ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1399

Extending The HIV Case Tracking System to Improve Accuracy, Minimize Duplicate Data, and Enhance Art Program Efficiency Across Multiple Testing Facilities in Kigali

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Publication Date: 2025/05/07

Abstract: This project aims to address the issue of false increases in the number of HIV-positive cases by expanding the HIV case monitoring system for ARV patients across multiple testing sites, improving reporting and planning capabilities. Currently, the system may mistakenly identify the same individual as a new case across different facilities due to repeated testing, leading to inflated case numbers and inefficient allocation of resources. For instance, a patient who tests positive at one medical facility is assigned to an ART treatment and social assistance. If the same person tests again at a different site, the system records them as a new case, causing discrepancies in patient tracking.

The proposed system will integrate testing sites, enabling accurate identification and centralized data sharing, thereby eliminating redundant records and ensuring better continuity of care. The study focuses on healthcare facilities in Kigali City, including Centre Hospitalier Universitaire de Kigali (CHUK), Nyacyonga Health Center, Gatenga Health Center, and Rugarama Health Center. A random sample of 400 participants, including doctors, nurses, and referred patients, was selected to provide insights into the current system's challenges. Data analysis was conducted using frequency tables and percentages.

The results highlight the need for an expanded HIV case monitoring system to support retesting across multiple facilities. After the implementation of the system, the number of individuals accurately identified across these facilities increased, ensuring each patient's data is consistently updated and tracked. For example, before the solution, patients were often duplicated across sites, with over 2,000 individuals spread across multiple facilities without clear identification. Post-implementation, each person is now accurately tracked, ensuring that resources are allocated more efficiently, and care continuity is improved.

Keywords*: ARV Program, Testing Facilities, HIV Testing and Retesting.*

How to Cite: Bigenimana Joseph; Dr. Bugingo Emmanuel; Tunezerwe Emmanuel (2025). Extending The HIV Case Tracking System to Improve Accuracy, Minimize Duplicate Data, and Enhance Art Program Efficiency Across Multiple Testing Facilities in Kigali. *International Journal of Innovative Science and Research Technology*, 10(4), 2648-2663 https://doi.org/10.38124/ijisrt/25apr1399

I. INTRODUCTION

This study provides a foundational overview, setting the stage for the investigation of the challenges surrounding HIV case tracking in Kigali City's healthcare system. The study aims to address the existing inefficiencies and issues related to the tracking of ARV patients across multiple medical facilities. By focusing on the integration and expansion of the HIV case tracking system, the research aims to enhance data accuracy, continuity of care, and reporting capabilities. The statement of the problem identifies the issues of redundant records, fragmented patient histories, and inefficient retesting processes, which undermine the overall effectiveness of HIV care management. The research objectives aim to create a unified platform for patient tracking that improves data sharing between health facilities. Corresponding research questions will guide the investigation into how a more efficient case tracking system can be implemented. The hypothesis predicts that a centralized tracking system will significantly reduce data redundancy and improve treatment continuity. The scope of the study encompasses healthcare facilities in Kigali City, focusing on the challenges faced by doctors, nurses, and patients in the current system. Lastly, the significance of the research lies in its potential to inform policy changes and improve healthcare outcomes for ARV patients, ultimately contributing to better HIV care management across Rwanda.

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➢ *Statement of the Problem*

This study aims to address the challenges in HIV case tracking within Kigali City's healthcare system, focusing on the inefficiencies in monitoring ARV patients across multiple medical facilities. The primary goal is to develop an integrated tracking system that enhances data accuracy, continuity of care, and reporting capabilities. The study identifies key issues such as redundant records, fragmented patient histories, and inefficient retesting processes that hinder effective HIV care management. The research objectives include creating a unified platform to improve data sharing among health facilities. Research questions will explore the feasibility and impact of such a system. The hypothesis suggests that a centralized tracking system will reduce data duplication and improve patient care continuity. The scope of the study is limited to healthcare facilities in Kigali, examining the experiences of doctors, nurses, and patients with the current system. This research is significant as it aims to inform policy improvements and enhance HIV care management across Rwanda, ultimately leading to better healthcare outcomes for ARV patients.

II. LITERATURE REVIEW

This literature review explores existing studies, concepts, and theoretical frameworks on enhancing HIV case tracking systems, with particular focus on Antiretroviral Therapy (ART) patients and retesting across multiple healthcare facilities. The goal is to address challenges such as fragmented patient records, missed follow-ups, and duplicated testing. By evaluating past studies and models, this review builds the foundation for improving system integration, accuracy, and patient outcomes.

➢ *Key Concepts*

- *Extending Capability:*

The term "extending" refers to improving or augmenting existing systems to enhance performance, utility, and efficiency. In this context, it involves expanding the capability of HIV tracking systems through technological and operational innovations.

- *HIV Case Tracking:*

This is the systematic collection, processing, and sharing of patient data for those diagnosed with HIV. It supports real-time monitoring, resource allocation, and outcome measurement. Accurate tracking is essential for ensuring continuity of care and evaluating program effectiveness.

- *ARV Patients:*

ARV patients are individuals undergoing Antiretroviral Therapy to manage HIV. Maintaining consistent treatment and monitoring their progress are crucial for preventing drug resistance and improving quality of life.

- *Testing Facilities:*

Testing facilities are locations equipped to diagnose HIV and monitor patient health. Disparities in data management across facilities can hinder effective tracking, especially when patients retest at different sites.

- *Retesting:*

Retesting ensures the accuracy of initial HIV results, detects early-stage infections during the window period, and addresses ongoing risk exposures. However, uncoordinated retesting across multiple sites may result in duplicated entries and unreliable data.

➢ *Theoretical Frameworks*

- Antiretroviral Therapy (ART)

ART remains a cornerstone of HIV care, using a combination of drugs to suppress viral load and boost immunity. Early initiation and sustained adherence significantly reduce HIV transmission and improve life expectancy. The "Undetectable = Untransmittable" (U=U) concept emphasizes the benefits of viral suppression.

- *HIV Testing Methodologies*

Traditional and modern testing methods include ELISA, Western Blot, rapid tests, and self-testing kits. Rapid and non-invasive testing, in particular, enhances accessibility in low-resource and emergency settings. Combining various testing strategies ensures both early detection and accurate diagnosis.

- *HIV Retesting Theories*

Several models inform retesting practices:

✓ **Confirmatory Testing Theory** emphasizes diagnostic accuracy through multiple tests.
✓ **Window Period Theory** addresses the latency between exposure and detectable antibodies.
✓ **Behavioral Risk Theory** promotes routine retesting for high-risk populations to prevent missed infections.

- *Health Belief Model (HBM):*

This model suggests that individuals are more likely to engage in retesting if they perceive a high risk of infection and believe in the benefits of early detection, despite potential barriers like stigma or access issues.

- *Theory of Planned Behavior (TPB)*

Behavioral intent to retest is influenced by attitudes toward testing, social pressures, and perceived control over one's ability to access services.

- *Social Ecological Model (SEM)*

SEM considers individual, interpersonal, organizational, and societal factors that influence retesting. For instance, stigma, healthcare infrastructure, and policy all impact patient behavior.

- *Diffusion of Innovations Theory*

This theory explains how new practices, such as home testing kits or digital reminders, spread within communities based on perceived advantages and compatibility with existing systems.

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- *Social Cognitive Theory (SCT)*

SCT focuses on how self-efficacy, education, and role modeling encourage patients to retest and maintain ART adherence.

➢ *Empirical Review*

Two empirical studies demonstrate real-world applications of HIV case tracking improvements.

- *Remote Sensing of HIV Care Programs (Morrow et al., 2022)*

This South African study used centralized laboratory data to assess ART program performance at the population level. It illustrated how remote sensing techniques, common in agriculture and geography, could be applied to health data monitoring. The system reduced dependency on patient-level records while maintaining data accuracy, scalability, and cost-effectiveness.

- *Patient Tracing Program in Trinidad (Edwards et al., 2021)*

This study examined a program that tracked and re-engaged patients who had defaulted from HIV care. Out of 2,212 lost-to-follow-up patients, 1,869 (84.5%) were successfully contacted and returned to care. Tracers educated patients about ART benefits, helped overcome barriers, and achieved viral suppression in 77.6% of cases after one year. This intervention highlighted the importance of human interaction in case management and the need for differentiated care strategies.

Additional studies from Malawi, Zambia, and Uganda confirmed varying degrees of success in patient tracing. Common challenges included patients' unawareness of treatment benefits, logistical constraints, and health system limitations. Nonetheless, consistent themes showed that integrated tracing and follow-up can significantly improve ART adherence and viral suppression.

III. ILLUSTRATION OF THE CONCEPTUAL FRAMEWORK

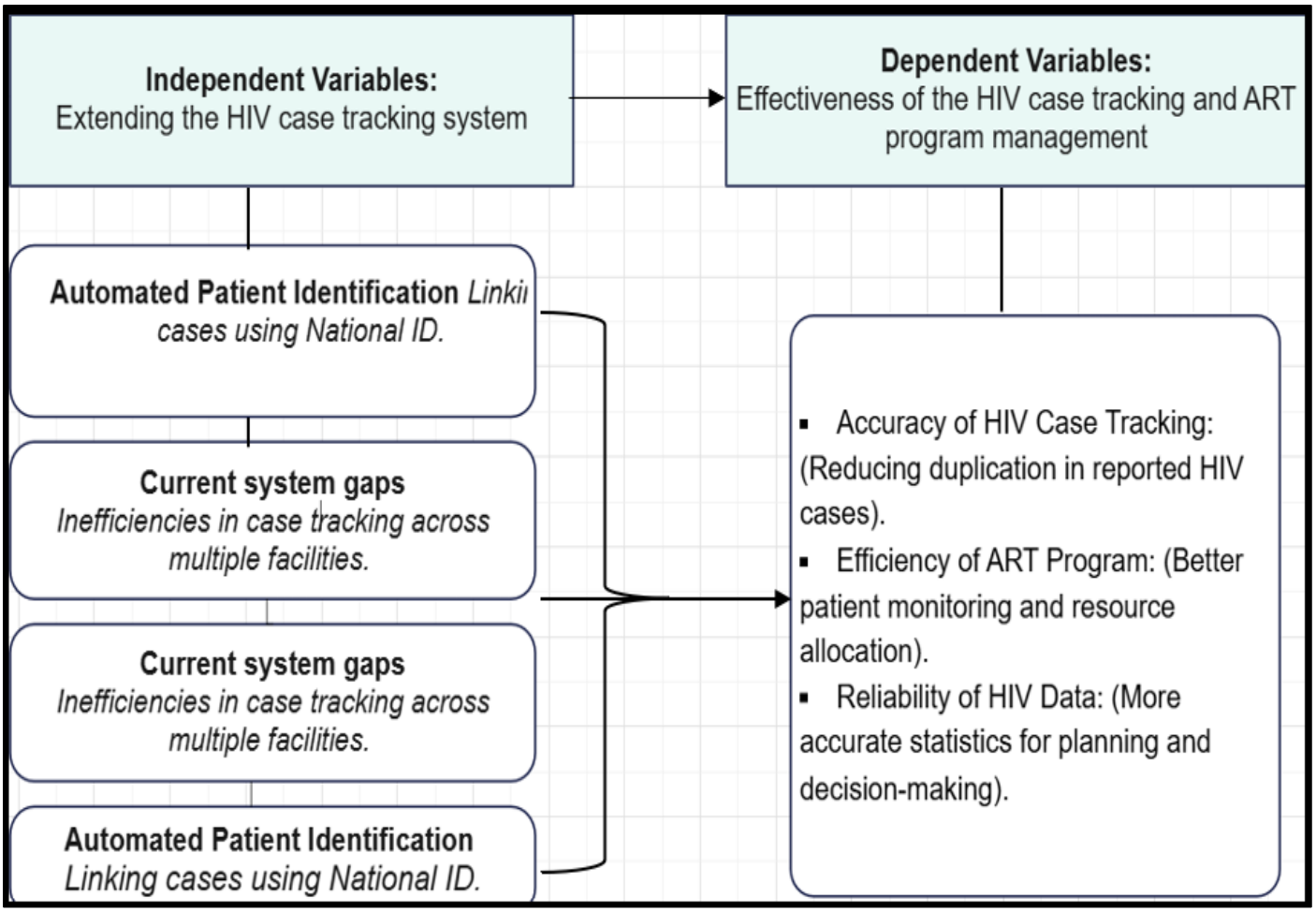

Fig 1 Conceptual Framework

➢ *Existing Prototype System*

The Rwanda Biomedical Center (RBC) presents a substantial barrier to the effectiveness of current case tracking systems, despite significant breakthroughs in HIV testing and treatment. One significant worry is that those who test positive for HIV may choose to get tested again at various locations in an attempt to get a false negative result. The accuracy and dependability of HIV case tracking systems are compromised by this practice, which is frequently motivated by stigma, fear, or a desire to hide one's HIV status. As a result, it significantly reduces the overall efficacy of public health measures. The occurrence of individuals retesting at

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1399

several facilities poses a risk of underreporting actual HIV prevalence rates, thereby impeding health authorities' capacity to effectively allocate resources, execute focused interventions, and furnish sufficient support to those requiring it. The success of antiretroviral (ARV) treatment programs and larger initiatives to stop the spread of HIV are eventually impacted by the possibility of false-negative results, which also jeopardizes the accuracy of data used to make decisions.

- *The Flowchart Likely Visualizes the Challenges in The Current System by Showing the Sequence of Problems and Their Consequences:*

- Lack of cross-facility tracking.
- Duplicate testing & inflated case statistics.
- Limited interoperability in Database Management Systems (DBMS).
- Inaccurate Reporting & Policy Implications

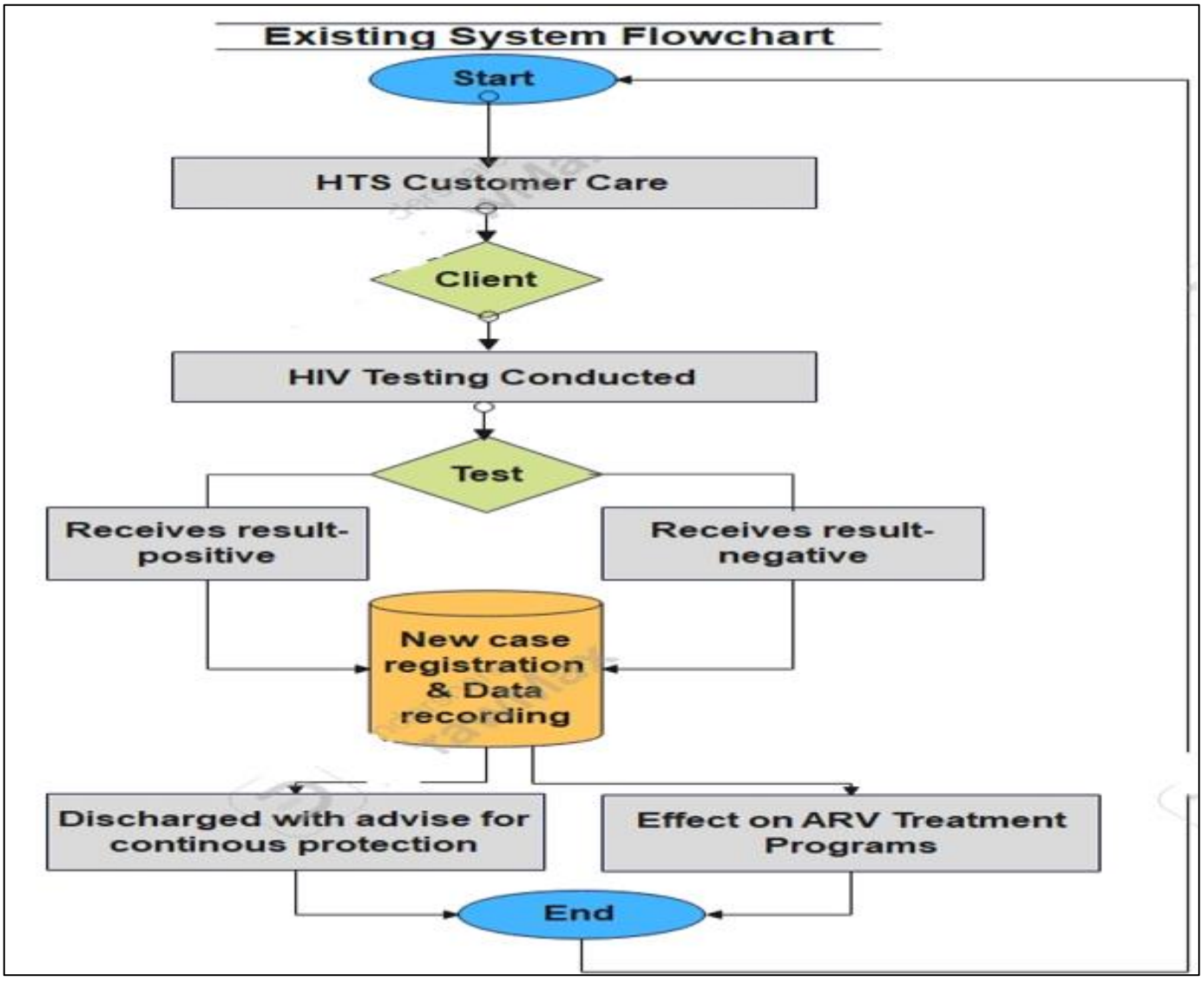

Fig 2 Existing System

- *Proposed System*

Generally speaking, this system will assist the Ministry of Health in tracking and precisely calculating the number of HIV-positive individuals, which will be useful in the design of medical services, medication, and infrastructure. The issue at hand is that the system may designate the same individual as a beneficiary at many health facility sites due to aid provided to AIDS patients. A patient began a program that included ART and some social assistance after testing positive at one medical institution center. The amount for the same person increases if they move, round a corner, and get tested again because the system records a new infection.

Health care providers can obtain information about AIDS infection through this system, which will make a person's national identification number their ID or citizen ID number for those without one. It also prevents the incorrect counting of infected individuals due to patients who retest positive elsewhere. As a result, the nurse will examine and accept the patient. Following the examination, the nurse will record, but the head of the medical facility must authorize it. Next, the patient's data is stored in the system using a unique

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1399

ID, such as their citizen or national ID number. In the event that the patient is examined somewhere else, they will be required to provide their national ID number. The system will indicate if this is the patient's first examination or, in the event that it is not, the current record (status) will be displayed. The patient will undergo the standard examination, and the results will be validated and updated (positive to positive or negative to negative). Should the results turn out to be positive, however, the system will automatically generate the new tracnet number (auto increment) of seropositive patients.

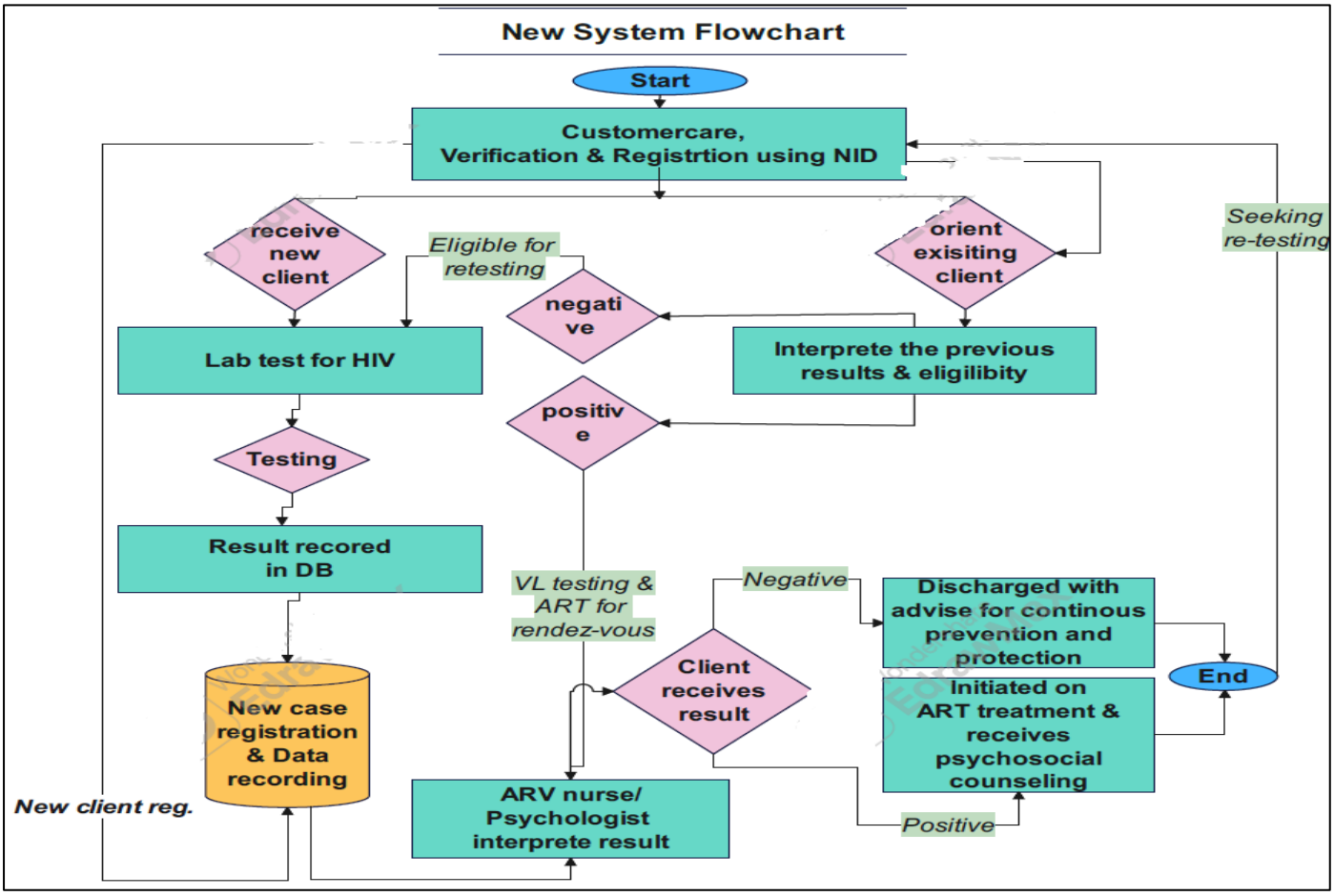

Fig 3 New System Flowchart

➢ *The New System Resolves the inefficiencies of the Old System by Centralizing Patient Data Management and Enhancing Data Security and Accuracy:*

- Each patient is assigned a unique identifier to prevent duplicate records. If a patient has already been registered, their existing record is retrieved.
- The system updates patient records across all facilities instantly. Alerts are generated if a patient has already been tested recently, preventing unnecessary re-testing.
- Only authorized personnel can access and modify patient data based on their roles (e.g., admins, doctors, lab technicians, nurses, psychologists and patients).
- The system generates real-time reports for policymakers, ensuring accurate case statistics and resource allocation. Data analytics tools identify trends and patterns for improved decision-making.

IV. RESEARCH METHODOLOGY

This study aims to explore the relationship between the predictor variables (independent variables) and the criterion variable (dependent variable) in the context of HIV case tracking. A comparative study approach is employed to collect data that assesses the current state of HIV case tracking, specifically expanding its capacity for ARV patients across multiple testing facilities for retesting. This approach is deemed appropriate to address the study's focus on improving HIV case management.

➢ *Research Design*

Research design refers to the strategic plan outlining how data will be gathered, analyzed, and interpreted to address research questions. To investigate the expansion of HIV case tracking for ARV patients across various testing facilities, this study adopts a **descriptive** and **correlation research design**. According to Hardt (2021), this combination of designs is suitable as it allows for the identification of characteristics within the population while also evaluating the relationships between key variables, such as system capacity and patient outcomes.

➢ *Study Population*

The study population includes all individuals directly involved in HIV care programs across health service locations in Kigali City, which has a population of 1250

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1399

people. The participants include patients, doctors, and nurses working at various health facilities. The population covers hospitals and health centers within the three districts of Kigali: Gasabo, Kicukiro, and Nyarugenge, as listed in Table 3.1.

➢ *Health Facilities In Kigali City:*

The public health facilities are distributed as follows:

- Gasabo District: Kibagabaga Hospital, King Faisal Hospital, Kacyiru Hospital
- Kicukiro District: Masaka Hospital, Gahanga Health Center, Kanombe Health Center
- Nyarugenge District: Centre Hospitalier Universitaire de Kigali (CHUK), Nyarugenge District Hospital, Muhima Hospital

These facilities ensure comprehensive healthcare coverage across Kigali City.

➢ *Sampling*

Sampling refers to selecting a representative group from the population. Since studying the entire population is impractical, a **random sampling technique** will be employed, ensuring the sample accurately reflects the larger population. Slovin's formula (1985) is applied to determine the appropriate sample size for this study.

The sample size is calculated as follows:

n=N1+Ne2n = \frac{N}{1 + Ne^2}n=1+Ne2N

Where:

- nnn is the number of samples
- NNN is the total population
- eee is the error margin (5%)

With 95% confidence and a margin of error of 5%, the calculated sample size is **303** respondents

Table 1 The sample distribution by district and professional category is as follows:

Location	Doctors	Nurses	Patients	Total
Gasabo	3	5	48	56
Kicukiro	3	10	97	110
Nyarugenge	4	12	121	137
Total	**10**	**27**	**266**	**303**

This ensures a proportionate and representative sample of doctors, nurses, and patients involved in HIV care programs.

➢ *Data Collection Methods and Instruments*

Data collection involves gathering relevant information to answer research questions. For this study, both **primary and secondary data** will be collected. The main tools for data collection are:

- *Questionnaires:*

Self-administered surveys for participants, designed to gather both qualitative and quantitative data.

- *Interviews:*

Semi-structured interviews for additional insights into healthcare practices and patient experiences.

- *Secondary Data:*

Existing records and reports on the state of HIV care and case tracking from health facilities.

Google Collaboratory and Python will be used for data processing, offering a cloud-based platform for collaborative work on data analysis (Walliman, 2011). **Convenience sampling** will be utilized, where participants are selected based on availability and willingness to participate.

➢ *Data Processing*

Data processing will involve the organization and preparation of data for analysis. Researchers will ensure that self-administered questionnaires are collected from respondents at the selected health facilities: CHUK, Nyacyonga Health Center, Gatenga Health Center, and Rugarama Health Center. Additionally, journals and other relevant secondary data will be reviewed to contextualize the findings and improve the accuracy of case tracking assessments.

➢ *Data Analysis*

Both **qualitative and quantitative analysis** will be conducted to comprehensively analyze the data:

- *Quantitative Data:*

Statistical tools such as SPSS or Excel will be used to analyze numerical data, including retesting rates and performance metrics. This will allow for the identification of patterns and correlations between testing procedures and case tracking efficiency.

- *Qualitative Data:*

Thematic analysis will be used to examine non-numerical data from interviews, focusing on underlying behaviors, attitudes toward retesting, and system inefficiencies.

Results will be cross-analysed across different healthcare facilities to identify variations in case tracking processes and propose an improved model.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1399

➢ *Limitations*

The primary limitation of this study is the restricted scope due to time constraints, which limits data collection to only three districts within Kigali City. A wider study encompassing all HIV testing facilities in Rwanda would offer more generalizable findings.

➢ *Ethical Considerations*

Ethical guidelines will be adhered to throughout the research process to protect participants' privacy and data. The study will ensure that all respondents' identities are confidential and that their participation is voluntary. No respondent will be judged or penalized based on their responses. The research will follow ethical standards of integrity, transparency, and respect for participants (Cohen, 2017).

V. PRESENTATION AND ANALYSIS OF RESEARCH FINDINGS

The research on the creation and deployment of an expanded HIV case tracking system intended to track ARV patients across several testing facilities in Kigali City is presented, examined, and interpreted in this chapter. From the initial system design, data collecting, and system modeling to the final deployment and testing, it offers a thorough explanation of the technologies, approaches, and techniques employed throughout the system development process. In order to guarantee that the system is secure, interoperable, and able to synchronize patient data across several health centers, suitable database technologies, programming languages, and frameworks have been chosen.

The architectural choices chosen to guarantee that the system efficiently supports correct reporting, the avoidance of duplicate records, and real-time patient tracking across CHUK, Nyacyonga Health Center, Gatenga Health Center, and Rugarama Health Center are also covered in length in this chapter. In order to improve clarity, this part illustrates the system's functionality and impact using frequency tables, system interface images, data visualizations, and pertinent case studies where needed. The research findings are analyzed and evaluated in accordance with the particular goals that motivated this investigation.

➢ *The Objectives were:*

- To evaluate the impact of retesting practices on the accuracy and reliability of HIV case tracking systems.
- Examine existing gaps and inefficiencies in the current HIV case tracking system across multiple facilities.
- Develop a prototype to improve the accuracy and integration of HIV case tracking for ARV patients.

➢ *Analysis of the existing system*

Despite major advancements in HIV testing and treatment, the Rwanda Biomedical Center (RBC) poses a significant obstacle to the efficacy of current case monitoring methods. The possibility that people who test positive for HIV might decide to get tested again at different places in an effort to obtain a fake negative result is a serious concern. This conduct, often driven by stigma, fear, or a desire to conceal one's HIV status, undermines the reliability and accuracy of HIV case tracking systems. Consequently, it considerably diminishes the overall effectiveness of public health campaigns (RBC, 2022). Because HIV prevalence rates vary, the practice of retesting at many institutions increases the risk of underreporting. As a result, health officials find it more challenging to deploy resources efficiently, implement targeted interventions, and provide enough aid to individuals in need. The potential for false-negative results ultimately affects the effectiveness of antiretroviral (ARV) treatment programs and broader efforts to prevent the spread of HIV, and it also compromises the reliability of data used for decision-making.

➢ *Modeling of the existing System*

It is possible to describe the current approach for monitoring HIV cases among ARV patients as a disjointed procedure with separate steps at each medical facility. The process begins when a patient gets tested for HIV at a facility and their data is manually entered into the local database. The system creates duplicate data if a patient transfers to a different facility for retesting since they are treated as a new case. Independent data management by each facility causes errors in reports at the national level. In order to review and consolidate data without cross-referencing patient histories across facilities, health personnel manually generate and submit monthly case reports to central authorities.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1399

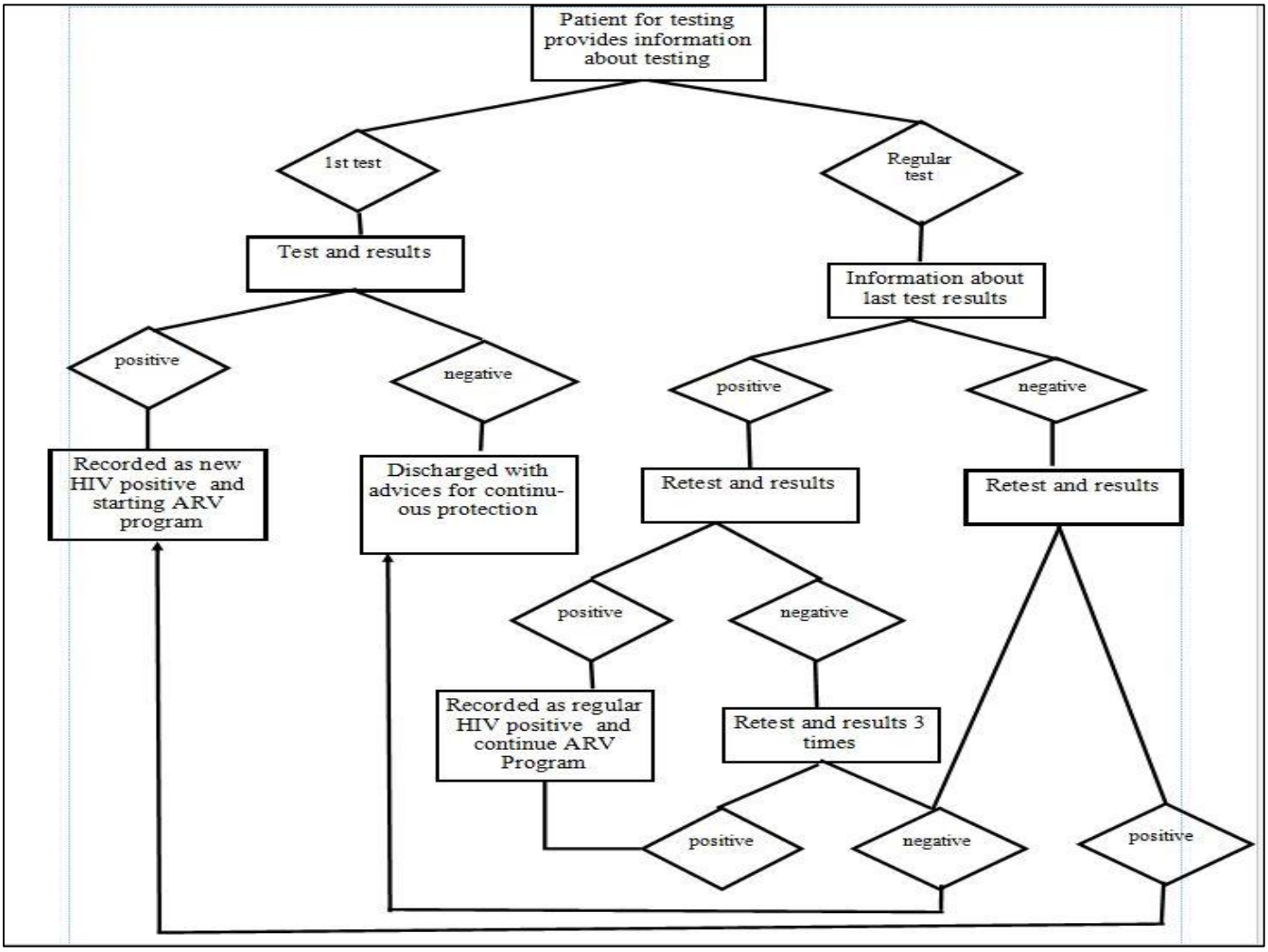

Fig 4 Activity Diagram of Existing System

➢ *Proposed Solutions*

The goal of the proposed expanded HIV case tracking system is to create a unified, patient-centered platform to address inefficiencies in the current system across Kigali's medical facilities. This system aims to improve accurate reporting, eliminate duplicate records, and ensure continuity of care for patients who transfer between testing locations. Key features of the solution include:

➢ *Patient Identification and Unified Records*

Unique patient identifiers will link test histories across participating facilities, ensuring a single patient is not mistakenly recorded multiple times across different centers.

➢ *Multi-Facility Case Tracking and Seamless Data Sharing*

The system will connect all HIV testing and ARV distribution centers, centralizing records like social assistance, counseling reports, prescriptions, and test results, making them accessible to authorized healthcare professionals at different locations.

➢ *Real-Time Notifications and Alerts*

When a patient retests at a different facility, the system will alert healthcare professionals in real-time, ensuring appropriate care and preventing redundant prescriptions.

➢ *Decision Support and Case Management*

The system will offer decision support tools to assist healthcare providers in giving consistent care based on previous test results and treatment history.

➢ *Integrated Counseling and Support*

Counselors and psychologists will have access to patient records and will document therapy sessions, ensuring continuous mental health support throughout the treatment process.

➢ *Patient Portal for Transparency*

Patients will be able to access their test results, ARV status, and appointment schedules via a self-service portal, promoting adherence to treatment and reducing care interruptions.

➢ *Data Analytics for Reporting*

The system will provide real-time data on treatment adherence, retesting frequencies, and patient movement patterns, supporting more accurate reporting for public health officials.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1399

➢ *Compliance and Data Security*

Strong encryption, role-based access, and audit trails will ensure the protection of patient data, while compliance with national health regulations will be maintained.

➢ *Cost Efficiency*

By automating case tracking, merging patient records, and generating cross-facility alerts, the system will reduce administrative overhead and optimize resources.

➢ *System Requirements and Design*

The system will address the issue of duplicate patient records by using a centralized database connected to national IDs. It will feature biometric authentication, real-time updates, and automatic duplicate detection. A three-tier architecture will be implemented:

- Data Collection Layer – For entering test results and registering patients.
- Processing Layer – To detect duplicates and verify identities.
- Decision Support Layer – For generating reports and tracking patterns.

The system will be developed using an **Agile methodology** (Scrum), allowing iterative testing and regular stakeholder feedback to ensure accuracy and system efficiency.

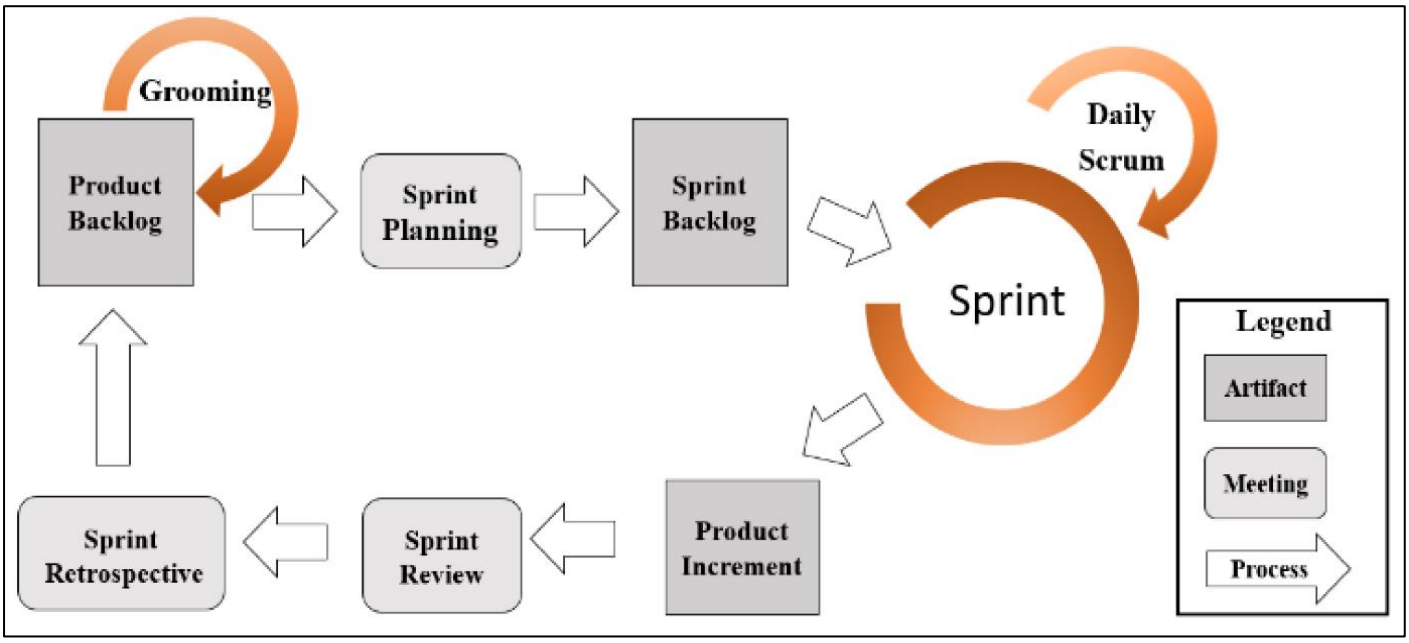

Fig 5 Agile Methodology, the Scrum Framework
Source: Scrum.org

➢ *Data Dictionary*

A data dictionary is a structured text that guarantees accuracy, consistency, and clarity by defining and describing the data items in a system. It contains information about permitted values, formats, data types, field names, and the connections between data points. With the aid of this reference manual, developers and users may better comprehend, handle, and preserve data across databases and applications.

➢ LAB (Lab Technicians)

The LAB table contains data about the lab technicians who do medical analysis and tests. Information like the technician's name, ID, credentials, lab assignment, and contact information are all included. While preserving accuracy and accountability in laboratory operations, this table facilitates communication between technicians, patients, and healthcare providers.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1399

Table 2 LAB (Lab Technicians)

Attribute Name	Data Type	Description
Lab_ID	INT (Primary Key)	Unique identifier for each lab record
Technician_Name	VARCHAR	Name of the lab technician
Test_ID	INT (Foreign Key)	Links to the HIV test records
Facility_Name	VARCHAR	Name of the testing facility
Date_Processed	DATE	Date the test was processed
Test_Result	VARCHAR	Result of the HIV test (Positive/Negative)

Source: Database

➢ *COUNSELLING (Counselling Information)*

The COUNSELLING table contains information about healthcare counseling sessions, including patient counseling and psychological support. It keeps track of patient IDs, session dates, counselor information, session notes, and results. Because all interactions are recorded for continuity and efficient mental health treatment, this organized data helps to improve patient Care.

Table 3 Counselling (Counselling Information)

Attribute Name	Data Type	Description
Counselling_ID	INT (Primary Key)	Unique identifier for each counselling session
Patient_ID	INT (Foreign Key)	Links to the patient record
Counsellor_Name	VARCHAR	Name of the assigned counsellor
Session_Date	DATE	Date of the counselling session
Session_Notes	TEXT	Notes and observations from the session
Follow_Up_Required	BOOLEAN	Indicates whether follow-up is needed

Source: Database

➢ *Patient Dashboard*

Once logged in, patients land on their personalized dashboard, showing their **profile details**, latest test results, appointment reminders, and health facility history. The dashboard acts as a central hub where patients can also **view their test results** and access **counseling support** if needed. It ensures patients can follow up on their HIV status conveniently across testing centers.

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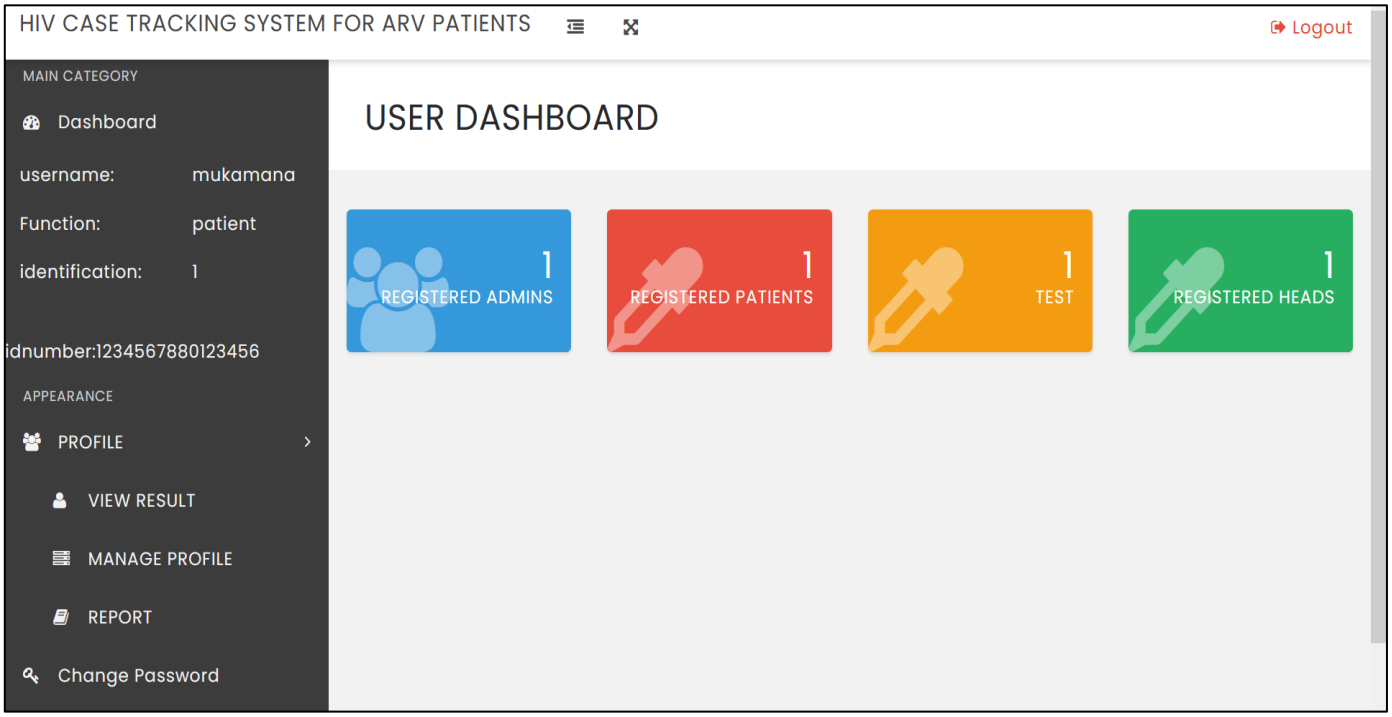

Fig 6 Patient Dashboard

➢ *Patient View Result*

This screen allows the patient to access their HIV test results after visiting a health center. It lists test dates, **facility names**, and corresponding results—whether **positive**, **negative**, or **inconclusive**. This transparency helps avoid double-counting, as patients can verify all previously recorded tests across different locations directly in their account.

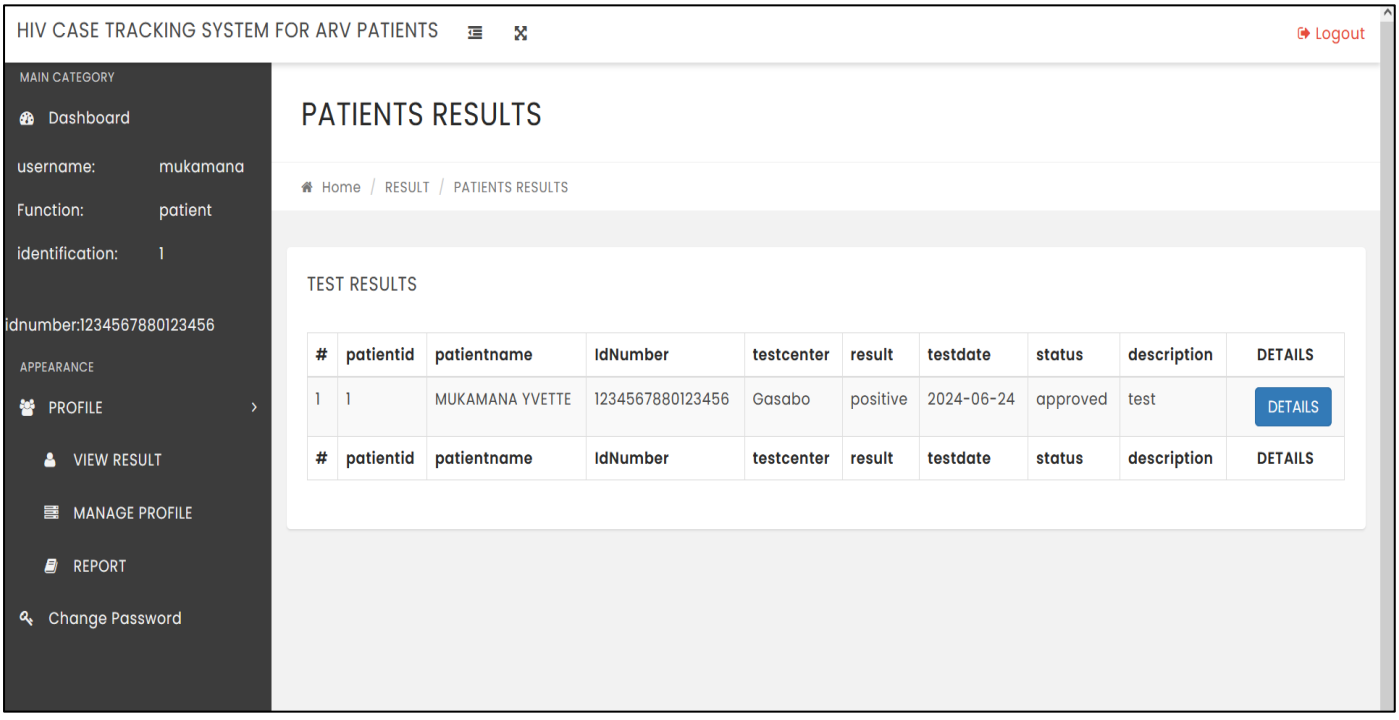

Fig 7 Patient View Result

➢ *Test Result*

The test result page provides **detailed lab results** for each test entry. It includes the test date, patient ID, facility, type of test conducted, and final result. It also highlights **ARV prescription status** and links to **counseling services** if the result is positive. This ensures consistent follow-up and accurate data tracking across Kigali's testing centers.

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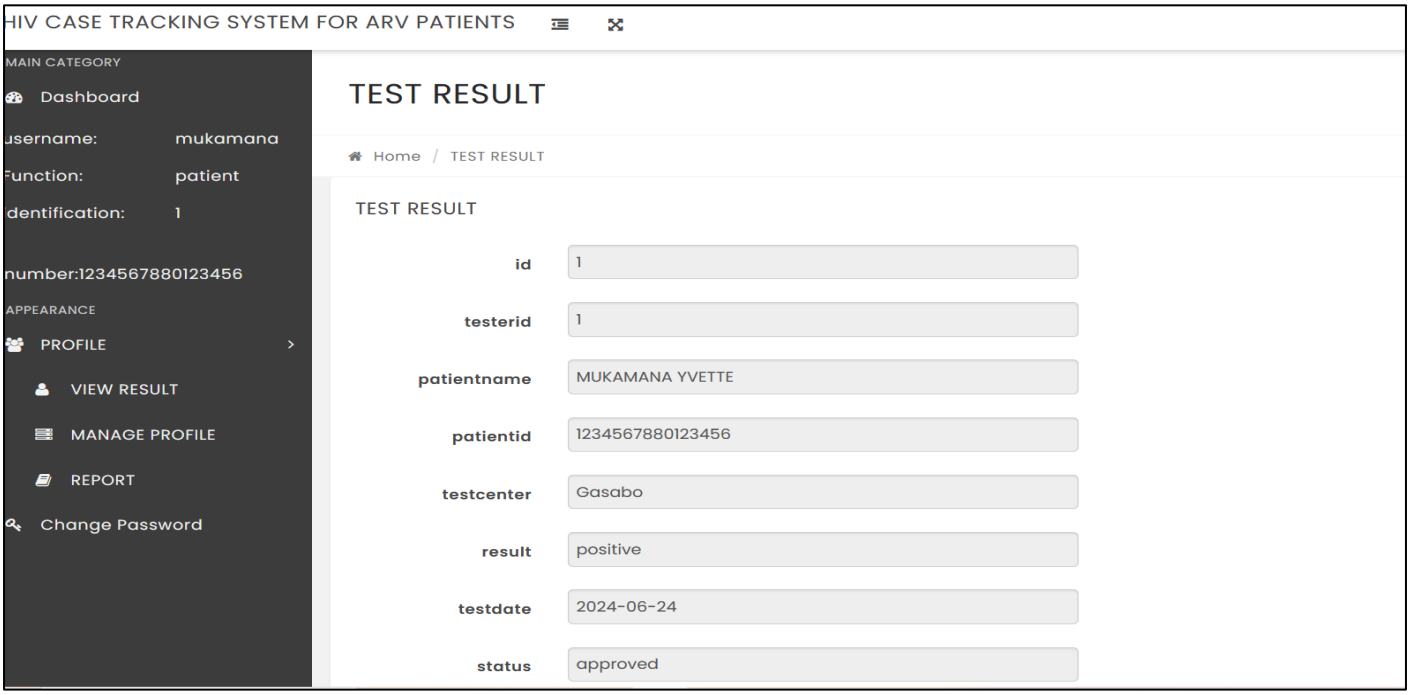

Fig 8 Test Result

➢ *Customer Care Dashboard*

The customer care dashboard is the central control panel for system staff who manage patient records. From this screen, staff can **add new patients**, **review and update test results**, **resolve patient inquiries**, and **monitor patient movements** across facilities. It helps customer care teams ensure accurate reporting and avoid duplication when patients test at different centers.

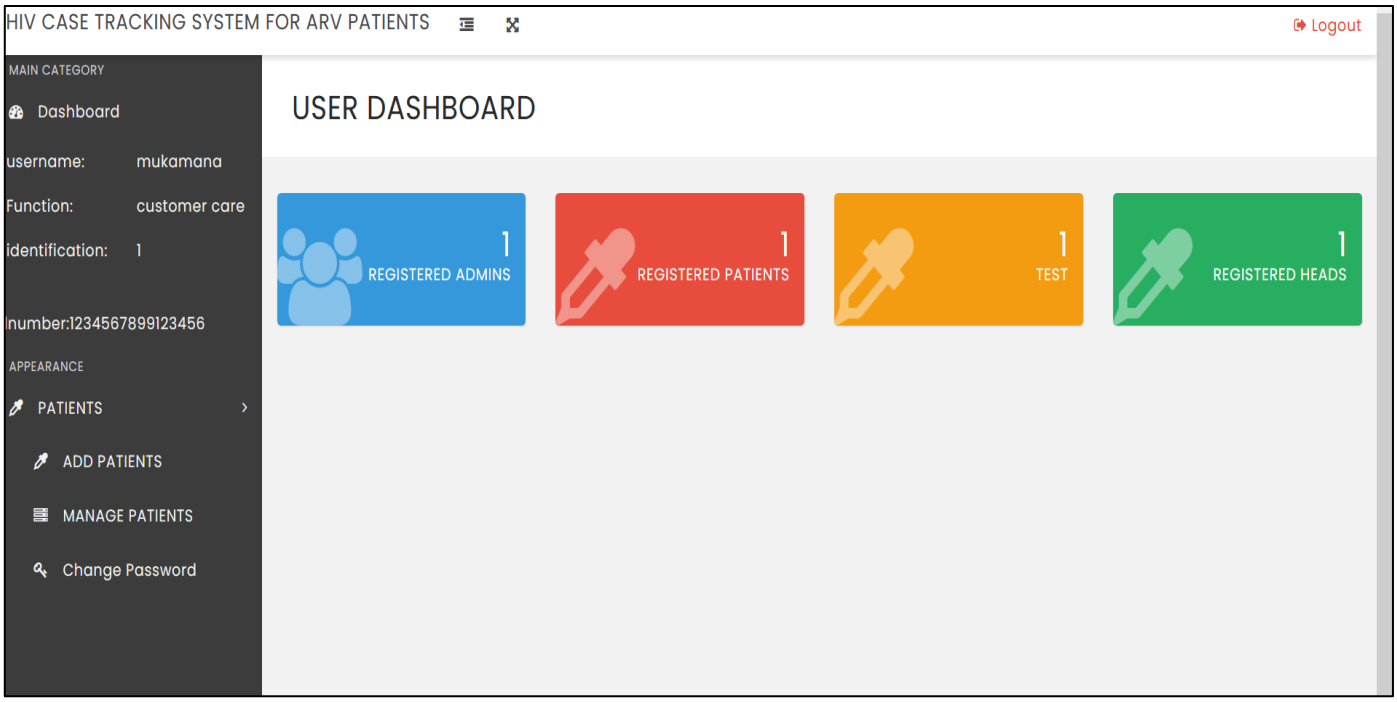

Fig 9 *Customer Care* Dashboard

➢ *Add Patient (by Customer Care)*

This page allows customer care staff to manually register a patient who visits a health facility directly, without prior system signup. It captures **personal details**, initial **test information**, and any **social support provided**. This ensures that the system tracks all individuals, including those unfamiliar with digital systems, avoiding duplication by checking existing records during registration.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1399

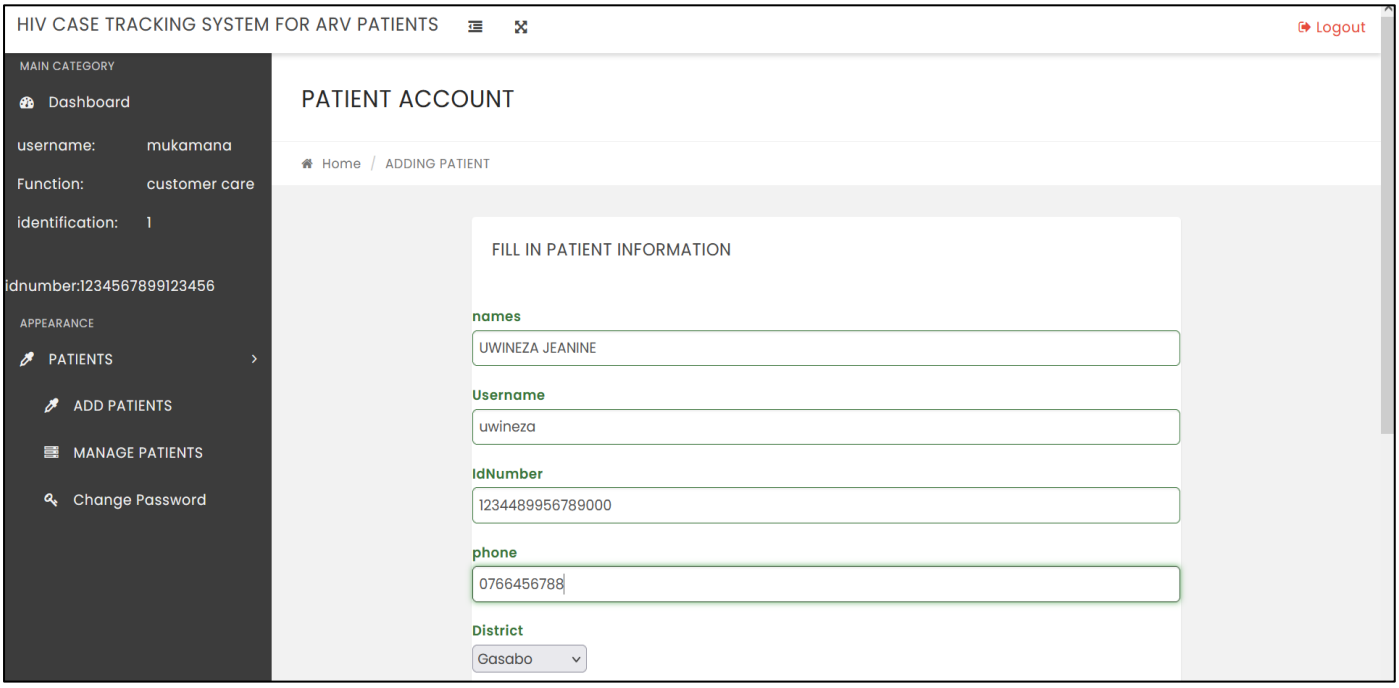

Fig 10 Creation of Patient Account

➢ *Manage Patients*

The manage patients screen displays a **complete list of all registered patients** across health facilities. Staff can search, view, update, or deactivate profiles if needed. Each record includes **name, unique ID, facility history, test results, and ARV treatment progress**. This page is critical for ensuring accurate, real-time updates for multi-facility HIV case tracking.

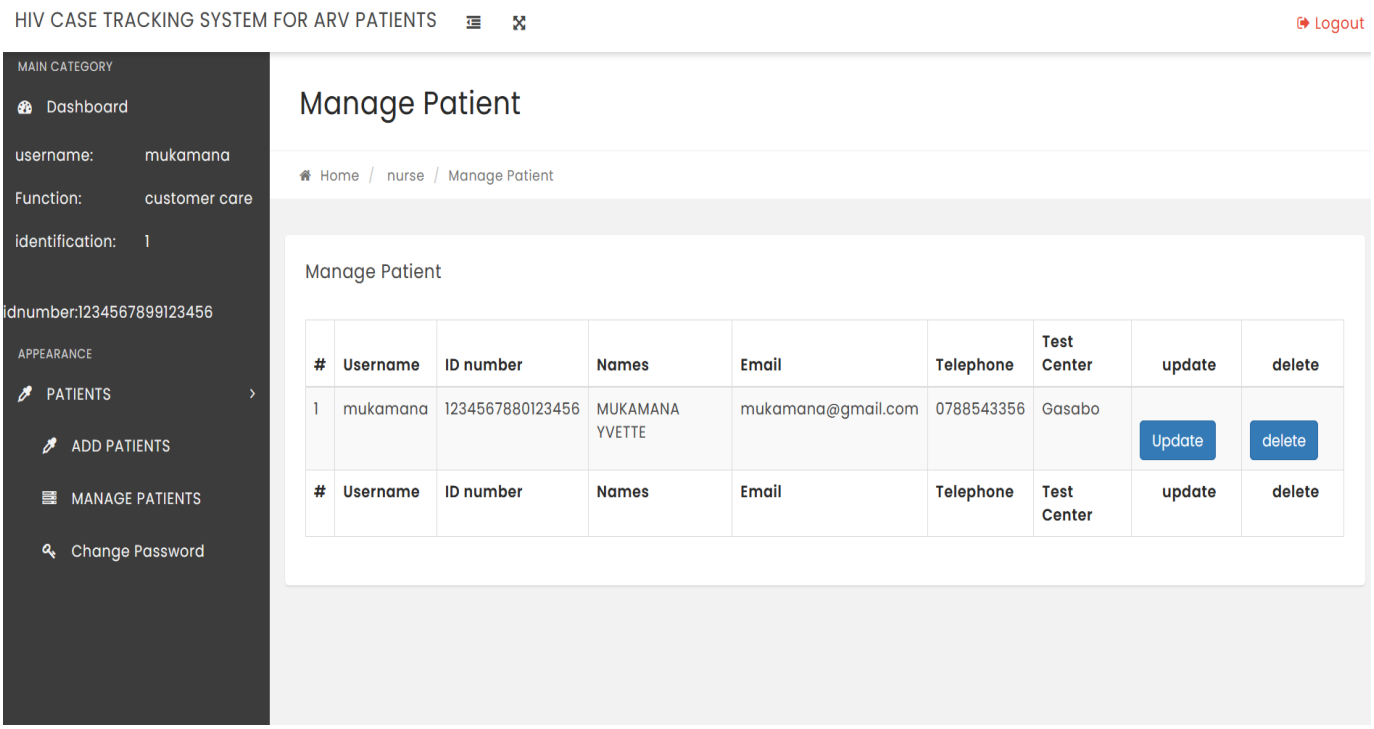

Fig 11 Manage Patient

➢ *Change Password*

The change password page allows logged-in users to update their password for **security** purposes. It requires users to enter their **current password**, followed by a **new password**, and then confirms it. This helps ensure user accounts remain secure, especially for sensitive patient data or privileged staff dashboards handling confidential case files.

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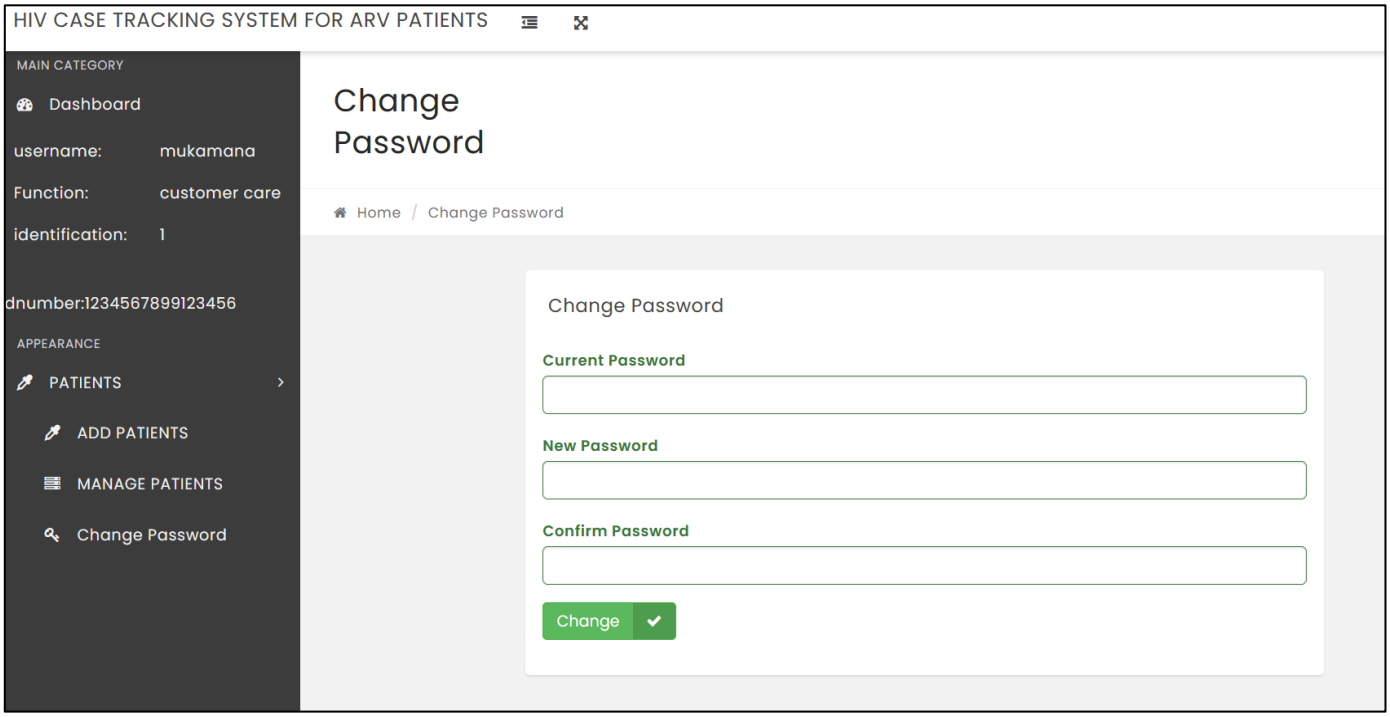

Fig 12 Password Change

➢ *Forgot Password*

This page helps users who have forgotten their login credentials regain access to the system. Users enter their **registered email or phone number** and receive a **reset link or code** to create a new password. This ensures all authorized users, especially patients, can always retrieve their data, promoting continued follow-up on treatment.

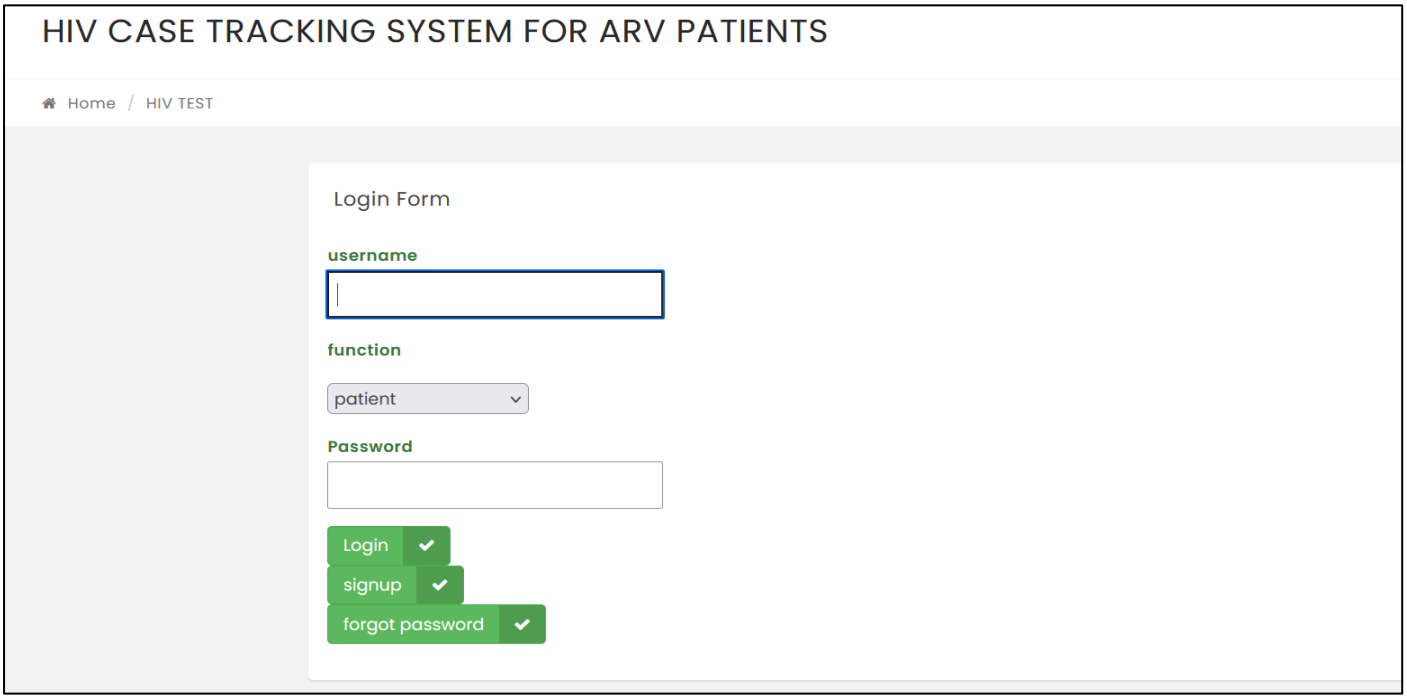

Fig13 HIV Case Tracking System for ARV Patient

➢ Psychologist Dashboard

The psychologist dashboard focuses on the **counseling and mental health support** side of HIV case tracking. Psychologists can **view assigned patients**, log **counseling sessions**, and update **mental health progress** for individuals undergoing ARV treatment. This helps ensure that psychosocial support is well-integrated into the patient's holistic care across multiple testing facilities.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1399

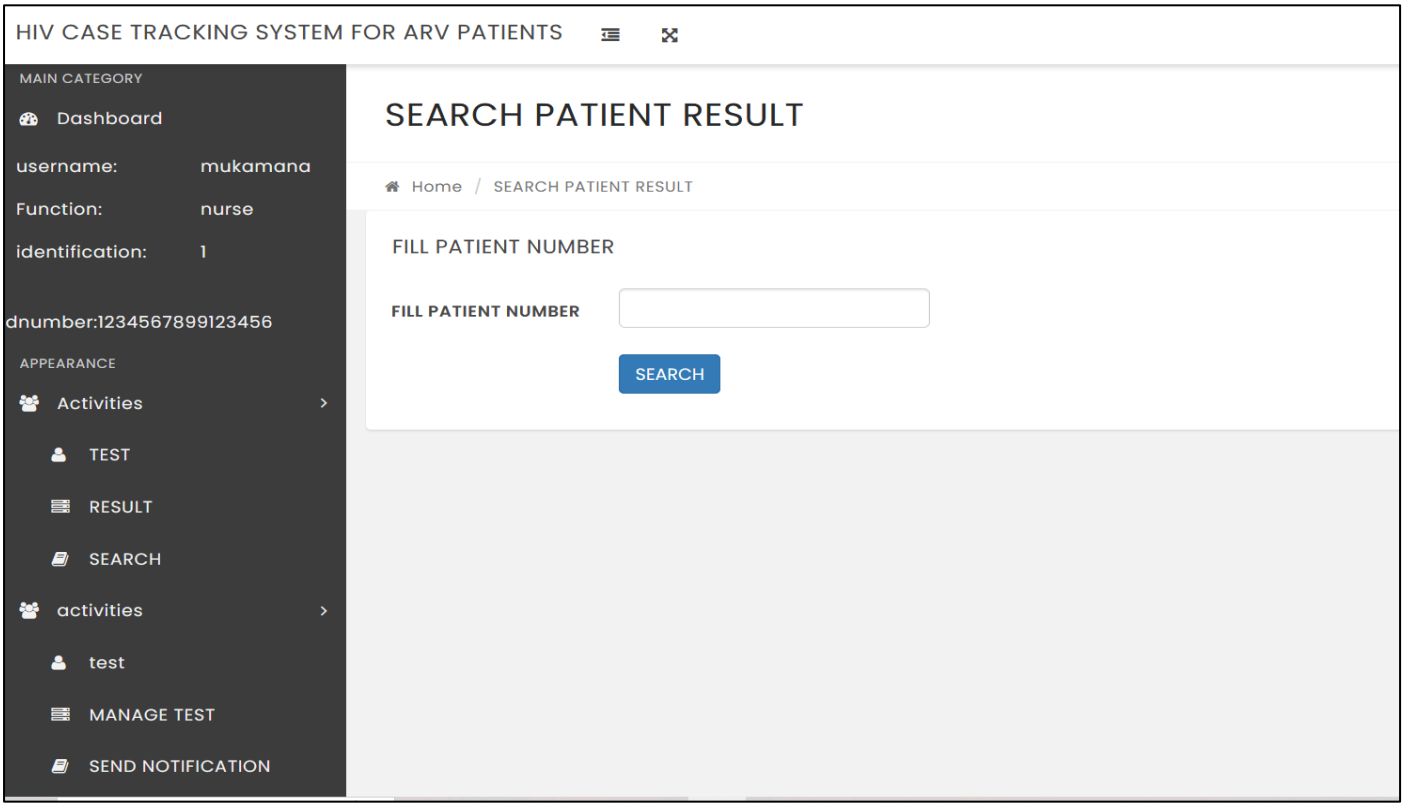

Fig 14 Search Patient Result

VI. CONCLUSION

The development and extension of the HIV Case Tracking System across multiple testing facilities in Kigali city represents a critical step toward strengthening Rwanda's HIV program. The system resolves the duplication of patient records, enabling health facilities to coordinate care more effectively. By capturing comprehensive patient histories, the system enhances data accuracy, ensuring that treatment decisions are based on complete, up-to-date information. This project promotes seamless collaboration between facilities, enhances accurate reporting, and provides policymakers with reliable data for planning and resource allocation. Ultimately, extending the case tracking system contributes to improved treatment continuity, better patient outcomes, and the reduction of unnecessary duplicate HIV-positive cases in national statistics.

RECOMMENDATIONS

➢ *To Fully Realize the Benefits of the Extended HIV Case Tracking System, The Following Recommendations Are Made:*

- Training and Capacity Building: Health workers, especially at the Centre Hospitalier Universitaire de Kigali (CHUK), Nyacyonga Health Center, Gatenga Health Center, and Rugarama Health Center, should undergo comprehensive training on how to use the system effectively.
- Unique Patient Identifier: The system should integrate a national patient identification number, linked to the national health information system, to ensure accurate matching of patient records across all facilities.
- Policy Integration: The Ministry of Health should mandate all HIV testing facilities in Kigali to use the system, ensuring uniform adoption and seamless data exchange.
- Continuous System Improvement: The system should be periodically updated based on user feedback and evolving health sector needs, ensuring ongoing relevance and efficiency.
- Data Privacy and Security: Given the sensitive nature of HIV data, strict data protection protocols must be followed to safeguard patient confidentiality across all facilities.

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