patient portal, uptake of the patient portal, and the satisfaction gained from using such software in HIV care.

Patient portals: an example from oncology

One such patient portal is that can be used to engage patients is Opal, which is an innovative, award-winning patient portal, first piloted at the Cedars Cancer Centre, MUHC [6]. Throughout the development of Opal, equal co-leadership, and participatory co-design was implemented to ensure the patient, computer science professor the late Laurie Hendren, as well as a medical physicist John Kildea, and a radiation oncologist Tarek Hijal were actively involved within all stages of the development, design, and piloting of Opal [6]. As the developmental process included patient engagement and principles of participatory co-design, patients and clinicians were involved with all stages of the design process, the piloted version followed the key values of patient-centered care. The Opal smartphone application allows patients to access their personal health information, including their consultation notes, laboratory results and trends, treatment plan, and appointment schedules. The application also allows for personalized education tailored to the cancer stage and specific treatment, check-in function at the hospital, and administration of PROMs. Additionally, personalized health information is explained in detail to ensure the content is beneficial and empowering for patients.



Prior To Treatment

Radiotherapy at the Cedars Cancer Center
Booklet

Planning for your radiotherapy
Video

Beginning Radiotherapy
Booklet

Treatment Guidelines
Booklet

Radiation Therapy Patient Charter
Factsheet

Take Care of Your Hearing During Treatment
Booklet

During Treatment

Breast Cancer PDF
Treatment Guidelines

Treatment Guidelines - Colorectal
Factsheet

Figure 1. *Screenshot of Opal in oncology from opalmedapps.com demonstrating the user interface and patient access to education material within the application.*

A patient portal based on Opal is a clear choice for a patient portal to implement the prior HIV-specific PROMs identified by Engler et al. (2017) [77]. These types of PROMs include quality of life, healthcare-related views and experiences, psychological challenges, symptoms, need for psychological resources, HIV-self management, HIV-related stigma, body and facial appearance, social support, sexual and reproductive health, and disability. Opal has been implemented, undergone multiple troubleshooting tests, and has demonstrated high levels of acceptance and satisfaction amongst stakeholders.

However, Opal is ultimately designed for oncology patients. The specialties of oncology and HIV care differ greatly, as do the patient population, patient needs, diagnostic methods, disease timeline, and treatment methods. Thus, further research must be conducted to ensure that Opal is adapted to the key stakeholders in HIV care, including PLWH, clinicians, nurses, social workers, pharmacists, clinical psychologists, and others who will be using the Opal patient portal.

Utility of patient portals

The patient portal functions as a health care system to provide patients access to their electronic medical record (EMR) [78]. Patients can access a portion or majority of their personal health information – which can include patient notes, treatment plans, and laboratory results [6, 79]. Additionally, patient portals can provide a myriad of functions including, but not limited to: access to the electronic medical record, access to test results, medication refills, appointment scheduling, and reminders, obtaining referrals, a secure messaging platform between the patient and medical institution, and access to general medical guidelines [80]. In prior literature, patients preferred such functions that facilitated communication and convenience and offered more personalized care and a closer collaborative clinician-patient relationship [13]. By meeting patient needs and preferences, patient portals have been noted to facilitate patient engagement, although, the added personalization of patient portals has been described to further promote patient engagement as a possible intervention for chronic disease medication management [81]. Such an intervention may include personalized lists of preventative measures or sending personalized electronic notifications, such as alerting patients of the need to attend health screening services [82, 83].

The impact of patient portals specifically within the HIV setting has not been well explored. Prior patient portal research often under-reported the specific features employed within the portal and did not readily consider several factors that had affected patient portal use and their impact on clinical outcomes (including psychosocial, and systemic factors) [84]. However, within available literature, patient portals have been viewed favourably by patients and healthcare professionals and have been associated with positive clinical outcomes, including increased patient engagement and doctor-patient communication [11, 15-17]. Evidence had noted that patients preferred to be kept involved and cognizant regarding any decisions in their medical care; indeed, evidence suggests an inability to fully inform patients of their condition and its management led to worsened outcomes, including treatment adherence [85, 86]. By providing patients access to patient health information, through a patient portal, HCPs had been able to better inform their patients, which allowed patients to organize themselves better for subsequent appointments [87]. Additionally, patient portals have demonstrated greater medication adherence [88], patient safety, screening, and preventative care, and informed decision-making [84]. Patient portals have also been found to improve certain outcomes in other clinical settings such as in primary care and cardiology, where they have led to decreased office visit rates, increased messages sent, corrected medication regimen, and improved adherence to treatment [11, 16, 89].

Concerns for patient portals

Although findings for patient portals have generally been positive, there have been concerns regarding patient confidentiality, patient understanding of the content, and an increased workload for clinicians [11, 90]. Privacy and confidentiality issues were one of the most prevalent concerns amongst patients using patient portals [12, 91]. Patients prioritize privacy and were often reluctant to share health information even amongst healthcare providers [12]. Further, security concerns regarding third parties' data and accessing and utilizing patient health data were common, despite reassurances of confidentiality[92-95]. Despite these concerns, a systematic review using electronic health records in primary care revealed that there were no reports of data breaches in security or privacy when using patient portals [96].

Another concern centers on clinicians' doubts regarding patients understanding of health information, such as laboratory results, potentially leading to increased clinic calls and patient worries [97]. Additionally, the need to provide additional education or general patient support with the application is often perceived to be an additional workload for clinicians [97, 98]. Despite these concerns, prior patient portals that communicated laboratory tests to patients noted no differences in anxiety for patients receiving test results, versus those who did not receive test results [99, 100]. Prior literature noted that healthcare professionals reported no additional telephone or face-to-face activities [91] and the general workload of HCPs did not increase [96].

Miscommunication issues previously impeded previous patient portal impact, as physicians and patients misunderstood each other due to the differences between what clinicians believe patients want to know, what patients should know, and what patients did know [101]. By forging a shared platform and utilising input from both parties, this communication barrier may no longer be present. In addition to these communication barriers, there are also ethnic (including cultural and language divides) and literacy barriers, which the development phase must identify and aim to mitigate [11]. As MUHC's CVIS works with many refugees and immigrants, this would be essential. To bridge such a communication gap, understanding such barriers can lead to successful uptake and implementation [76]. This includes considering the social context in which the portal is being implemented and understanding the cultural shifts within the context of the patient population through engaging with stakeholders [76]. Within HIV care, some PLWH are also in lower-income brackets and may experience inequities related to accessing care and smart devices, and therefore, a patient portal [102]. Such inequity to accessing care and health technology can impact portal uptake and has been demonstrated in prior literature, where PLWH were less likely to use telehealth services if participants did not have access to a smartphone or computer, or if participants were not knowledgeable regarding the use of smartphones [102].

Adapting a patient portal to HIV care

A framework for the development of such portals, or the adaptation of a patient portal from one chronic disease to another, has not been clearly defined [18, 103]. There is a growing amount of literature reporting on the development of various patient portals and how they performed in the clinical setting to provide guidance for novel software development [104]. There is also a plethora of attention given to the engagement of stakeholders and examining the socio-economic aspects of care and patient experiences linked to patient portal usage [104]. However, there are limited articles that highlight the challenges and solutions to securing stakeholder engagement, security and privacy, data governance, and financial sustainability in developing patient portals [104]. In a systematic review of the development of patient portals, Otte-Trojel et al. (2016) recommended forming portal designs and implementations on existing evidence, utilizing several iterations of the design process, and utilizing evidence from numerous patient portal types [104]. However, as mentioned, there are multiple challenges presented with the development and adaptation of patient portals, leading to limited patient and HCP portal usage [104, 105]. To facilitate stakeholder engagement through participatory design approaches, prior literature suggested aiming to meet patients' needs, characteristics, and preferences, offer translation of portal content into minority languages, and train patients and staff regarding utilizing the patient portal [105-107]. To further encourage HCPs engagement, suggestions included a formal curriculum and teaching of the utility and functioning of patient portals [108], utilization of workflow engineering to minimize workflow disruption [109, 110], and a notification system to highlight urgent matters to support provider liability concerns [104].

Another framework for developing a patient portal is Opal's participatory co-design, which utilised: 1) equal co-leadership, 2) patient preference determination, 3) security, governance, and legal input, 4) user evaluation and feedback, 5) continuous staff input, and 6) end-user testing [6]. Participatory co-design showed clear benefits, as patient co-leads successfully noted requirements for patient-centeredness, confirmed patient acceptability, and patient engagement to ensure complete stakeholder buy-in[6]. Kildea et al. (2019) acknowledged three key considerations in developing the smartphone application: 1) patients should decide their level of patient health information access, 2) all patient health information provided to patients should be contextualized with explanatory content, and 3) educational material should be personalized and tailored to the patient's immediate medical situation [6].

Stakeholder engagement is particularly important in the configuration of a patient portal to HIV care, considering the vastly different needs and experiences of HIV patients from different, including women [111], people who use drugs [112], transgender women [113], men who have sex with men [114], and migrants [115].

Research questions

This descriptive cross-sectional survey study aims to quantify the level of acceptability as an indicator for the potential feasibility and usefulness of introducing a patient portal for HIV care. This study's overarching hypothesis is that the majority of people living with HIV and their health care providers perceive patient portals as useful technologies that have potential to improve their shared care experience and positively affect HIV care. Specifically, this study aims at answering the question "How acceptable is a patient portal for stakeholders in HIV care, our PLWH, and HCPs?" This study anticipated a moderate to high representation of study participants (PLWH) who own a smart phone (expected range between 65% and 83%) [6, 116, 117]. The literature on acceptance and willingness to use patient portals in the HIV context is scarce. However, evidence from specific subpopulations such as young men who have sex with men showed relatively high levels of willingness to use a patient portal and/or interest in patient portal functions and PROMs [118]. For instance, Jackman et al. (2020) showed that more than 78% of PLWH are willing to use a patient portal to share HIV test results [116] and Kildea et al. (2018) found that >60% of patients had an interest in patient portal functions and PROMs in the context of implementing a successful patient portal [6]; thus this study anticipated moderate to high levels of interest in using a patient portal as well as interest in its functions and PROMs. Hence the study data will enable estimation of acceptability levels in an exploratory (i.e., non-confirmatory) manner. To do so, our objective is to assess key stakeholders' acceptability of a patient portals' existing design, and functions for HIV care. Thus, this study's objectives were to assess five complimenting facets: 1) the experience of PLWH and HCPs with healthcare applications and smart device ownership, 2) PLWH and HCPs interest in a patient portal and their preferences for sharing their personal health information, 3) their anticipated benefits and inconveniences of a patient portal, 4) PLWH and HCPs interest in different PROMs, and 5) the factors that predict PLWH willingness to use a patient portal.

Materials and Methods

Study design

This acceptability study employed a cross-sectional design using two distinct surveys, developed using validated tools, including individual electronic surveys with PLWH and paper surveys with HCPs [119].

This study was conducted as part of a broader research program (the I-Score program) with sites in Canada and France aimed at improving ART adherence among PLWH using electronically administered PROMs [120]. In the HIV context, our goal is to first implement a patient portal in a pilot study at the CVIS, one of the largest public hospital-based HIV clinics in Quebec, Canada, which provides comprehensive multidisciplinary care to over 1600 PLWH. Subsequently, our goal is to implement a patient portal across Quebec and in France as well, therefore, this study recruited participants from Hôpital Saint-Antoine (Paris, France).

Study sites

Recruitment occurred at five sites; however, recruitment was focused on the CVIS. A patient portal is expected to be eventually implemented in other urban HIV care centers in Montreal and Paris, thus, PLWH and HCPs were recruited from the CVIS at MUHC in Montreal and Service de Maladies Infectieuses et Tropicales (SMIT) at Hôpital Saint-Antoine, Paris. HCPs were also recruited from three Montreal-based non-CVIS sites specializing in HIV care, including, 1) HIV Unit (Unité hospitalière de recherche, d’enseignment et de soins sur le sida, UHRESS) at the Centre Hospitalier de l’Université de Montréal, 2) private HIV clinic, Clinique Médicale du Quartier Latin, and 3) Clinique Médicale l’Actuel. Research ethics approval was obtained from the MUHC Research Ethics Board (study number: 2020-5910), where two co-investigators were based. According to French public health legislation [121], no ethical approval was needed in France. A confidentiality and data transfer agreement were signed between l'Assistance Publique – Hôpitaux de Paris (AP-HP) at the Hôpital Saint-Antoine and the MUHC, thus not requiring a separate REB for Hôpital Saint-Antoine. This study also met the standards set by the Declaration of Helsinki.

Study design and participant eligibility

This descriptive cross-sectional survey study aimed at estimating relative frequencies in the target population of 1600 PLWH registered with the CVIS. The desired minimum precision, i.e. the width of respective 95% confidence intervals generated from the sample data was set to be ±10 percentage points. Under this requirement, a total sample of approximately n=110 was needed. This sample size implied that in the absence (zero count) of a specific response category, the respective estimated proportion for the target population would be consistent with a prevalence of <3%, applying a 95% exact confidence interval. Convenience sampling was used to recruit PLWH, i.e. the first 110 eligible PLWH who presented for an appointment at participating HCPs from the CVIS were recruited into the study. To be included in the study, PLWH must have met the following inclusion criteria: 1) be over 18 years of age, 2) receive care for HIV, and 3) no cognitive impairments. PLWH who did not own a smartphone, or any other smart devices were also included, as our research team acknowledged PLWH who experience inequitable access to healthcare and smart devices. The inclusion criterion for HCPs included those with at least 6 months of clinical experience in HIV care. Exclusion criteria for both PLWH and HCPs included:

1) participants who could not communicate with the research team in French or English or 2) participants with a schedule that did not permit participation in the study.

The principal investigator recruited HCPs through personal email invitations following a convenience sampling approach. The goal was to recruit representatives of various disciplines within HIV care to garner multiple perspectives. Hence, the approached HCPs included individuals who would be potentially interested in using a patient portal to facilitate HIV care, comprising physicians, pharmacists, nurses, social workers, and administrative staff. To facilitate the sampling, available email addresses of HCPs from the respective study sites were retrieved through liaising with higher level site administrators and clinicians.

To achieve a fair representation of the HCP target population (clinical staff across the 5 sites) within the study sample, a total of 30 HCP was anticipated to be included in the study i.e., in expectation, six HCPs per site. This sample size enabled a minimum precision (95% confidence interval widths of estimated proportions within the HCP study population) of ±20 percentage points.

Data collection – questionnaires and surveys

Data were collected from August 2019 to February 2020.

The two distinct questionnaires for PLWH and HCPs were developed to address each objective by referencing and adapting validated tools from the literature [6, 77, 122-125]. Tools were selected based on their relevance to Opal [6], HIV-specific PROMs [77], patient engagement through electronic patient portals [122], sharing HIV-related patient data [123], acceptability and self-efficacy of health technology [124], and assessing implementation outcome measures such as acceptability [29]. The PLWH questionnaire (73 items) (Document S1) captured demographics and addressed: our first objective, by measuring smart device use, and healthcare technology self-efficacy [124]; our second objective, by evaluating interest in a patient portal's functions and willingness to share personal health information [6, 123, 125]; our third objective, by collecting data on the anticipated impact of accessing physicians' clinical notes [122]; and our fourth objective, by acquiring PLWH's interest in different HIV-specific PROMs [77, 123, 125]. The questionnaire for HCPs (55 items) (Document S2) was shorter. It documented their demographic characteristics and addressed: our first objective by collecting information on their perspective on smart device use, healthcare applications, and self-efficacy [124]; our second objective, by capturing interest in a patient portal's functions [6, 123, 125]; our third objective, by assessing the anticipated impact of PLWH access to physicians' clinical notes [122], anticipated compatibility of a patient portal with their work [126]; and our fourth objective, by measuring interest in different types of HIV-specific PROMs [77, 123, 125]. Various types of HIV-specific PROMs were identified in a review by Engler et al. (2017), and were presented to PLWH and HCPs on each questionnaire [27]. However, this list has not been finalized for the patient portal's clinical implementation to HIV care. A systematic review is planned to identify which PROMs have been used in HIV clinical practice to best inform patient care. These results are to be presented to stakeholders during the implementation of a patient portal to guide PROM selection. For example, within prior HIV clinical care, the QuaLiv [127], PROgress [128], Positive Outcomes [129], and AmbuFlex PRO system [130] all contain PROM domains including physical activity, drug use, and mental health. Our PROM package will likely contain similar outcomes to meet local PLWH needs. The specific PROM types presented to participants in this study are further documented in the appendix (*Questionnaire for people living with HIV, Questionnaire for HIV healthcare professionals)*.

Item response options included multiple choice and 5 to 7-point Likert scales. For items with 5 or 6-point Likert scale, responses were collapsed into three categories; “not at all interested” and “not interested” were classified as “not interested”; neutral responses “I don’t know” and/or “undecided” (6-point Likert scales included both responses) were classified as “undecided”; while positive responses “a little interested”, and “very interested” were classified as “interested”. For items with a 7-point Likert scale, responses were collapsed into three categories; negative responses, “completely disagree”, “disagree”, “somewhat disagree”, were classified as “disagree”; neutral responses, “undecided” remained as “undecided”; and positive responses “agree” “somewhat agree”, and “completely agree”, were classified as “agree”.

PLWH and HCPs were provided an in-person 5-minute PowerPoint presentation on Opal’s main functions (Presentation S1) and were offered a chance to ask questions to ensure participants fully understood how a patient portal may fit into their care or work. HCPs were also introduced to how a patient portal could be used in their work to support their management of PLWH, for example, through using a clinic check-in system, or integrating data from PROMs into the clinical encounter. HCPs had also participated in focus group discussions prior to completing their questionnaires; however, results from the focus groups were presented separately. A researcher administered the in-person survey to PLWH electronically, by presenting PLWH each item and their possible responses, before recording each answer; while HCPs completed a paper questionnaire. Data were then entered into a secure online platform, REDCap© (version 9.1.15), which conferred ease of administration and storage of data [131, 132].

Statistical analysis

All statistical analyses were performed using R statistical software (version 1.2) [133] and the R package ‘randomForest’ [134]. The distribution of continuous variables was described by their means, standard deviations, and ranges; for categorical variables, relative frequencies were reported. To express uncertainty in estimates of proportions, 95% confidence intervals were reported. Random forests were applied to predict the willingness of persons living with HIV to use a patient portal based on survey responses and patient demographics. Each random forest employed 500 classification trees. To illustrate prevalent variable interactions implied by the random forest, a final classification tree was fitted to the dataset, depicting patient characteristics that were associated with relatively lower or higher levels of willingness to use a patient portal.

The random forest analysis was a secondary analysis and was applied to explore possible interactions between variables [135]. The potential predictor variables were chosen based on barriers and facilitators of patient portal use highlighted in prior literature, such as income, age, gender, education, socioeconomic status, and health technology self-efficacy [92]. To establish a variable importance ranking, the relative decrease in classification accuracy associated with removing (permuting) a respective predictor variable from the random forest was reported as a percentage. Random forests maximize the overall accuracy of predicting the outcome variable when being trained on data. Hence, imbalances in the representation of respective outcome categories can lead to undesirably low sensitivity or specificity values as it is most rewarding for the model to correctly predict the most prevalent category. To mitigate such overfitting, the training data was weighted to equally represent cases with the outcome of interest and cases with complement outcome status. Due to the limited available sample size, no random forest analysis was conducted for the co-primary outcome variable ‘willingness of health care providers to use a patient portal’.

Results

Sample characteristics

Table 1 shows the characteristics of the PLWH and HCP participants. PLWH (n=114) included 86 men (74%), 28 women (24%), and 2% identified as transgender or 'other'. A total of 106 (93%) PLWH were recruited from the CVIS (Montreal), while 8 (7%) were from SMIT (Paris). CVIS clinic data from 2019 shows that of the 1679 registered PLWH, 63% were men, and 37% were women. For the CVIS clinic data, the mean age of PLWH was 51.2 years old (SD=12.7), compared with 47.8 (SD=12.4), in the present study sample.

Table 1. *Descriptive characteristics of people living with HIV and healthcare providers who participated in the study.*

	People living with HIV (n=114) Mean (SD) or n (%)	Healthcare providers (n=31) Mean (SD) or n (%)
Age (years)	47.8 (12.4)	46.5 (11.4)
Range	27, 74	25, 68
Gender		
Male	84 (74)	10 (32)
Female	27 (24)	20 (65)
Other / Transgender	3 (2)	1 (3)
Sexual orientation		
Heterosexual	55 (48)	N/A
Men who have sex with men	47 (41)	
Bisexual	10 (9)	
Unsure or other	2 (2)	
Marital status		
Single	54 (47)	N/A
Married	43 (38)	
Divorced or widow(er)	17 (15)	
Level of education		
University or higher	41 (36)	N/A
CEGEP*, trade/vocational school or high school	60 (53)	
Up to high school	13 (11)	
Paid work		
Student	9 (8)	N/A
Part-time	16 (14)	
Full-time	40 (35)	
Unemployed, retired, or disabled	49 (43)	

Income (CAD)		
1 to < 19 999	38 (33)	N/A
20 000 to 39 999	33 (29)	
40 000 to 59 999	17 (15)	
>60 000	16 (14)	
None or missing	10 (9)	
Ethnicity		
Caucasian or White	41 (36)	N/A
Black, African, or Caribbean	35 (31)	
Latino, Latin American, or South American	23(20)	
North African or Middle Eastern	7 (6)	
Asian or Pacific Islander	5 (4)	
Indian or South Asian	1 (1)	
Other	3 (3)	
Aboriginal, First Nations, or Métis	---	
Occupation		
Physician		13 (42)
Pharmacist		8 (26)
Nurse	N/A	6 (19)
Social worker		2 (6)
Administrative staff		2 (6)
Smart devices owned		
Smartphone	103 (90)	27 (87)
Computer (desktop or laptop)	74 (65)	26 (84)
Tablet	44 (39)	9 (29)
iPod or phablet	9 (8)	6 (19)
Smartwatch	4 (4)	3 (10)
Other	1 (1)	---
None	4 (4)	---

--- represents no responses.

*CEGEP is the first level of post-secondary education exclusive to Quebec, Canada.

HCPs’ (n=31) mean age was 46.5 years (SD=11.4) and included 20 women (65%), 10 men (32%). Of the HCPs recruited, 16 (52%) were from the CVIS (Montreal), 8 (26%) were from non-CVIS Montreal sites, and 7 (22%) from SMIT (Paris).

Smart device ownership and experience and comfort using healthcare applications

Overall, 109 (96%) PLWH and 31 (100%) HCPs owned at least one type of smart device including computers (desktops or laptops), smartphones, and/or tablets, three devices capable of operating Opal. However, the current patient-operated side of Opal can only be operated through smartphones and tablets. PLWH still demonstrated high ownership (n=106, 93%) when accounting for only these two devices; however, smartphone and tablet use for PLWH above 50 years of age was lower (n=39, 85%).

There were 93 (82%) PLWH and 19 (61%) HCPs who indicated very little to no experience using healthcare applications, including any applications targeted towards improving user health (for example, other patient portals, calorie counters, step counter, etc.); yet 84 (74%) PLWH were willing to use a patient portal and 21 (68%) HCPs were willing to use a patient portal in their work to support the management of PLWH. For HCPs, this would entail using a patient portal to facilitate HIV care. Of those willing to use a patient portal, 67 (80%) PLWH and 13 (60%) HCPs reported very little to no experience with healthcare applications. With a patient portal, 70 (61%) PLWH wanted immediate and comprehensive access to personal health information (PHI), while 29 (25%) PLWH preferred to only access PHI after review with their HCPs (see Table 2).

Table 2. *Participants' healthcare application experience, willingness to use a patient portal, preferences for accessing medical records, healthcare application self-efficacy, and acceptability of a patient portal (Opal).*

	People living with HIV (n=114) n (%)	Healthcare providers (n=31) n (%)
Healthcare application experience		
None to very little	93(82)	19(61)
Moderate to extensive	21(18)	11(35)
Willing to use a patient portal		

Yes	84(74)	21(68)
No	25(22)	3(10)
Uncertain	5(4)	6(19)
Access to personal health information		
Immediate access	70(61)	N/A
Following physician review	29(25)	
No access	11(10)	
Only need-to-know information	4(4)	
Healthcare application self-efficacy		
Capacity to use healthcare applications	103(90)	28(90)
Comfortable using healthcare applications	88(77)	25(81)
Ease of healthcare application use	87(76)	24(77)
Confidence pressing the right buttons to promote health	83(73)	26(84)
Acceptability the proposed Opal patient portal		
Opal is appealing	103(90)	30(97)
Opal has my approval	102(89)	27(87)
I would welcome Opal in HIV care	102(89)	25(81)
I like Opal	87(76)	25(81)

N/A represents not applicable

Most participants reported the capacity to use healthcare applications (n=103, 90% PLWH; n=28, 90% HCPs). Of the ten PLWH who did not agree they could use healthcare applications, of which three were over the age of 50 years. Among the three HCPs who did not feel capable of using healthcare applications, two were over 50 years old. Additionally, the proposed patient portal was perceived as appealing by most participants (n=103, 90% PLWH; n=30, 97% HCPs), and was met with approval by 102 (89%) PLWH and 27 (87%) HCPs.

Interest in patient functions and willingness to share personal health information

The patient portal functions that most interested the two groups included the appointment schedule (n=107, 94% PLWH; n=30, 97% HCPs), user account and password (n=105, 92% PLWH; n=23, 74% HCPs), and notifications and reminders (n=105, 92% PLWH; n=27, 87% HCPs) (see Figure 2). Among the functions deemed more useful by HCPs than PLWH were a navigational tool (n=72, 63% PLWH; n=27, 87% HCPs) and text messaging (n=71, 62% PLWH; n=24, 77% HCPs). Compared to PLWH, HCPs were less interested in functions for PLWH to access treatment plans (n=101, 89% PLWH; n=20, 64% HCPs), access consultation notes (n=97, 85% PLWH; n=12, 39% HCPs), and share consultation notes (n=97, 85% PLWH; n=16, 52% HCPs).

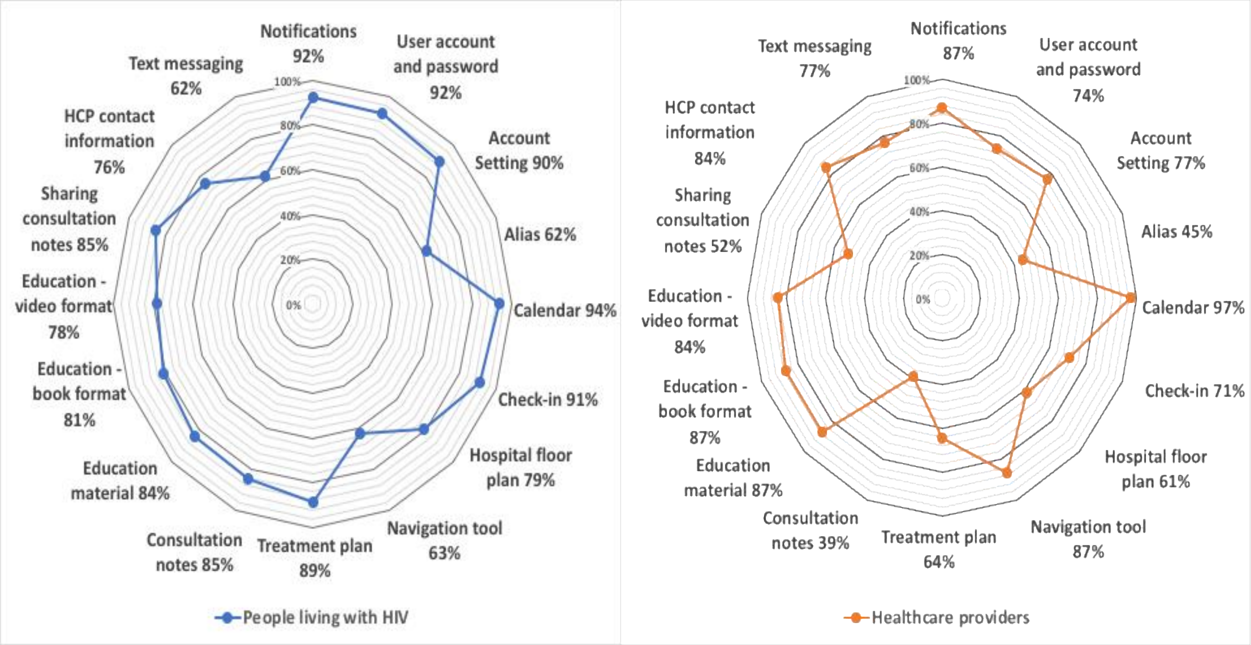


***Figure 2**. Participant interest in proposed patient portal functions.*

Using a patient portal, PLWH would have the option to share their personal health information. PLWH were most comfortable sharing their HIV health data with their primary HIV healthcare provider (n=109, 96%, 95% CI =90, 99), followed by pharmacists (n=86, 75%, 95% CI =66,83) and other HIV specialists at their clinic (n=86, 75%, 95% CI =66, 83) (see Figure 3). However, PLWH were more reluctant to share information with public health (n=51, 45%, 95% CI =35, 54) and health insurers (n=41, 36%, 95% CI =27, 45).

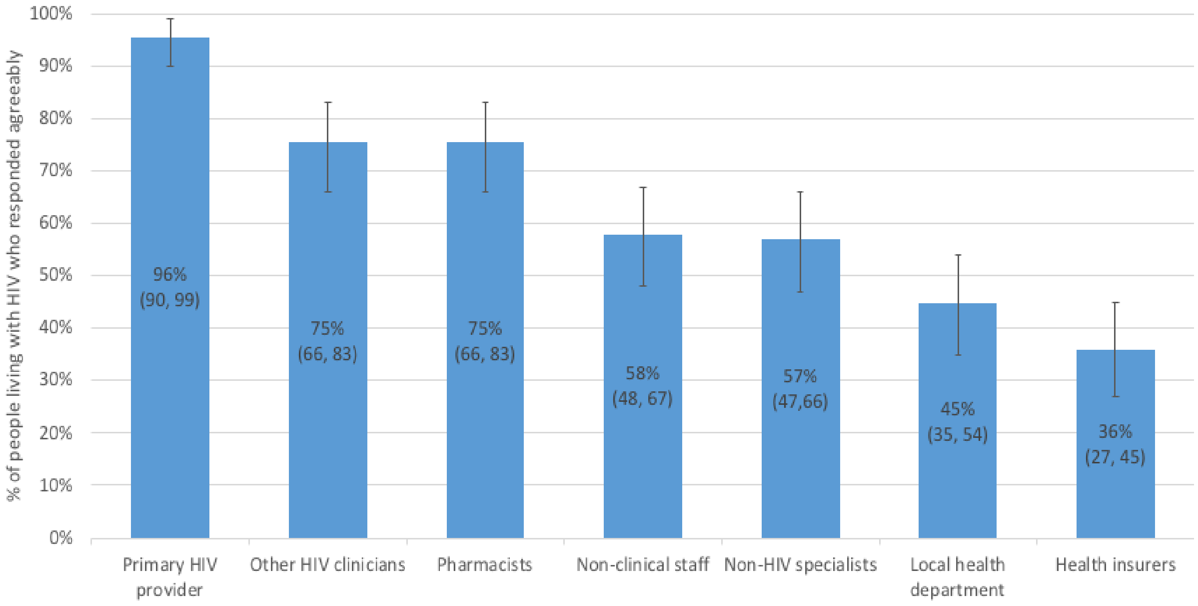


Figure 3. *Willingness of people living with HIV who agree to share their personal health information with others. Percentages are displayed with 95% confidence intervals in brackets.*

Anticipated benefits and inconveniences of a patient portal

Most PLWH believed a patient portal could provide various benefits, including better preparing themselves for clinical visits (n=101, 89%), remembering their HIV care plan (n=99, 87%), and feeling more in control of their healthcare (n=99, 87%) (see Figure 4). However, nearly two-thirds of PLWH (n=73, 64%) noted concerns about their privacy if using a patient portal.

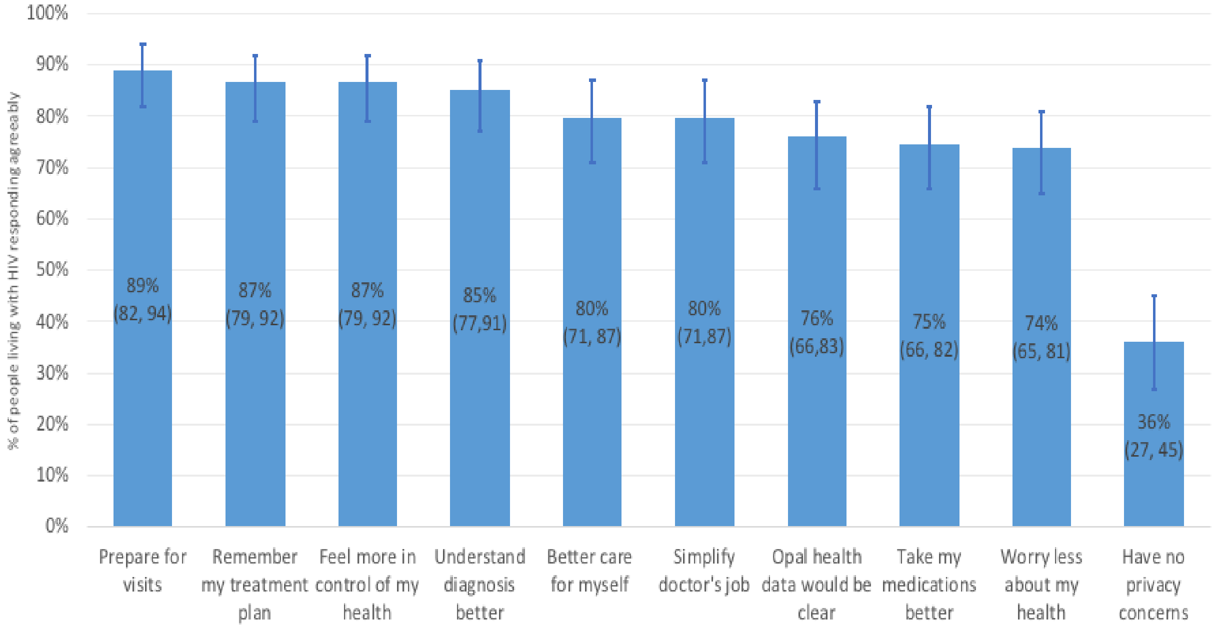


Figure 4. *People living with HIV who responded agreeably to anticipated benefits and inconveniences of a patient portal. Percentages are displayed with 95% confidence intervals in brackets.*

As for HCPs, almost two-thirds of physicians (n=8, 62%) were worried PLWH would contact them with questions about consultation notes, nearly half (n=6, 46%) of physicians had concerns PLWH may find significant errors in their consultation notes, and 6 (46%) physicians were concerned PLWH would request changes to their consultation notes. Lastly, approximately two-thirds (n=20, 64%) of all HCPs thought a patient portal would fit into the way they work.

Interest in different patient-reported outcome measures

At least 60% of all participants were interested in each of the PROM types evaluated (see Figure 5), particularly those regarding the experience of healthcare (n=109, 96% PLWH; n=30, 97% HCPs), HIV self-management (n=105, 92% PLWH; n=30, 97% HCPs), and the experience of treatment (n=103, 90% PLWH; n=28, 90% HCPs). The PROM types of least interest were body and facial appearance (n=77, 68% PLWH; n=19, 62% HCPs) and disability (n=71, 62% PLWH; n=25, 81% HCPs).

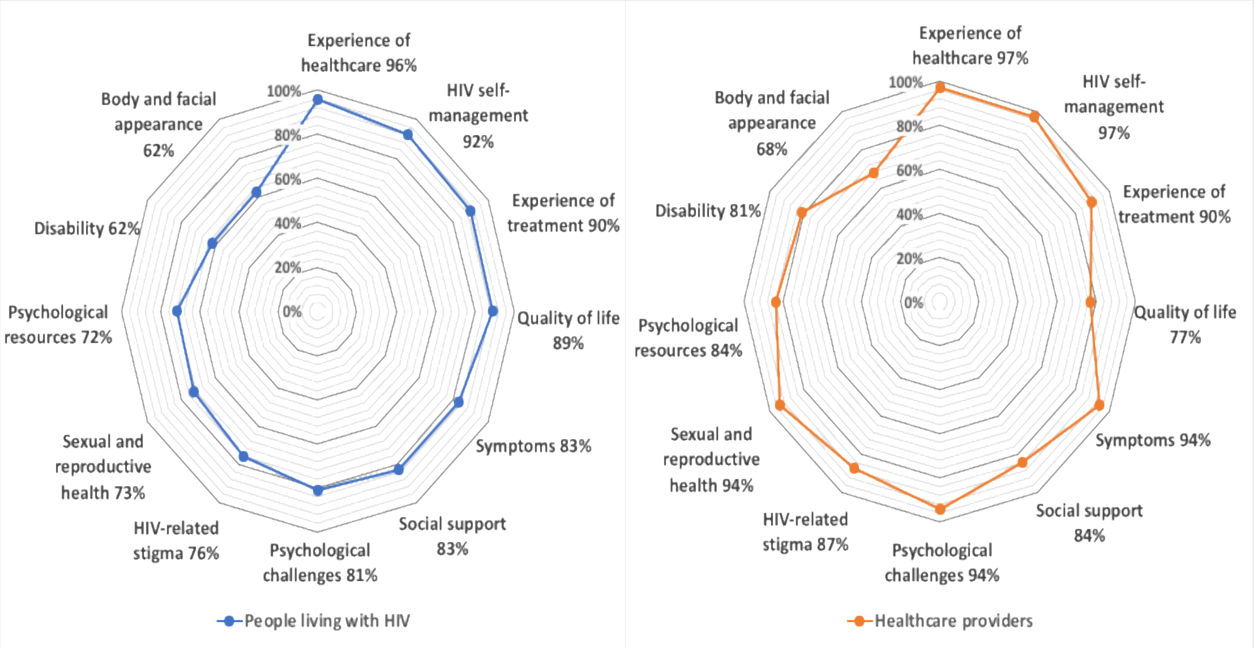


Figure 5. *Participant interest in types of HIV-specific PROMs for administration via a patient portal.*

Random forest analyses

For PLWH, demographics and multiple survey response variables were analyzed to predict their willingness to use a patient portal. Factors that were most predictive, in order from most to least, were gender, income, and age, with a classification error rate of 39.4% (see Figure 6). Based on the random forest model, variable cut-offs were derived that maximize the accuracy of predicting 'willingness to use a patient portal'. The respective cut-off for the variable age was 31 years, and for income $60 000. Accordingly, among PLWH of 31 years and above, 56% were willing to use a patient portal, of which 74 were men (52% willing), and 32 were women (73% willing). PLWH with an annual income less than $60 000 (n=101), 55% (n=55) were willing to use a patient portal, while 70% (n=9) of those with an income equal to or greater than $60 000 were willing (see Figure 7). Additionally, of those with an income less than $60 000, 73% (n=73) of PLWH reported having none to limited experience with health technology but were still willing to use a patient portal, while 53% (n=53) of PLWH with some to very extensive health technology experience were willing to use a patient portal.

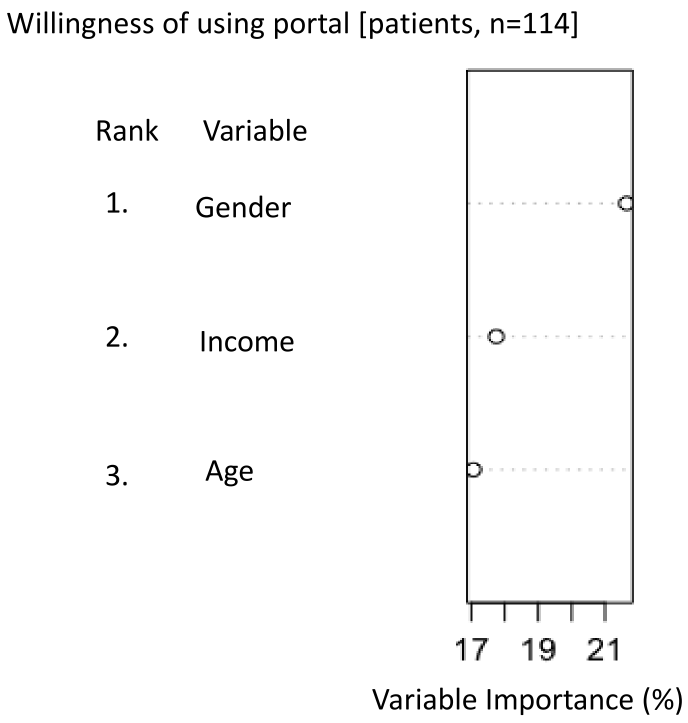


Figure 6*. Variable Importance based on Random Forest analysis predicting willingness of people living with HIV to use a patient portal including the predictor variables gender, income, and age.*

Additionally, questionnaire items concerning comfort using health technology and PLWH capability using health technology were also strong predictive factors (see Figure 8). Of PLWH capable using health technology (n=104, 79%), were willing to use a patient portal and of those individuals, while 86% of PLWH (n= 63) with no experience using health technology were willing, and 68% (n=41) of those with experience with health technology were willing to use a patient portal (see Figure 9).

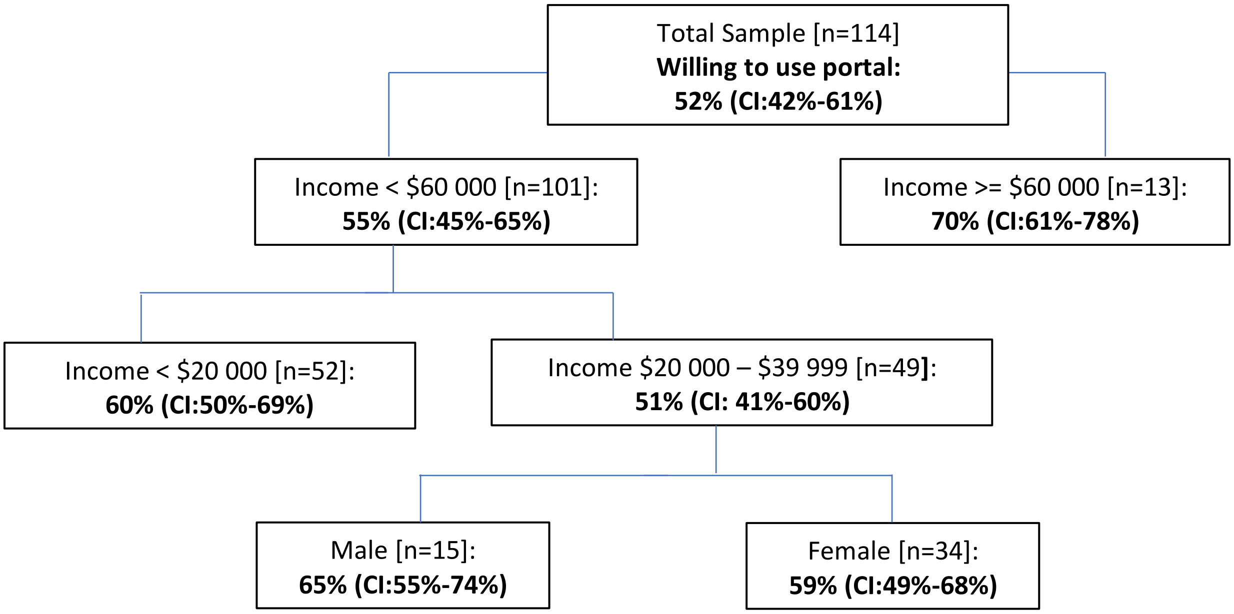


Figure 7. *Classification tree demonstrating the association between income, gender, and age on willingness to use a patient portal. Each split delineates a class prediction of the variable with the greatest predictive importance. Age is not shown due to its relatively lower variable importance. Ninety-five percent confidence intervals are shown in brackets. This classification tree model demonstrates only the sub-groups of men and women to visualize the predictive value of different levels of income.*

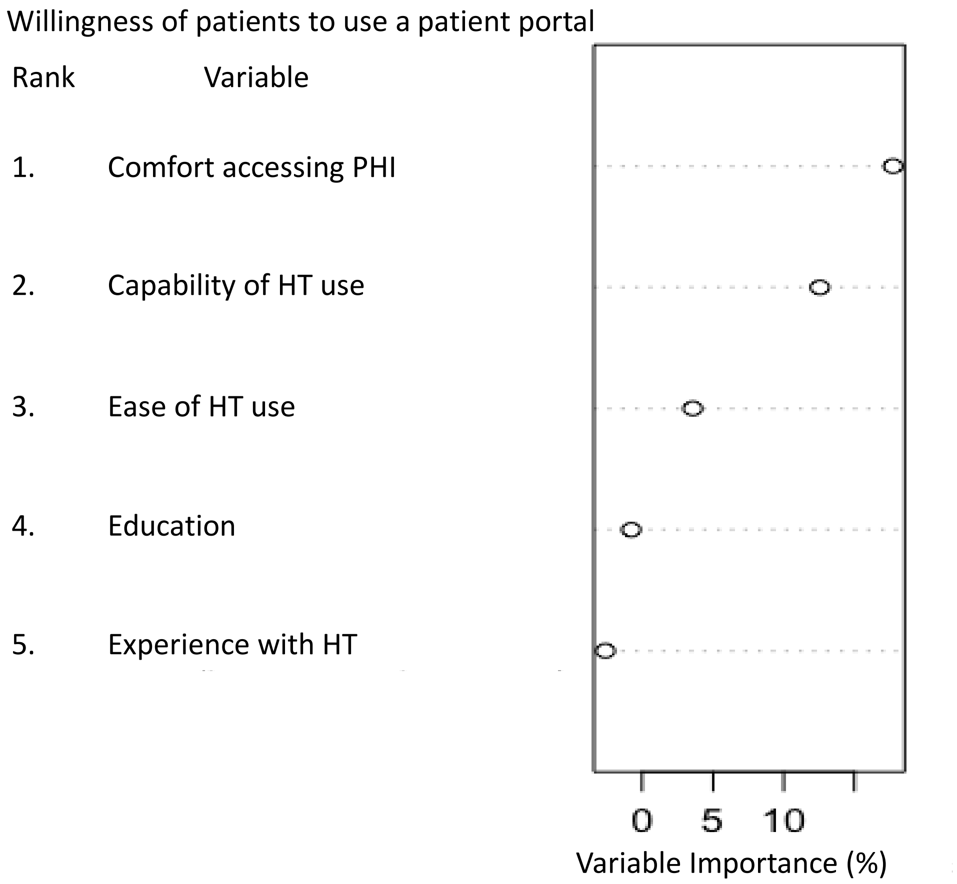


Figure 8. *Variable Importance based on Random Forest analysis predicting patient willingness to use a patient portal using variables related to access to personal health information (PHI) , health technology (HT) self-efficacy and education.*

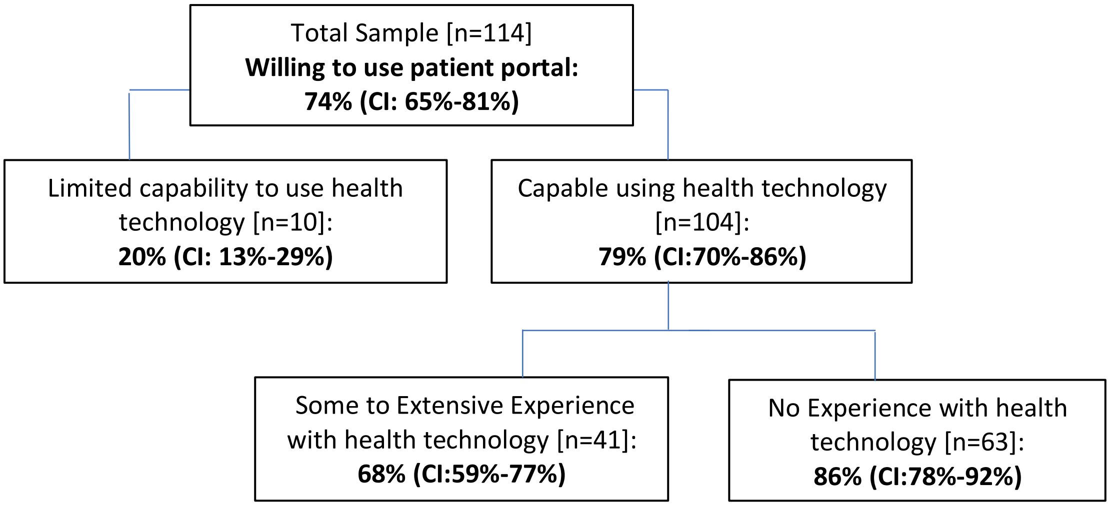


Figure 9. *Classification tree demonstrating HIV patients' willingness to use a patient portal. Factors examined include experience using health technology, technology self-efficacy, educational background, and comfort with accessing personal health information. Education was not displayed due to lower variable importance. Ninety-five percent confidence intervals are displayed in brackets.*

Discussion

This study sought to ascertain the acceptability of using a patient portal in HIV care with key stakeholder input obtained through a cross-sectional survey. The majority of PLWH and HCPs were willing to use a patient portal, meeting our overarching hypothesis. Beyond this, these results highlight a high prevalence of smart device ownership, acceptability of most patient portal functions, and acceptability of most PROMs, as well as several perceived benefits and inconveniences of a patient portal, and. Considering these results, a patient portal may be feasible for use in HIV care.

Smart device ownership, experience with healthcare applications, and health info preferences

Critical to implementing a patient portal is the consideration of factors such as user access to smart devices, experience with healthcare applications, and willingness to use a patient portal [136-140]. Our sample revealed a high use of smart devices across all age groups for all participants, by which they could access a patient portal. This high ownership of smart devices had also met this study's anticipated smart device ownership, which coincided with the prevalence of smart device use in prior HIV mobile health-related literature [116, 118]. Although the ownership of smartphones was high within this sample (90%), it was consistent with Canadian smartphone ownership in 2020 (84.4%) [141]. Given sample uncertainties and sampling errors, the ownership of smartphones between the sample and population did not differ greatly. However, the uptake of smartphones or tablets was relatively lower in age groups above 50 years (85% of PLWH) compared to younger age groups. Similarly, prior studies noted lower access to and uptake of patient portals with older age [138, 139]. The mean age of the entire CVIS clinic was also above 50 years old and may affect the overall uptake of a patient portal.

The proportion of PLWH and HCPs willing to use a patient portal was less than the proportions reported within prior literature (78%) [116]. Most participants had limited healthcare application experience, although this did not reduce participants' interest in using the patient portal. However, participants with greater experience with health technology were less likely to use a patient portal, which may explain individuals' limited willingness to use a patient portal. This lends concern to portal uptake for these individuals. Considering prior health technology innovations such as patient portals, those with prior experience with health technology may have had negative experiences due to concerns over confidentiality and privacy, as well as an inability to meet the specific needs of end-users [12, 91, 104, 105]. Further engagement and consultation of these individuals with greater experience with health technology should be considered for the implementation of a patient portal due to its implications on patient portal uptake and satisfaction with the patient portal.

Interestingly, the proportion of PLWH preferring immediate access to medical records and patient portal access after physician review were similar to the preferences of oncology patients in the initial Opal study [6]. It was important to consider Opal's initial success in oncology care, considering their utilization of a patient-centered approach, where patients had chosen their preferred level of access to personal health information [6]. Given the varying preferences for access to personal health information in the HIV care context, it would be imperative to offer PLWH the option to choose their preferred level of access to personal health information during end-user testing to optimize PLWH uptake and satisfaction with a patient portal.

Interest in patient portal functions

PLWH met anticipated levels of interest for most proposed patient portal functions including access to their treatment plan, consultation notes, and sharing consultation notes, however, HCPs were less receptive to these functions. The only function that did not meet this study's anticipated interest was the alias for HCPs, however, given concerns for confidentiality, using a patient's photo or alias in HIV care was understandable. Concerns for certain functions mirror those reported in prior literature, specifically, HCP worried that their workload may increase due to an influx of PLWH messages or phone calls with these types of portal functions [142]. However, prior studies that examined patient portal use showed that allowing access to consultation notes through patient portals had not increased clinician workload, and in some cases, even decreased the need for telephone calls and reduced unnecessary appointments [143, 144].

Anticipated benefits and inconveniences of a patient portal

Patient portals have been reported to be useful for monitoring the health of PLWH as they could meet the changing needs and expectations of PLWH [94, 145]. The anticipated benefits of a patient portal for PLWH, such as allowing for better clinic visit preparation and understanding of their HIV diagnosis, were consistent with these observations [145]. Despite the many anticipated benefits of using a patient portal, there were concerns as well. A patient portal raised privacy issues for many PLHW surveyed, which was congruent with prior literature citing concerns with data security theft, confidentiality, privacy, and HIV-related stigma as barriers to patient portal use and implementation [12, 94, 95, 142, 146-149].

Interest in different types of PROMs

Participants met this study's anticipated levels of interest in types of PROMs, which highlighted the various topics and issues they preferred to discuss, particularly PLWH-perceived experiences of healthcare, symptoms, psychological challenges, and social support. PROMs capturing body and facial appearance received the least amount of interest amongst all participants as some PLWH have not been exposed to the complications of outdated ART regimens. While a PROM capturing disability was received less interest from PLWH compared to HCPs. Interestingly, compared to HCPs, PLWH showed less interest in PROMs related to psychological challenges and resources, as well as to HIV-related stigma, despite their well-documented prevalence among PLWH [150].

Random forest analyses to predict willingness to use a patient portal

Several co-variates compared to willingness to use a patient portal were based on facilitators and barriers to patient portal adoption highlighted in prior literature [13]. These included age, social-economic status, and health literacy, and experience with technology [147, 151, 152]. Variables such as income, age, comfort with accessing PHI, prior health technology experience, and self-efficacy were good predictors. Similar to prior literature, those with an income below $60 000 per year were less inclined than those with a higher income to use a patient portal [13]. This finding may be explained by patients' lower income and thus, these PLWH may have limited access to smart devices and access to care [153, 154]. Additionally, those with greater capability and ease of using health technology were more willing to use a patient portal. However, perceived capability and ease of health technology use did not suggest PLWH had prior experience with health technology, as PLWH with greater experience with health technology were associated with less willingness to use a patient portal. This finding may be explained by PLWH who have had negative prior experiences with health technology, as previously mentioned. Therefore, during the implementation phase, it is imperative to engage and consult these individuals to optimize patient portal uptake.

By considering the most predictive variables for patient willingness to use a patient portal, several considerations can be made to refine the implementation of a patient portal in HIV care. Firstly, implementation of a patient portal can be catered to cohorts more interested in using a patient portal, to secure early adoption, including those with greater income, men, and limited experience with health technology. Secondly, research efforts can be made to identify recommendations of those who are less likely to use a patient portal, including those with less income, previous experience with health technology, and women. For example, those with lower income face greater health inequities and limited access to care, therefore, alternative, more accessible methods of care must be considered (i.e., home visits, paper-based PROMs, and education material) to promote engagement to care [155].

Limitations

A limitation of this acceptability study was the lack of equivalent participant recruitment from all sites to allow for site-to-site comparison; however, the goal was to implement a patient portal at the CVIS first, therefore recruitment was predominantly from the CVIS. Additionally, the use of convenience sampling of PLWH may have resulted in volunteer bias and social desirability bias; while convenience sampling of HCPs may have led to a sampling bias, more specifically, self-selection bias, by which HCPs were more inclined to respond, if they were interested in the use of a patient portal. However, the sampling of HCPs intended to include a variety of HIV-related healthcare specialists in terms of role and expertise. Additionally, for the random forest analyses, the HCP sample size was too small and thus, could not be adequately performed for this cohort.

Due to convenience sampling biases for PLWH, the data reflected a high rate of smart device ownership but may not be representative of all PLWH in Canada. The research team prioritized the inclusion and equity of all PLWH and understood that not all PLWH and HCPs had equitable access to smart devices, and thus, cannot use a patient portal within their HIV care during its implementation. However, this study aimed to include even PLWH without smart device ownership to include their perspectives. Additionally, for those who cannot use smart devices during the patient portal implementation, the CVIS aims to offer certain patient portal functions such as paper-based PROM administration and educational material.

Future Considerations

Understanding the acceptability of using a patient portal and the needs of PLWH and their HCPs was an initial step prior to piloting the implementation of a patient portal in HIV clinical care. This study aims to continue engaging with key stakeholders to optimize the patient portal for pilot development and testing. To optimize a patient portal for use in HIV care, the HIV research team aims to discuss further design considerations with stakeholders that could optimize portal uptake, utility, and usability.

Conclusions

This study assessing the acceptability of configuring a patient portal to HIV care revealed several considerations for using a patient portal for PLWH and their HCPs, primarily for a large HIV clinic such as the CVIS. The results obtained suggest that a patient portal's implementation at the CVIS is feasible and meets this study's overarching hypothesis that the majority of PLWH and HCPs perceived a patient portal within HIV care to be useful and positively affect HIV care. Additionally, for both PLWH and HCPs, there was a high rate of smart device ownership, comfort with using healthcare applications, and interest in most patient portal functions and proposed PROMs, as well as several anticipated benefits of using a patient portal. By consulting key stakeholders, end-users of the patient portal, this study also offer insight into a framework for future patient portal adaptations from one specialty to another. Through the random forest model, the research team's understanding of the factors that predict willingness to use a patient portal can inform its implementation by catering a patient portal to patient cohorts most likely to use the patient portal, thus securing early adopters. Our next step, within my future PhD studies in the Department of Family Medicine at McGill University, hopes to utilize these results and inform the patient portal pilot implementation at the MUHC.

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Appendix A

Questionnaire for people living with HIV

Demographics

1. **What is your date of birth?**

___/_____/_____
DD/MMM/YYYY

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2. **What is your gender (select all that apply)?**

Female ☐
Male ☐
Trans ☐
Other ☐ Specify:____________________________

---

3. With respect to your sexual orientation, how do you currently identify? (check all that apply)

Heterosexual/straight ☐
Lesbian ☐
Gay ☐
Bisexual ☐
Other (queer, two-spirited, etc.) ☐ Specify:____________________________
Unsure ☐

---

4. **What is your marital status?**

Single ☐
Married or common-law ☐
Divorced ☐
Widow(er) ☐

---

5. **If a refugee or immigrant:**

Year of entry in Canada: ____________
Country of origin: ____________

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6. **What ethnic group(s) or family background(s) do you identify with? (check all that apply)**

Caucasian or White ☐
Black, African, or Caribbean ☐
Asian or Pacific Islander ☐
Indian or South Asian ☐

North African or Middle Eastern ☐
Aboriginal, First Nations, or Métis ☐
Other ☐ Specify:___________________________

---

7. What is the highest level of education that you have completed?

- No formal education ☐
- Elementary ☐
- Some high school but did not graduate ☐
- High school diploma or a high school equivalency certificate ☐
- Trade, vocational, or technical diploma certificate ☐
- Some post-secondary education but no certificate or diploma ☐
- University, college diploma, or certificate less than a bachelor's degree ☐
- Bachelor's degree ☐
- Graduate (PhD or Masters) or professional degree (medical, law, etc.) ☐
- Other ☐ Specify:___________________________

8. What is your current employment status? (check all that apply)

- Student ☐
- Part-time employment ☐
- Full-time employment ☐
- Unemployed ☐
- Homemaker ☐
- Retired ☐
- Sick leave or work-related illness/injury leave ☐
- Long-term disability ☐

9. What was your total income for last year, from all paid work and other sources before taxes and other deduction?

- $0 or No income ☐
- $1 - $19,999 ☐
- $20,000 - $39,999 ☐
- $40,000 - $59,999 ☐
- $60,000 - $79,999 ☐
- $80,000 - $99,999 ☐

$100,000 or more ☐

10. What is the first language that you learned?	________________________________

11. What is your preferred language of communication at the service where you receive HIV care?

French ☐
English ☐
Other ☐ Specify:___________________________

12. How much time, in minutes, does it take you to travel from your home to the service where you receive HIV care?

________ minutes

13. What mode of transportation do you use to go to the service where you receive HIV care?

On foot / Walking ☐
Car ☐
Public transit (bus, metro, train, etc.) ☐
Bicycle ☐
Other ☐ Specify:___________________________

HIV care and use of digital applications

1. When did you learn you were HIV-positive?

____/_____
MM/YYYY

2. Do you currently use any of the following smart devices? (check all that apply)

Smartphone ☐
iPod, phablet ☐
Tablet ☐
Smartwatch ☐
Computer, laptop ☐
Other ☐ Specify:___________________________
I do not use any of these devices ☐

3. Do you currently use an application (app) on a smart device in relation to your health or HIV care?

Yes ☐ Specify:___________________________
No ☐

4. How much experience do you have with health-related applications (apps) on smart devices?

None ☐
Very little ☐

Average ☐
Quite extensive ☐
Very extensive ☐

A *patient portal* is a secure website or application (app) that gives you access to your medical records, as well as other services (for example, a mobile check-in function and messaging with care providers).

Your *medical records* include: your diagnosis; personal and medical information; a list of your appointments; your treatment plan and medication; your physician's consultation notes; and your lab test results.

5. Would you use a patient portal to access your personal health information relative to your HIV care?

Yes ☐
No ☐
I don't know ☐

---

6. What is your level of comfort with accessing your personal health information on a smart device?

I would like access to all my medical records as soon as the information is available. ☐
I would like access to all my medical records, after I have reviewed them with my doctor. ☐
I would like access to just my appointments and other need-to-know information (for example, instructions on how to go to the clinic). ☐
I do not want access to my medical records on a smart device. ☐

The term *health technology* refers here to any health-related application (app) or software.

7. Please indicate to which extent you agree with the following statements

Statements	**1 Strongly disagree**	**2 Somehow disagree**	**3 Disagree**	**4 Undecided**	**5 Agree**	**6 Somehow agree**	**7 Strongly agree**
It is easy for me to use health technology.	☐	☐	☐	☐	☐	☐	☐
I have the capability to use health technology.	☐	☐	☐	☐	☐	☐	☐
I do not feel comfortable using health technology.	☐	☐	☐	☐	☐	☐	☐
When using health technology, I worry I might press the wrong button and risk my health.	☐	☐	☐	☐	☐	☐	☐

Comments:____

____

____

____

____

Patient-reported outcome measures (PROM)

A *patient-reported outcome measure* is a questionnaire or survey about a given aspect of their health or illness, in which answers come directly from patients. They capture answers from patients, with no input from a physician or health professional. They are not blood test results (for example, viral load, CD4 counts).

1. **Please specify your level of interest in filling out these different types of patient-reported outcome measures:**

Types of patient-reported outcome measures	1 Not at all interested	2 Not interested	3 Undecided	4 A little interested	5 Very interested	I don't know
Quality of life	☐	☐	☐	☐	☐	☐
Experience of treatment (e.g., attitudes towards treatment, side effects, satisfaction with treatment)	☐	☐	☐	☐	☐	☐
Experience of healthcare (e.g., patient needs, quality of care, barriers to care)	☐	☐	☐	☐	☐	☐
Psychological challenges (e.g., stress, depression)	☐	☐	☐	☐	☐	☐
Symptoms (e.g., symptoms of HIV, fatigue, psychomotor slowness)	☐	☐	☐	☐	☐	☐
Psychological resources (e.g., perceived control, spiritual beliefs and activities, resiliency)	☐	☐	☐	☐	☐	☐
HIV self-management / self-care (e.g., adherence to treatment)	☐	☐	☐	☐	☐	☐
HIV-related stigma	☐	☐	☐	☐	☐	☐
Body and facial appearance (e.g., body image)	☐	☐	☐	☐	☐	☐
Social support (e.g., unsupportive social interactions)	☐	☐	☐	☐	☐	☐
Sexual and reproductive health (e.g., motivation for childbearing, HIV status disclosure, safer sex)	☐	☐	☐	☐	☐	☐
Disability	☐	☐	☐	☐	☐	☐
Others, specify:______________ ____________________________	☐	☐	☐	☐	☐	☐

Functions of Opal

The staff administering this questionnaire will now show you different functions considered for the Opal application (app).

---

1. For each function considered for Opal, please specify how useful it is for you:

Functions	**1 Not at all useful**	**2 Not useful**	**3 Undecided**	**4 A little useful**	**5 Very useful**	**I don't know**
Welcome message	☐	☐	☐	☐	☐	☐
Appointment schedule	☐	☐	☐	☐	☐	☐
Appointment check-in	☐	☐	☐	☐	☐	☐
Appointment map	☐	☐	☐	☐	☐	☐
Navigation tool, top left	☐	☐	☐	☐	☐	☐
Contacts	☐	☐	☐	☐	☐	☐
Notifications	☐	☐	☐	☐	☐	☐
Treatment plan	☐	☐	☐	☐	☐	☐
Consultation Note	☐	☐	☐	☐	☐	☐
Messages	☐	☐	☐	☐	☐	☐
Educational material	☐	☐	☐	☐	☐	☐
Booklet	☐	☐	☐	☐	☐	☐
Video	☐	☐	☐	☐	☐	☐
Notes	☐	☐	☐	☐	☐	☐
Account setting	☐	☐	☐	☐	☐	☐
Allow an alias for the screen display	☐	☐	☐	☐	☐	☐

Comments:____

____

____

____

____

Acceptability, benefits, and risks of Opal

1. Please indicate to which extent you agree with the following statements:

Statements	**1 Completely disagree**	**2 Somehow disagree**	**3 Somehow agree**	**4 Completely agree**	**I don't know**
Opal meets my approval	☐	☐	☐	☐	☐

Opal is appealing to me	☐	☐	☐	☐	☐
I like Opal	☐	☐	☐	☐	☐
I welcome Opal	☐	☐	☐	☐	☐
Using a secure electronic network, I am willing to allow my personal health information to be shared with…					
…my primary HIV care provider.	☐	☐	☐	☐	☐
… other clinicians at my HIV clinic.	☐	☐	☐	☐	☐
… the non-clinical staff at my HIV clinic.	☐	☐	☐	☐	☐
… non-HIV specialists.	☐	☐	☐	☐	☐
… pharmacists.	☐	☐	☐	☐	☐
… my health insurers.	☐	☐	☐	☐	☐
… the local health department.	☐	☐	☐	☐	☐
With Opal…					
…I would better understand my health and medical conditions.	☐	☐	☐	☐	☐
…I would better remember the plan for my care.	☐	☐	☐	☐	☐
…I would take better care of myself.	☐	☐	☐	☐	☐
…I would be more likely to take my medications as prescribed.	☐	☐	☐	☐	☐
…I would feel more in control of my health care.	☐	☐	☐	☐	☐
…I would be better prepared for visits.	☐	☐	☐	☐	☐
…I would worry more	☐	☐	☐	☐	☐
…I would be concerned about my privacy.	☐	☐	☐	☐	☐
…the information would be more confusing than helpful.	☐	☐	☐	☐	☐
…it could make my doctor's job more difficult.	☐	☐	☐	☐	☐

Comments:____

____

____

____

Questionnaire for HIV healthcare providers

Demographics

1. **What is your date of birth?**

___/_____/_____
DD/MMM/YYYY

---

2. **What is your gender (select all that apply)?**

Female ☐
Male ☐
Trans ☐
Other ☐ Specify:____________________________
Prefer not to answer ☐

---

3. **What is your occupation at the Chronic Viral Illness Service?**

Physician ☐
Nurse ☐
Psychologist ☐
Psychiatrist ☐
Social worker ☐
Pharmacist ☐
Other ☐ Specify:____________________________

---

4. **What is the first language that you learned?**

____

---

5. **What is your preferred language of communication when you provide HIV care?**

French ☐
English ☐
Other ☐ Specify:____________________________

HIV care and use of digital applications

1. Do you currently use any of the following smart devices? (check all that apply)

Smartphone ☐
iPod, phablet ☐
Tablet ☐
Smartwatch ☐
Computer, laptop ☐
Other ☐ Specify:____________________________
I do not use any of these devices ☐

---

2. Do you currently use an application (app) on a smart device for your work as an HIV care provider?

Yes ☐ Specify:____________________________
No ☐

---

3. Do you know of any digital, smartphone, or web-based application (app) currently used by your HIV patients for their HIV health care?

Yes ☐ Specify:____________________________
No ☐

---

4. How much experience do you have with health-related applications (apps) on smart devices?

None ☐
Very little ☐
Average ☐
Quite extensive ☐
Very extensive ☐

A *patient portal* is a secure website or application (app) that gives you access to your medical records, as well as other services (for example, a mobile check-in function and messaging with care providers).

Patients' *medical records* include: their diagnosis; their personal and medical information; a list of their appointments; their treatment plan and medication; their physician's consultation notes; and their lab test results.

5. Would you use a patient portal for your HIV patients that allows them to access their medical records?

Yes ☐
No ☐
I don't know ☐

7. Please indicate to which extent you agree with the following statements

Statements	**1 Strongly disagree**	**2 Somehow disagree**	**3 Disagree**	**4 Undecided**	**5 Agree**	**6 Somehow agree**	**7 Strongly agree**
It is easy for me to use health technology.	☐	☐	☐	☐	☐	☐	☐
I have the capability to use health technology.	☐	☐	☐	☐	☐	☐	☐
I do not feel comfortable using health technology.	☐	☐	☐	☐	☐	☐	☐
When using health technology, I worry I might press the wrong button.	☐	☐	☐	☐	☐	☐	☐

Comments:____

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Patient-reported outcome measures (PROM)

1. **Please specify your level of interest in having your HIV patients fill out patient-reported outcome measures via Opal for each of the following types:**

Types of patient-reported outcome measures	**1 Not at all interested**	**2 Not interested**	**3 Undecided**	**4 A little interested**	**5 Very interested**	**I don't know**
Quality of life	☐	☐	☐	☐	☐	☐
Experience of treatment (e.g., attitudes towards treatment, side effects, satisfaction with treatment)	☐	☐	☐	☐	☐	☐
Experience of healthcare (e.g., patient needs, quality of care, barriers to care)	☐	☐	☐	☐	☐	☐
Psychological challenges (e.g., stress, depression)	☐	☐	☐	☐	☐	☐
Symptoms (e.g., symptoms of HIV, fatigue, psychomotor slowness)	☐	☐	☐	☐	☐	☐
Psychological resources (e.g., perceived control, spiritual beliefs and activities, resiliency)	☐	☐	☐	☐	☐	☐
HIV self-management / self-care (e.g., adherence to treatment)	☐	☐	☐	☐	☐	☐
HIV-related stigma	☐	☐	☐	☐	☐	☐
Body and facial appearance (e.g., body image)	☐	☐	☐	☐	☐	☐
Social support (e.g., unsupportive social interactions)	☐	☐	☐	☐	☐	☐
Sexual and reproductive health (e.g., motivation for childbearing, HIV status disclosure, safer sex)	☐	☐	☐	☐	☐	☐
Disability	☐	☐	☐	☐	☐	☐
Others, specify:_______________ ______________________________	☐	☐	☐	☐	☐	☐

Functions of Opal

The staff administering this questionnaire will now show you different functions considered for the Opal application.

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2. For each function considered for Opal, please specify how useful it is for you:

Functions	**1 Not at all useful**	**2 Not useful**	**3 Undecided**	**4 A little useful**	**5 Very useful**	**I don’t know**
Welcome message	☐	☐	☐	☐	☐	☐
Appointment schedule	☐	☐	☐	☐	☐	☐
Appointment check-in	☐	☐	☐	☐	☐	☐
Appointment map	☐	☐	☐	☐	☐	☐
Navigation tool, top left	☐	☐	☐	☐	☐	☐
Contacts	☐	☐	☐	☐	☐	☐
Notifications	☐	☐	☐	☐	☐	☐
Treatment plan	☐	☐	☐	☐	☐	☐
Consultation Note	☐	☐	☐	☐	☐	☐
Messages	☐	☐	☐	☐	☐	☐
Educational material	☐	☐	☐	☐	☐	☐
Booklet	☐	☐	☐	☐	☐	☐
Video	☐	☐	☐	☐	☐	☐
Notes	☐	☐	☐	☐	☐	☐
Account setting	☐	☐	☐	☐	☐	☐
Allow an alias for the screen display	☐	☐	☐	☐	☐	☐

Comments:____

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Acceptability, benefits, and risks

1. Please indicate to which extent you agree with the following statements:

Statements	**1 Completely disagree**	**2 Somehow disagree**	**3 Somehow agree**	**4 Completely agree**	**I don't know**

Opal meets my approval	☐	☐	☐	☐	☐
Opal is appealing to me	☐	☐	☐	☐	☐
I like Opal	☐	☐	☐	☐	☐
I welcome Opal	☐	☐	☐	☐	☐
For physicians only: ***Knowing that Opal may give patients access to their physician's consultation notes…***					
Patients will disagree with what I write in their visit notes	☐	☐	☐	☐	☐
Patients will request changes to the content of visit notes	☐	☐	☐	☐	☐
Patients will find significant errors in the notes	☐	☐	☐	☐	☐
Patients will contact me or my practice with questions about their notes	☐	☐	☐	☐	☐

2. **Please indicate to which extent you agree with the following statements:**

Statements	**1 Strongly disagree**	**2 Somehow disagree**	**3 Disagree**	**4 Undecided**	**5 Agree**	**6 Somehow agree**	**7 Strongly agree**
Using Opal is compatible with all aspects of my work	☐	☐	☐	☐	☐	☐	☐
Using Opal is completely compatible with my current situation	☐	☐	☐	☐	☐	☐	☐
I think that using Opal fits well with the way I like to work	☐	☐	☐	☐	☐	☐	☐
Using Opal fits into my work style	☐	☐	☐	☐	☐	☐	☐

Comments:____

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Appendix B

Ethics and related certificates

MUHC approval (Supplemental S2) to conduct ethical research with people was received on August 21, 2019 through the completion of CITI Program’s Good Clinical Practice – Canada (Supplemental S3), Standard Operating Procedures of the MUHC, and Health Canada Division 5 training.