International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 23s, 2025
https://www.theaspd.com/ijes.php

Onomatopoeia-Based Self-Monitoring for Early Detection of HIV: A Human-Centered Approach Integrating Patient-Reported Outcomes and Subjective Symptom Tracking

Maki Sakamoto[1*], Haruka Matsukura[2], Zhiyang Qi[3], Toshio Naito[4], Mai Suzuki[5], Kunihisa Tsukada[6]

[1,2,3] The University of Electro-Communications, Tokyo, Japan
[4,5] Juntendo University, Tokyo, Japan
[6] Saitama Medical University, Saitama, Japan

[*]Corresponding author: maki.sakamoto@uec.ac.jp

Abstract: *HIV is a virus that primarily infects immune cells and continues to replicate, gradually leading to immunodeficiency in those infected. However, the symptoms of early HIV infection resemble those of other infectious diseases, making it difficult to distinguish. As a result, diagnosis often occurs only after the immune system has significantly deteriorated in the AIDS stage. To address the challenges faced by people living with HIV, the short-form version of the HIV Disability Questionnaire has been developed as a patient-reported outcome measure in clinical practice. It is used to assess health-related challenges and their changes over time, promoting interdisciplinary approaches to care. Recognizing and analyzing subjective symptoms—such as pain and discomfort—is also essential for understanding disease progression. The authors have developed an application software that allows users to record their daily physical and mental states using a single word in the form of an onomatopoeia or metaphor. This enables easy, quantifiable tracking of health conditions. In this presentation, we will explain our application software to support the early detection of HIV by facilitating the daily collection of personal health data, including information that may be difficult to communicate in person to healthcare providers.*

Keywords: *HIV Early Detection, Patient-Oriented Questionnaire System, Subjective Symptoms Of Pain/Mental States, Onomatopoeia, Personal Health Data.*

1. INTRODUCTION

Human Immunodeficiency Virus (HIV) is a retrovirus that infects key immune system cells, particularly CD3-positive T lymphocytes and macrophages, leading to the gradual decline of immune function in affected individuals. As the virus replicates within the host, it disrupts the body's immune defenses, increasing susceptibility to opportunistic infections and malignancies. In its advanced stage, the condition progresses to Acquired Immunodeficiency Syndrome (AIDS), characterized by a severely compromised immune system and a high risk of life-threatening diseases. The time from initial infection to the onset of AIDS varies significantly among individuals, typically ranging from 2 to 15 years [1]. While HIV was once considered a terminal illness, advances in antiretroviral therapy (ART) have transformed it into a manageable chronic disease. With continuous medication and medical follow-up, people living with HIV can maintain their health and life expectancy at near-normal levels [2], [3].

Despite the progress in treatment, early detection of HIV remains a critical public health challenge. This is particularly true in Japan, where the majority of new HIV infections are transmitted through sexual contact, and over 90% of newly reported cases are among men. A significant proportion of these cases involve sexual activity between men, a group that continues to face social stigma and discrimination [1], [3]. As of 2023, an estimated 39.9 million people globally are living with HIV, and the virus has caused the deaths of approximately 42.3 million individuals, making it one of the most devastating pandemics in recent history [2].

One of the primary obstacles to early HIV diagnosis is the lack of specific symptoms in the early stages of infection. Acute HIV symptoms, which may appear 2 to 4 weeks post-infection, often resemble those of common viral infections such as influenza or COVID-19. These symptoms include fever, fatigue, sore throat, rash, and lymphadenopathy. Because of their nonspecific nature, these symptoms are frequently misdiagnosed or overlooked, particularly by general practitioners unfamiliar with HIV [4]. Moreover, during the window period—typically 10 days to several weeks after infection—HIV may not be detectable in blood tests, further complicating timely diagnosis [4]. Consequently, some patients are not diagnosed until the AIDS stage, by which time significant and often irreversible damage to the immune system has occurred.

Although HIV testing is available in Japan through health insurance as well as free and anonymous testing at public health centers, social stigma and insufficient public awareness continue to hinder individuals from seeking testing. In particular, members of high-risk populations—such as men who have sex with men (MSM), sex workers, intravenous drug users, and individuals in correctional facilities—may avoid testing due to fear of discrimination or breach of privacy. Even among the general population, misinformation about HIV can result in social isolation and human rights violations upon diagnosis [3].

Given these challenges, there is an urgent need for tools that can promote self-awareness of symptoms and facilitate earlier consultation with medical professionals. Such tools must be sensitive to the privacy and psychological well-being of users, especially those in vulnerable populations.

In response, this study proposes the development of a symptom-tracking application designed to assist individuals in monitoring physical and emotional indicators that may be related to HIV infection. The application is based on validated patient-reported outcome measures, including the HIV Disability Questionnaire (HDQ) and its short-form version (SF-HDQ). These instruments assess symptoms across multiple domains—physical, cognitive, emotional, and social—and have been used in clinical environments in countries such as Canada, the United States, and Ireland [3]. In this study, we conducted interviews with medical professionals affiliated with infectious disease departments in Japan to refine the list of symptoms relevant for daily tracking. The final set of indicators includes not only physiological data such as temperature and blood pressure, but also subjective symptoms like fatigue, diarrhea, fever, and emotional distress.

By allowing individuals to systematically record their symptoms over time, this application may serve as a useful tool for both patients and clinicians. For patients, it fosters awareness and encourages early engagement with healthcare services. For clinicians, the accumulated records may offer valuable insights into symptom patterns, which can aid in differential diagnosis—particularly when HIV is not immediately suspected. Furthermore, the tool respects patient autonomy and privacy by enabling individuals to monitor their condition before deciding to seek formal medical care.

In summary, while HIV remains an incurable but treatable disease, the barriers to early detection and diagnosis continue to be substantial. This research seeks to bridge that gap by providing a practical, non-invasive, and privacy-conscious approach to symptom monitoring that aligns with the clinical needs of both healthcare providers and patients. It is hoped that such tools can complement existing diagnostic protocols and contribute to more timely and effective HIV care in real-world settings.

2. LITERATURE REVIEW

The prediction and early detection of various diseases through data analysis has become increasingly prevalent in recent medical research. With the growing availability of diverse patient data, ranging from

structured electronic medical records (EMRs) to subjective self-assessment questionnaires, researchers have sought to construct models that enhance diagnostic accuracy and clinical efficiency.

One representative study by Chen et al. explored the use of unsupervised clustering and ontology-based classification to identify Unified Diagnoses (UDs) from EMRs. By embedding structured disease ontologies into the learning process and applying multi-class classification, their model succeeded not only in specifying accurate UDs from diagnosis groups, but also in anticipating the emergence of comorbidities during hospitalization [5]. This demonstrated the potential of semantic integration in improving clinical decision support.

Building on this, Li et al. proposed a predictive framework that incorporated multimodal inputs such as vital signs, demographics, and laboratory results, in addition to standard medical codes. Their analysis found that respiratory indicators—particularly oxygen saturation and respiratory rate—were among the most influential predictors for pulmonary conditions. Through feature importance visualization, the study provided a transparent foundation for data-driven triage in emergency and outpatient settings [6].

In the context of pandemic preparedness, Braun et al. illustrated how routine clinical data can serve as an early warning system for infectious disease outbreaks. By modeling patient characteristics stored in EHRs, including body temperature, blood pressure, and symptom history, they demonstrated the feasibility of predicting COVID-19 infection trends. Their findings emphasized that widely available clinical parameters could be repurposed for public health surveillance during emergent crises [7].

Beyond physiological metrics, subjective data has also proven valuable. Kawai et al. analyzed self-reported chronic pain using standardized instruments like the MPQ and painDETECT. Through cluster analysis, they identified distinct patient subgroups based on symptom severity and emotional distress scores. This study highlighted the importance of psychosocial factors in disease classification, particularly in chronic pain populations [8].

Similarly, Zieliński et al. collected over 13,000 responses to a 134-item questionnaire from patients suspected of endometriosis. Their machine learning-based risk model revealed ovarian cysts, infertility history, and pelvic pain as key predictors. This large-scale study underscored how patient-reported outcomes (PROs) can complement clinical findings in complex, symptom-driven conditions [9].

Lastly, Sakamoto et al. explored the diagnostic utility of onomatopoeic expressions—common in patient narratives of pain—in clinical interviews. By aligning such qualitative descriptions with standardized medical evaluation scales, they managed to quantify previously vague symptom expressions, offering a novel approach to pain assessment and non-invasive triage tools [10].

3. RESEARCH METHODOLOGY

Timely identification of HIV infection remains difficult because the early clinical picture is largely indistinguishable from benign viral illnesses such as influenza or the common cold. General practitioners therefore have few objective triggers to order an HIV test, and recommending the test unprompted can inadvertently reinforce stigma among populations already subject to discrimination. At the same time, Japan's national HIV strategy calls for a tripartite focus on early detection, research and development, and strict respect for human rights.

This study responds to those policy imperatives by exploring a self-recording approach that shifts the first step of case finding away from the consulting room and into the hands of the individual. Instead of relying on episodic medical visits, our design encourages users to log day-to-day variations in symptoms—however

minor—through a lightweight mobile diary. Aggregated over time, such longitudinal data can reveal patterns that would otherwise remain invisible to physicians and patients alike, supporting earlier suspicion of HIV while preserving personal autonomy.

A. Design and Development of a Self-Monitoring Application for HIV Detection

To operationalize the self-monitoring framework proposed in this study, we developed a mobile application that allows users to record daily health indicators relevant to the early detection of HIV. Given the nonspecific and often mild nature of early HIV symptoms, the application is designed to support diagnosis by encouraging longitudinal self-recording of symptoms commonly associated with early-stage HIV infection.

The selection of items to be included in the app was informed by existing validated instruments used in HIV-related patient-reported outcome assessments. Specifically, we reviewed the HIV Disability Questionnaire (HDQ) and its condensed version, the Short-Form HIV Disability Questionnaire (SF-HDQ). The HDQ consists of 69 items categorized under six domains: Physical Domain, Cognitive Domain, Mental-Emotional Domain, Uncertainty Domain, Day-to-Day Activities Domain, and Social Domain. Recognizing that the full HDQ may be too burdensome for daily use due to its length and complexity, we adopted the SF-HDQ as the primary reference for item selection. The SF-HDQ includes 35 key items that retain high validity and clinical relevance. These 35 items are summarized in Table 1, which lists the questionnaire items categorized by domain.

Table 1: Contents of SF-HDQ

Category	**Item**
Physical Domain	Trouble Sleeping
	Fatigued
	Aches or Pains
	Headaches
	Nauseous
	Fever. Chills or Sweats
	Shortness of Breath
	Muscle Cramps
	Numb/Tingling Hands
	Feel Dizzy
Cognitive Domain	Trouble Concentrating
	Trouble Remembering
	Touble Thinking Clearly
Mental-Emotional Domain	Feel Anxious
	Feel Sad, Down, or Depa
	Afraid for my Future
	Lack Confidence Around
	Feel Lonely
Uncertainty Domain	Worry About Income and Fi
	Worry About Future Heal
	Worry About What Happy
	Worty About Side Effectd

	Worry about Lab Tecte
Day-to-Day Activities Domain	Trouble Taking Part Leis
	Unsteady on Feet
	Trouble Getting Out-Erra
	Trouble with Household
	Trouble Walking
Social Domain	Find it Hardto StartNew
	Find it Hard Take Part Leis
	Find it Hard to Ask Othe
	Tend to Isolate Self fro
	Feel Work Performance
	Struggle Maintain Housir
	Find Hard to Meet Needs

To further refine the questionnaire for our application, we conducted a multidisciplinary consultation session involving a total of seven participants: two healthcare professionals specializing in general and infectious diseases at university hospitals, and five researchers (including professors, associate professors, and graduate students) in medical informatics and digital health. This discussion lasted approximately one hour and centered around determining the most clinically relevant and ethically appropriate symptom categories for inclusion in the self-monitoring system.

The experts confirmed that both subjective symptoms (self-reported complaints) and objective physical findings (as assessed by clinicians) are critical in suspecting HIV. Among patients who were later confirmed to be HIV-positive, the following features were frequently observed at initial presentation: fever, sore throat, diarrhea, and seizures. While it was noted that the diagnostic process becomes easier if clinicians already know that a patient belongs to a high-risk group (e.g., men who have sex with men, MSM), asking about such sensitive information can be ethically problematic—especially if HIV is not strongly suspected. Thus, a key concern in the app design was to protect user privacy while still capturing indirectly informative data.

To address this, the app includes optional entries for gender, the existence of a sexual partner, and the gender of the partner, which allow for demographic inference without requiring the user to disclose sensitive information explicitly. Furthermore, the app presents users with a symptom checklist designed to capture the most indicative manifestations associated with early HIV infection. These include items covering systemic symptoms, gastrointestinal distress, and neurological conditions. The complete list of final data entry fields included in the application is shown in Table 2.

Table 2: Input Items for Daily Health Logging Application

Category	**Item**
Basic Registration Information	Prefecture of Residence
	Age
	Gender
	Presence and Gender of Partner
	Height
	Weight
	Medical History (including ongoing or past treatments)
Daily Basic Information	Body Temperature

	Pulse
	Systolic Blood Pressure
	Diastolic Blood Pressure
	Measurement Time
Subjective Physical Condition	Subjective Rating of Today's Physical Condition (Scale 1–5)
Specific Symptoms	Physical Pain, Diarrhea, Itching, Cough, Chills, Dizziness, Loss of Appetite, Other (free entry)
Pain-related Information	Location of Pain
	Onomatopoeia for Pain
	Degree of Pain
Subjective Mood	Subjective Rating of Today's Mood (Scale 1–5)
	Onomatopoeia for Feelings

This design framework, built upon the SF-HDQ, expert clinical input, and sensitivity to human rights considerations, enables respectful and effective personal health tracking for HIV-related conditions.

B. System Modification Based on the Pain Visualization and Logging Application

Building upon the findings from the previous section, we developed a daily health logging application tailored for early HIV detection. To accomplish this, we adapted the "Pain Visualization and Logging System," a pre-existing application co-developed by a private partner company in collaboration with our university laboratory. This original application is designed to regularly capture both physical and emotional health states, with particular emphasis on subjective pain descriptions using onomatopoeic expressions.

The current system allows users to input baseline information (e.g., height, weight), specify pain locations, describe pain using metaphorical and onomatopoeic expressions, and log additional health notes. It also features a visualization module that displays symptom transitions over time through graphical reports. The application interface is shown in Figure 1, which illustrates the calendar-based input, pain location selection, pain descriptor entry, and graphical symptom tracking.

Figure 1: Screenshots of the pain and mood logging application interface.

To meet the goals of this study, we introduced the following key modifications to the original system based on expert interviews at a medical university. These modifications aim to maintain user anonymity while facilitating the identification of HIV-specific health cues.

Profile Entry Screen

- Added fields to specify presence and gender of sexual partners
- Added field for past medical history (including current or completed treatment)

Daily Logging Screen

- Added a field for subjective health condition rating (1–5 scale)
- Added a field for logging concrete symptoms (e.g., fatigue, fever, sore throat)
- Added a field for subjective emotional state rating (1–5 scale)
- Added a field for entering emotional state using onomatopoeia

Report Visualization Screen

- Added graph visualization for trends in subjective health and mood
- Added numerical graphs visualizing mood transitions based on onomatopoeic descriptors

Profile Entry Screen

- Added fields to specify presence and gender of sexual partners
- Added field for past medical history (including current or completed treatment)

To implement mood and pain tracking, we incorporated systems developed by previous research and the aforementioned private company, which convert onomatopoeic expressions—like those used to describe pain or feelings—into numerical values. This allows subtle sensations to be recorded in a structured and consistent way.

In particular, our study builds on the work of Doizaki et al. [11], who investigated both Japanese onomatopoeic and metaphorical expressions commonly used to describe pain. For example, “kiri-kiri” conveys a sharp, stabbing abdominal pain, while “gan-gan” expresses a pounding or throbbing headache. In addition to such onomatopoeia, their study also examined figurative expressions like “being punched,” “being peeled,” or “being cut,” which describe pain by likening it to specific physical actions. Participants evaluated these expressions based on characteristics such as intensity, depth, and emotional impact. The quantified results enabled researchers to capture how people naturally describe pain and to convert such descriptions into structured numerical data for further analysis.

In our system, we adopt a similar method. Users can select the onomatopoeia that best matches their current physical sensations, and the system converts these expressions into numbers. These values are then visualized over time (Figure 1), helping users track changes in their physical condition more intuitively. By using familiar and expressive words, even vague or hard-to-describe symptoms can be captured, offering both individuals and clinicians a new way to monitor health.

These modifications support respectful and anonymized tracking of subjective symptoms and health indicators over time, enabling individuals to monitor their physical and emotional well-being without compromising their privacy. By accumulating such longitudinal records, the system facilitates more informed clinical decision-making, contributes to the early identification of HIV-related conditions, and offers tailored insights that can enhance personalized healthcare delivery.

Evaluation Study with Medical Professionals

To evaluate the usability and perceived effectiveness of the developed health monitoring application, a short-term user study was conducted with medical professionals. The goal was to assess whether the

proposed set of recording items—designed to support early HIV suspicion through self-tracked daily symptoms—was appropriate and practically usable. A total of **five clinicians** participated in the evaluation, including physicians affiliated with departments of general internal medicine and infectious disease at university-affiliated hospitals.

The evaluation followed a structured procedure. Participants were instructed to use the mobile application for approximately one week to enter daily records. Following the trial period, they were asked to complete a survey designed based on criteria discussed in Komori's work on healthcare app development [12]. The survey consisted of six key evaluation categories: (1) usability, (2) functionality, (3) intention for continued use, (4) changes in self-awareness regarding daily health, (5) privacy considerations, and (6) points for improvement. Each item was rated on a five-point Likert scale, and participants also provided additional comments through free-text responses. These qualitative insights were used to identify strengths and potential areas of refinement for future development. The questionnaire structure is summarized in Table 3.

This evaluation provided foundational feedback from the clinical perspective, contributing to the future implementation of self-tracking systems as a complementary tool for public health initiatives targeting early-stage infectious diseases.

Table 3: Questionnaire for Physicians

Category	Question Content
Usability	Was the operation method of the app (how to use and record) easy to understand for medical practice?
	Was the app easy to operate?
	Was the design of the app easy to view?
	Was the data input appropriate? (Please tell us if you found it cumbersome to input, etc.)
Functionality	Do you think the basic profile information is applicable to HIV diagnosis?
	Do you think physical condition records can be used for HIV diagnosis?
	Do you think records of specific subjective symptoms can be used for HIV diagnosis?
	Do you think records of specific symptoms (e.g., examples of conditions) are sufficient?
	Do you think records of pain locations and the number of pain events are applicable to HIV diagnosis?
	Do you think the patient's subjective mood information is applicable to HIV diagnosis?
	Do you think onomatopoeic expressions of pain can be used for HIV diagnosis?
	Do you think pain reports are useful for HIV diagnosis?
	Do you think reports on physical and emotional conditions are useful for HIV diagnosis?
	Do you think this app is useful for daily health management in HIV early detection?
	Do you think reviewing detailed changes in patient symptoms and emotions via the app supports early detection of HIV?
	Do you think reviewing detailed symptom changes supports HIV diagnosis?
	Do you think reviewing detailed emotional changes helps in identifying signs of HIV?
	Do you think reviewing detailed emotional changes and confirming them with patients helps deepen understanding of patient information?
	Do you think reviewing detailed emotional changes and confirming them improves app

	content?
	Do you think reviewing detailed emotional changes and confirming them helps in HIV diagnosis?
	Please indicate items that are not needed, confusing, or unnecessary.
	Please indicate if there are any necessary but missing items.
	Please tell us if there is any information you would like to record in addition.
	If the app is used to accumulate patient data, do you think this could help predict HIV infection risk?
	Do you think this app can predict disease progression?
	If creating a medical record report from this app, what data would be better recorded elsewhere?
	If there is too much data and you cannot input all, which items should be prioritized?
Willingness to Continue	Would you like to use this app for patient recordkeeping?
	Please explain the reason for your answer.
	What kind of frequency would be acceptable for usage?
	Please tell us if you ever felt inconvenience or burden in using the app.
	Would you like to use this app for patient recordkeeping in your hospital?
	Please explain the reason for your answer.
	Do you think patients would use this app?
	Please explain the reason for your answer.
Behavioral Awareness	Do you think this app can increase patient motivation for health maintenance?
	Do you think the app increases awareness of daily health behavior?
Privacy	Do you feel resistance to sharing basic records with physicians through this app?
	Do you think there is resistance when comparing or sharing personal emotional records with physicians?
Improvement Points	Please tell us if there were any concerns or points for improvement when using the app. (Open-ended question)

4. FINDINGS AND DISCUSSION

A. Evaluation Results

The results of the application evaluation by medical professionals are summarized below, based on five key dimensions: usability, functionality, willingness for continued use, impact on daily health awareness, and privacy considerations. Each item was rated on a 5-point Likert scale, with 5 indicating strong agreement and 1 indicating strong disagreement.

Usability. Physicians rated the overall usability of the application moderately. Scores for items such as ease of use and intuitive understanding of operations averaged around 3.0, with standard deviations indicating diverse opinions. In particular, the input load (i.e., the amount of data users are required to enter) was seen as neither particularly light nor overly burdensome, suggesting that interface and workflow optimizations may be needed to enhance the user experience.

Functionality. Functionality-related evaluations revealed mixed outcomes. Among the various items assessing whether specific records (e.g., basic health information, subjective symptom evaluations, and mood tracking via onomatopoeia) could support HIV diagnosis, most average scores ranged from 2.2 to 3.8. For instance, entries related to patient profiles and specific symptom tracking received relatively higher ratings (e.g., 3.4), while the usefulness of onomatopoeic expressions of pain and mood received lower scores (e.g., 1.8 and 2.2, respectively).

Willingness for Continued Use. The intention to continue using the application was relatively low. The average score for whether physicians would like to keep using the app for health tracking was 2.8, and similarly low scores were given to questions about implementing the app in clinical settings (2.4).

Impact on Daily Health Awareness. The application was rated somewhat positively in terms of raising awareness of daily health. Physicians gave relatively high scores for items evaluating whether app usage would encourage more proactive health behaviors (3.6) and increase awareness of health maintenance (3.8).

Privacy Considerations. Physicians generally did not report strong resistance to sharing app-recorded information with clinicians. The average score for discomfort in sharing data with doctors was low (1.8), indicating little concern about privacy in clinical communication. However, the perceived benefit of using the app to share information over direct communication was modest (average: 2.6), suggesting the app may not significantly reduce psychological burden for patients in discussing sensitive topics.

B. Discussion

Evaluation results from participating physicians revealed that the application's current level of clinical functionality is insufficient. One fundamental challenge lies in the nature of HIV infection itself—its early symptoms often overlap with common illnesses such as colds or gastrointestinal disturbances. As such, symptom-based screening alone is not adequate for distinguishing HIV from other conditions. This limitation underscores the difficulty of supporting HIV diagnosis solely through general symptom tracking.

Moreover, while it is well established that knowledge of a patient's sexual behavior—particularly among men who have sex with men (MSM)—is highly informative for early HIV suspicion, directly inquiring about such behavior remains sensitive and ethically complex. In clinical settings, asking about sexual history without a clear diagnostic rationale may raise concerns about patient privacy and discrimination. However, responses from physicians in this study suggest that when such information is entered via a self-administered application, patients may feel less psychological resistance than they would during direct face-to-face questioning.

Currently, the application includes only indirect indicators of sexual behavior, such as the presence and gender of partners. While these provide a degree of insight, they may be insufficient. If more direct questions are to be included in future versions, it will be essential to carefully assess how users—particularly those from marginalized communities—respond to such items. Further qualitative evaluation involving individuals who identify as MSM and who have experience with HIV testing is recommended for ethical and effective refinement of the question set.

In terms of clinical utility, physicians generally rated objective data—such as specific symptoms (e.g., fever, diarrhea, vomiting) and demographic attributes—as more useful. By contrast, subjective evaluations of mood and physical condition were perceived as less relevant for HIV diagnosis, reflecting current clinical practice where such data are rarely used in isolation for infectious disease detection. Nevertheless, the diagnostic potential of subjective health indicators remains an open question and merits future empirical investigation.

Usability evaluations among physicians indicated that the application's interface may not yet be intuitive enough for use without prior explanation. This highlights a need to further simplify the design so that users without technical experience can engage with the app independently—particularly important if the application is to be introduced into routine medical settings.

Finally, several physicians indicated that they would only consider using the app once a week rather than daily. Since the effectiveness of the application depends on the consistent logging of daily health data, new features may be needed to encourage habitual use. For instance, integrating simple task management functions—such as medication reminders or daily health goals—could incentivize users to open the application more regularly. Additionally, providing automated motivational messages (e.g., "Great job logging your week!" or "Let's keep up the progress!") may also help reinforce long-term engagement.

To improve the application's utility and usability, future iterations should not only refine the question design but also consider expanding the scope of health tracking beyond HIV-specific parameters. This broader approach may better align with user expectations and improve both adoption and adherence—while maintaining ethical sensitivity to personal information.

5. CONCLUSION AND FURTHER RESEARCH

C. Conclusion

In this study, we aimed to promote early HIV testing and diagnosis in a manner that respects human rights by developing an application for daily health record-keeping, based on medical items selected through interviews with physicians affiliated with the Department of General Medicine at Juntendo University Hospital. The selection of these items was informed by the HIV Disability Questionnaire (HDQ) and tailored to the clinical context.

A total of five medical professionals evaluated the developed application across six categories—usability, functionality, willingness to continue use, changes in health awareness, privacy considerations, and suggestions for improvement—using a 5-point Likert scale. The evaluation revealed that, in the category of functionality, most items received average ratings below 3.5, indicating that the application in its current form lacks sufficient diagnostic support capability for HIV. This is largely attributed to the absence of questions addressing key risk factors, such as MSM-related behavior and sexual activity.

However, findings also suggested that individuals may feel less resistance to disclosing sensitive information through digital platforms than during in-person consultations. This implies that the application may help facilitate communication on topics that patients typically find difficult to discuss face-to-face, such as sexual history. While the current functionality of the application is limited, these results demonstrate its potential to mitigate challenges of stigma and discrimination in HIV testing by reducing the need for direct interpersonal disclosure.

D. Future Perspectives

Although the application showed promise in terms of usability for users accustomed to digital tools, limitations remain regarding its accessibility and functionality for those less familiar with such interfaces. Two key areas of improvement have been identified:

First, the user interface should be redesigned for greater intuitiveness. During the evaluation, some users found the layout complex, likely due to insufficient instruction. To address this, the application should provide an onboarding tutorial at the initial login, including step-by-step guidance and possibly a practice entry. This would enhance users' understanding of how to interact with the system while minimizing the explanatory burden in clinical settings.

Second, the recorded items require reconsideration. The lack of direct indicators related to sexual activity—particularly those pertinent to MSM populations—was identified as a significant barrier to using the

application for HIV diagnosis support. However, given the sensitive nature of such information, strict safeguards must be implemented to protect user privacy. Prior to full deployment, both the application's architecture and its security protocols should be reviewed and tested to ensure data confidentiality.

Moreover, while subjective self-assessments of mood and physical condition were included, their clinical relevance to HIV diagnosis has not been sufficiently investigated. Future research should focus on collecting and analyzing data to determine whether these indicators could contribute meaningfully to diagnostic support.

Finally, because this study was limited to medical professionals, it will be necessary to evaluate the application with actual members of the target patient population. Such testing will facilitate refinement of the system's usability and allow for the collection of real-world health and symptom data from individuals at risk of HIV infection.

Through the incorporation of these improvements, it is expected that the application can be further developed into a practical diagnostic support tool suitable for use in clinical settings. Future research will focus on the detailed refinement of recordable items to help realize more effective support for HIV diagnosis.

ACKNOWLEDGEMENT
The present study was supported by the Ministry of Health, Labour and Welfare of Japan; Research on HIV/AIDS (Program Grant JPMH24HB1002). We thank Misaki Yokoyama for her assistance with this research.

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