RWANDA FDA
Rwanda Food and Drugs Authority

GUIDELINES FOR REVIEW AND APPROVAL OF SOFTWARE AS MEDICAL DEVICES (SaMD)

JUNE, 2025

Rwanda FDA, P.O.Box:1948 Kigali-Rwanda, Email: info@rwandafda.gov.rw
Website: www.rwandafda.gov.rw, Toll Free:9707

FOREWORD

Rwanda Food and Drugs Authority (Rwanda FDA) is a regulatory body established by Law No. 003/2018 of 09/02/2018 with the mandate to regulate all matters related to the quality, safety, and efficacy of medical products in order to safeguard public health and enhance access to essential, quality-assured medicines.

As advancements in science and technology continue to reshape healthcare and pharmaceutical systems globally, Artificial Intelligence (AI) has emerged as a transformative tool in the development, evaluation, and regulation of medical products. In response to this evolving landscape and in line with the provisions of Rwanda's technical regulations governing the registration of human medicinal products, Rwanda FDA has developed the *Guidelines for the Review and Approval of Software as Medical Devices (SaMD).*

These guidelines aim to establish a regulatory framework for stakeholders and applicants seeking to introduce AI-based Software as Medical Devices in Rwanda. The objective is to ensure that the integration of AI technologies adheres to national regulatory requirements while enhancing patient safety, public health outcomes, and regulatory efficiency. This includes promoting the responsible, ethical, and evidence-based use of AI, within the Rwandan regulatory and healthcare context. These guidelines also incorporate ethical AI governance principles outlined by the World Health Organization (WHO), emphasizing transparency, fairness, accountability, and human oversight in AI-based SaMD.

During development of these guidelines, Rwanda FDA considered international best practices and benchmarked the existing guidance from the International Medical Device Regulators Forum (IMDRF), European Medicines Agency (EMA), the Saudi Food and Drug Authority (SFDA), and the Egyptian Drug Authority (EDA), among others. This reflects the Authority's ongoing commitment to aligning with global standards and fostering innovation while upholding regulatory excellence.

The Authority extends its sincere acknowledgement and appreciation to all stakeholders, technical experts and partners who contributed to the development, review, and validation of these guidelines.

Prof. Emile BIENVENU

Director General

DOCUMENT DEVELOPMENT HISTORY

First issue date	11/06/2025
Effective date of this revision	11/12/2025

Document Revision History

Date of revision	Version number	Changes made and/or reasons for revision
-	1	First issue

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

SaMD: Software as a Medical Device

MLMD: Machine Learning-enabled Medical Device

AI: Artificial Intelligence

ML: Machine Learning

QMS: Quality Management System

PMS: Post-Marketing Surveillance

ROC: Receiver Operating Characteristic

AUC: Area Under the Curve

PPV: Positive Predictive Value

NPV: Negative Predictive Value

IMDRF: International Medical Device Regulators Forum

WHO: World Health Organization

EMA: European Medicines Agency

SFDA: Saudi Food and Drug Authority

EDA: Egyptian Drug Authority

SDLC: Software Development Life Cycle

MLOps: Machine Learning Operations

SPIRIT-AI: Standard Protocol Items: Recommendations for Interventional Trials-AI

CONSORT-AI: Consolidated Standards of Reporting Trials-Artificial Intelligence.

ROC-AUC: Receiver Operating Characteristic

DEFINITION

"Software as a Medical Device (SaMD)" software intended to be used for one or more medical purposes that perform these purposes without being part of a hardware medical device.

"**Machine Learning-enabled Medical Device (MLMD)"** a type of SaMD or medical device that incorporates machine learning algorithms to achieve its medical purpose. MLMDs are considered within the scope of SaMD if they operate as standalone software. They require additional regulatory control around training data, validation, and continuous performance monitoring.

"Artificial Intelligence (AI)" Technology that simulates human intelligence using algorithms and models to support decision-making or prediction.

"Machine Learning (ML)" a subset of AI that enables software to learn patterns from data and improve over time without being explicitly programmed.

"Quality Management System (QMS)" a structured system of procedures and processes covering all aspects of design, production, and post-market monitoring to ensure product quality and compliance.

"Post-Marketing Surveillance (PMS)" The process of monitoring the quality, safety and performance of a medical device after it has been placed on the market.

"Receiver Operating Characteristic (ROC)" A graphical plot used to illustrate the diagnostic ability of a binary classifier system, showing the trade-off between sensitivity and specificity**.**

"Area Under the Curve (AUC)" A measure under the ROC curve representing the ability of the model to distinguish between classes; the higher the AUC, the better the model's performance.

"Positive Predictive Value (PPV)" The proportion of positive test results that are true positives, indicating the probability that a positive result reflects the actual condition.

"Negative Predictive Value (NPV)" The proportion of negative test results that are true negatives, reflecting the probability that a negative result is accurate.

"Algorithm Drift (or Model Drift)" The phenomenon where the performance or accuracy of an AI/ML model degrades over time due to changes in the input data distribution or the relationship between input and output variables, necessitating continuous monitoring and potential retraining or updates**.**

"Medical Device" Any instrument, apparatus, implement, machine, appliance, implant, reagent for in vitro use, software, material or other similar or related article, intended by the manufacturer to be used, alone or in combination, for human beings, for one or more of the specific medical purpose(s) of diagnosis, prevention, monitoring, treatment or alleviation of disease, diagnosis, monitoring, treatment, alleviation of, or compensation for, an injury, investigation, replacement, modification, or support of the anatomy, or of a physiological process, supporting or sustaining life, control of conception, cleaning, disinfection, or sterilization of medical devices, providing information by means of in vitro examination of specimens derived from the human body; and does not achieve its primary intended action by pharmacological, immunological, or metabolic means, in or on the human body, but which may be assisted in its intended function by such means.

NOTE 1: Products which may be considered to be medical devices in some jurisdictions but not in others include: cleaning and disinfection substances, aids for persons with disabilities, devices incorporating animal and/or human tissues, devices for in-vitro fertilization or assisted reproduction technologies.

NOTE 2: For clarification purposes, in certain regulatory jurisdictions, devices for cosmetic/aesthetic purposes are also considered medical devices.

NOTE 3: For clarification purposes, in certain regulatory jurisdictions, the commerce of devices incorporating human tissues is not allowed.

"Clinical evaluation of a SaMD" is defined as a set of ongoing activities conducted in the assessment and analysis of a SaMD's clinical safety, effectiveness and performance as intended by the manufacturer in the SaMD's definition statement.

"Investigational products" Investigational Product" A pharmaceutical product in form of an active ingredient or placebo being tested or used as a reference in a clinical trial, including a product with a marketing authorization when used or assembled (formulated or packaged) in a way different from the approved form, or when used for an unapproved indication, or when used to gain further information about an approved use. These include but are not limited to pharmaceutical products, biologicals (e. vaccines), medical devices.

"In Vitro Diagnostic (IVD) Medical Device" means a medical device, whether used alone or in combination, intended by the manufacturer for the in-vitro examination of specimens derived from the human body solely or principally to provide information for diagnostic, monitoring or compatibility purposes.

Note 1: *IVD medical devices include reagents, calibrators, control materials, specimen receptacles, software, and related instruments or apparatus or other articles and are used, for example, for the following test purposes: diagnosis, aid to diagnosis, screening, monitoring, predisposition, prognosis, prediction, determination of physiological status.*

Note 2: *In some jurisdictions, certain IVD medical devices may be covered by other regulations.*

1. INTRODUCTION

1.1. BACKGROUND

Software as a Medical Device (SaMD) refers to standalone software intended to be used for medical purposes without being part of a hardware medical device. Rwanda FDA recognizes the growing development and use of standalone digital health technologies, including Artificial Intelligence (AI) and Machine Learning (ML)-based tools. The regulatory oversight of SaMD is essential to ensure the safety, quality, and performance of such technologies within Rwanda.

This document establishes the regulatory requirements for standalone Software as a Medical Device (SaMD) intended to be placed on the Rwandan market. It is adapted from international best practices, including guidance from the International Medical Device Regulators Forum (IMDRF), the World Health Organization (WHO), the Saudi Food and Drug Authority (SFDA), and the Ministry of Food and Drug Safety (MFDS) of South Korea.

These guidelines specifically address the unique technical, clinical, and ethical challenges posed by AI/ML technologies to ensure their responsible deployment for public health benefits, aligning with principles of fairness, accountability, and transparency as articulated by international ethical frameworks for AI in health, such as the WHO's Ethics and Governance of Artificial Intelligence for Health.

Note: SaMD includes a wide range of software products, including Machine Learning-enabled Medical Devices (MLMD). MLMD is considered a subcategory of SaMD and is subject to these guidelines with additional considerations for risks associated with continuous learning, algorithm transparency, data bias, and post-market algorithm drift. Where relevant, these additional regulatory expectations are highlighted.

1.2. PURPOSE

To provide guidance on the requirements and procedures for the clinical trial, marketing authorization, and post-marketing surveillance of Software as a Medical Device (SaMD) in Rwanda. This aims to promote public health by ensuring the safety, performance, and quality of AI/ML-based medical software in line with Rwanda FDA legal mandate under Law No. 003/2018 of 09/02/2018 establishing Rwanda FDA. Furthermore, these guidelines seek to strike a balance between facilitating the adoption of innovative AI/ML technologies in healthcare and maintaining stringent regulatory oversight to protect public health.

1.3. SCOPE

This guideline applies to:

i) All standalone software that meets the definition of a medical device

ii) Both locked (fixed) algorithms and adaptive/continuously learning AI/ML models, with specific additional requirements detailed for the latter, especially concerning their ongoing performance monitoring and management of algorithm drift.

iii) AI/ML-based SaMD, including requirements for algorithmic transparency, bias mitigation, continuous learning protocols, and explainability of outputs.

Note: Software that does not meet the criteria of a medical device shall not be regulated by Rwanda FDA.

1.4. GENERAL PRINCIPLES

1. All SaMDs must comply with national regulatory requirements for safety, quality, and effectiveness.
2. Risk-based classification shall be used to determine the level of regulatory oversight.
3. The intended use and claims of the manufacturer determine the regulatory pathway.
4. Compliance with applicable international standards such as ISO 13485, ISO 14971, IEC 62304 is encouraged.
5. Clinical evaluations must adhere to IMDRF/SaMD WG/N41 and ISO 14155, ensuring robust analytical/clinical validation and ethical data use.
6. Ethical considerations, including fairness, accountability, and transparency, must be integrated throughout the SaMD lifecycle, particularly for AI/ML-based systems, to ensure equitable access and prevent algorithmic bias.
7. Traceability and clear documentation of AI/ML model development, training data, validation, and performance are paramount to facilitate regulatory review and post-market surveillance.

2. REGULATORY REQUIREMENTS

2.1. CLINICAL TRIAL APPLICATION PROCESS AND REQUIREMENTS

2.1.1. Requirements for Pre-Submission Meeting Application

An application for a pre-submission consultation meeting is optional and shall be made by the sponsor or Principal investigator who submit to the Authority following documents:

i) The cover letter requesting the pre-submission meeting;

ii) A brief synopsis of the proposed trial protocol as per APPENDIX-VI

iii)A list of preliminary questions to be discussed in the meeting;

The Authority will acknowledge the receipt of the application and will confirm the meeting date, venue and time of meeting within fifteen (15) calendar days after the receipt of meeting request.

After the meeting, the sponsor should prepare and send to the Authority a written record of the discussions and conclusions of the meeting within 14 calendar days.

2.1.2. Clinical Trial Application requirements

A Clinical Trial Application for conducting clinical trials in Rwanda including bioavailability studies should be made to the Authority prior to the initiation. The content and format of clinical trial application is composed of three modules;

Module I: Administrative and protocol related information about the trial;

Module II: Information related to the Quality summaries about the investigational products to be used in the proposed trial;

Module III: Other Supporting Information.

The contents of each module of clinical trial application dossier are summarized in the table provided below:

Module I	**Administrative Information and Protocol Related Information**
1.1.	**Administrative Information**
1.1.1.	Signed and dated Clinical Trial Application Cover letter
1.1.2.	Signed and dated clinical trial application form (**Doc No: DD/PVCT/FOM/007)**
1.1.3.	Valid Ethical Clearance Certificate from Rwanda National Ethics Committee
1.1.4.	Curriculum vitae (CVs) of Principal investigator(s) and Co-investigator(s)
1.1.5.	Copy of Valid GCP Certificates for both Principal Investigator(s) and co-Principal investigator (s)
1.1.6.	Signed and dated Joint declaration between Sponsor & Principal Investigator for sufficient funds in the prescribed format (**Doc No: DD/PVCT/FOM/033**)
1.1.7.	Signed and dated declarations by the Principal investigator and/or Co-investigators (**Doc No: DD/PVCT/FOM/034**)
1.1.8.	Valid Local Insurance Policy Covering trial participants
1.1.9.	Signed and dated Sponsor/ Principal investigator contractual Agreement
1.1.10.	Letters of Access authorizing Authority to access related files (Product Master Files, Site Reference Files, etc) must be submitted
1.1.11.	Clinical Trial Site Agreement/contract
1.1.12.	Collaborative note from Rwanda Biomedical Center for clinical trial on products
1.1.13.	used under public health programs(HIV,TB, Malaria, etc.),if applicable
1.1.14.	Minutes of the discussions and conclusions of the pre-submission meeting or other relevant correspondence with the Authority, if applicable
1.1.15.	Proof of registration of the trial with a WHO recognized Clinical Trial Registry. Preferably, trials may be registered with the Pan African Clinical Trials Registry (PACTR)
1.1.16.	Evidence of payment of prescribed fees
1.2.	**Clinical Trial Protocol-related Information**
1.2.1.	A copy of the final proposed protocol(s), including the version number. The trial protocol must be signed by the sponsor and the investigator prior to the start of the clinical trial
1.2.2.	A copy of the Informed Consent Forms (ICFs) in English, French and Kinyarwanda signed and stamped by the Rwanda National Ethics Committee that includes a statement regarding the risks and anticipated benefits to the clinical trial participants
1.2.3.	Copy of Participant Information Leaflet (PIL)
1.2.4.	Copy of Case Report Forms (CRFs) to be used for data collection

1.2.5.	Capacity building plan including training and updating of staff involved in the trial
1.2.6.	Good Clinical Laboratory Practice (GCLP) accreditation certificate, if applicable
1.2.7.	Signed Charter of DSMB and CVs of Members if applicable
1.2.8.	Signed and dated Materials Transfer Agreement (MTA) if applicable
Module II	**Information related to the Quality of Investigational Product**
2.1.	Investigational Product (IP) Dossier containing non-clinical data, and Data from previous clinical use (if applicable). Non-clinical data reports should be included in the dossier as per the requirements in the latest version of ICH M3.
2.2.	A copy of the current Investigator's Brochure (IB), supplemented as appropriate with up-to-date safety, non-clinical, and available clinical data
2.3.	**QMS Certificate or equivalent**
2.4.	Labelling (User manual, catalogue of IFU of the device)
2.5.	Copy of declaration of conformity for the version of the investigational products to be used in a clinical trial if applicable
2.6.	Composition of the placebo /(Sharma devices)
2.7.	Risk Management file
2.8.	Standards List
Module III	**Other Supporting Information**
3.1.	Additional supporting quality information such as publications
3.2.	Literature References

Note: ***For more information, related to clinical trial process and requirements, please refer to the guideline on clinical trial application available on Rwanda FDA website***

2.1.3. CLINICAL TRIAL PHASES

As per IMDRF/SaMD WG/N41FINAL:2017, the common and converged understanding of clinical evaluation and principles for demonstrating the safety, effectiveness and performance of SaMD is illustrated as per the following process;

Clinical Evaluation Process

Clinical Evaluation		
Valid Clinical Association	**Analytical Validation**	**Clinical Validation**
Is there a valid clinical association between your SaMD output and your SaMD's targeted clinical condition?	Does your SaMD correctly process input data to generate accurate, reliable, and precise output data?	Does use of your SaMD's accurate, reliable, and precise output data achieve your intended purpose in your target population in the context of clinical care?

2.1.4. EVALUATION METRICS

Applicants must pre-define and justify the clinical performance metrics, including but not limited to:

a) **Sensitivity, Specificity:** Measure of true positive/true negative rates

b) **Positive Predictive Value (PPV) and Negative Predictive Value (NPV):** Measures of the likelihood that patients identified by the SaMD as having (or not having) a condition truly do or do not have it, respectively, within the intended population.

c) **Receiver Operating Characteristic – Area Under the Curve (ROC-AUC) and F1 Score:** measures the ability of the SaMD to distinguish between different diagnostic categories across all classification thresholds, providing insight into overall model discrimination. The F1 Score is the harmonic mean of precision and recall, particularly useful for imbalanced datasets, and reflects a balance between false positives and false negatives.

d) **Clinical Usability and Error rate**: Especially important for patient-facing or clinician-assistive software.

e) **Effect on Clinical Workflow**: Evaluates how the SaMD integrates into existing clinical processes. Applicants must describe how the software impacts clinician workload, patient throughput, decision-making efficiency, alert fatigue, or time savings. Evidence can include following tools and methodologies

i) *Time-Motion Studies* to evaluate changes in time spent on tasks before and after SaMD implementation.

ii) *Workflow mapping and process modeling* to identify shifts in task sequences or bottlenecks.

iii) *User experience (UX) assessments* and *usability testing* involving healthcare providers.

iv) *Simulation studies* to test integration within clinical environments without disrupting patient care.

Note:

1. Evidence from these tools should be summarized and discussed in the clinical evaluation documentation to demonstrate the SaMD's compatibility with routine practice and its potential to enhance clinical workflows.
2. Each metric must include acceptable thresholds, Statistical significance plans and Clinical relevance justification

2.1.5. DATASET REQUIREMENTS

To ensure reproducibility and reliability of clinical outcomes. Applicants must;

a) Describe data sources such as hospitals, EHRs, registries, etc…

b) Demonstrate representativeness of the intended population

c) Ensure dataset independence from model training data, particularly for validation and testing sets

d) Conduct and report power calculations with appropriate statistical justification

e) Provide detailed information on data provenance (origin, handling, versioning) and ensure transparency in how the data were collected, cleaned and used

f) Present data preprocessing methods including handling of missing data and bias correction

g) Show dataset partitioning for training, validation, and testing, ensuring minimal data leakage

h) Ensure compliance with national and international data protection laws

Data summary report, data quality control methods, and evidence of ethical use shall be submitted.

2.2. MARKETING AUTHORIZATION

2.2.1. Types of SaMD Registration Applications

For the purposes of submission of SaMD registration applications Dossier to Rwanda FDA, applications are classified into three main types as follows:

1. **New Application for Registration**: This is applicable for SaMDs being submitted for the first time in Rwandan market. It includes all required documentation and data necessary to evaluate safety, performance, and compliance.
2. **Variation/Amendment of registered SaMD:** This is applicable when there is a change to an already registered SaMD, such as updates to the intended use, algorithm modifications, software version upgrades, or significant design changes. The nature of the change determines whether re-evaluation is required prior to continued market authorization.
3. **Renewal product Registration:** Applicable when the registration certificate for an approved SaMD is nearing expiry, and the product will continue to be marketed. Renewal applications must be submitted at least three (3) months prior to the expiry of the current registration through the Rwanda FDA online portal.

Applicants must clearly indicate the type of application in the application form submitted.

2.2.2. Rwanda FDA Dossier Assessment Procedures

After receiving the device application, the Authority shall proceed with screening of the dossier for completeness. In the event that the dossier is incomplete, it will not be scheduled for assessment and the applicant will be notified within **thirty (30)** working days and requested to comply with requirements in writing.

In case of a positive outcome during the screening, the application will be scheduled for assessment according to the First in First out (FIFO) rules. Priority assessment may be granted where the device is intended for treatment of rare disease conditions through an expression of interest (DHT/FMT/032) or in the case of emergency situation.

A product dossier is reviewed by two assessors to provide scientific and regulatory oversight regarding the quality, safety and performance of the device under assessment.

The Authority reserves the right to request any additional information to establish the quality, safety and performance of medical devices. During the assessment, additional data and/or samples may be requested through an official communication letter. Once a query has been issued to the applicant, the assessment process stops until the Authority receives a written response to the raised queries. Further processing of the application may only be undertaken if responses to queries issued in the official communication letter contains all outstanding information requested in one submission. Failure to comply with this condition or if the queries have been reissued for a **fourth** time and the applicant provides unsatisfactory responses, the application will be rejected.

In the event that the responses to the queries are not submitted within sixty (60) working days from the date they were issued, it will be considered that the applicant has withdrawn the application unless the applicant has requested for extension of deadline to the Authority.

2.2.3. Compliance with Quality Management System (QMS)

Compliance with Quality Management System (QMS) is mandatory for all SaMD development. Rwanda FDA shall conduct inspection of the software development environment to verify whether it complies with QMS standards before registration. For SaMDs registered by other regulatory body, the Authority may rely on valid QMS certificates issued by recognized regulatory authorities or conduct an on-site inspection where necessary.

2.2.4. Rwanda FDA Internal Scientific Review Committee for Marketing Authorization Decision

Upon completion of the assessment, a final dossier assessment report shall be presented to the Rwanda FDA Internal Scientific Review Committee for review and recommendation on approval or rejection. If additional data or clarifications are required to address safety, quality, or efficacy concerns, the application shall remain pending until resolution of raised issues. Failure to provide the requested data within the specified timeline shall result in the application being considered withdrawn.

A SaMD product shall be registered only when data on quality, safety, and efficacy are deemed satisfactory and a Registration Certificate for SaMD Products will be issued. The registration shall be valid for a period of **five (5) years**. In the event that the Rwanda FDA suspends or cancels the registration validity, a written official communication shall be made to the applicant.

2.2.5. Timelines for Registration

Medical device dossiers shall be scheduled for assessment according to the First in First out (FIFO) basis upon compliance of the requirements. A new application shall be processed within nine (9) months of receipt of the application. The applicant will be required to provide any requested additional data within sixty (60) working days. Additional data or query responses shall be processed within forty (40) working days.

2.2.6. SaMD Categorization

According IMDRF SaMD WG/N12 guidance, the categorization of Software as Medical Device (SaMD) is based on its intended purpose and the risk posed to patient health if the software fails to perform as intended.

2.2.6.1. Categorization Principles

The following are necessary principles important in the categorization approach of SaMD.

1. The categorization relies on an accurate and complete SaMD definition statement.
2. The determination of the categories is the combination of the significance of the information provided by the SaMD to the healthcare decision and the healthcare situation or condition.
3. The four categories (I, II, III, IV) are based on the levels of impact on the patient or public health where accurate information provided by the SaMD to treat or diagnose, drive or inform clinical management is vital to avoid death, long-term disability or other serious deterioration of health, mitigating public health.
4. The categories are in relative significance to each other. Category IV has the highest level of impact, Category I the lowest.
5. When a manufacturer's SaMD definition statement states that the SaMD can be used across multiple healthcare situations or conditions it is categorized at the highest category according to the information included in the SaMD definition statement.

6. When a manufacturer makes changes to SaMD, during the lifecycle that results in the change of the definition statement, the categorization of SaMD should be reevaluated appropriately. The SaMD is categorized according to the information included in the changed (new) SaMD definition statement.
7. SaMD will have its own category according to its SaMD definition statement even when a SaMD is interfaced with other SaMD, other hardware medical devices, or used as a module in a larger system.

2.2.6.2. SaMD Categories

State of Healthcare situation or condition	Significance of information provided by SaMD to healthcare decision		
	Treat or diagnose	Drive clinical management	Inform clinical management
Critical	IV	III	II
Serious	III	II	I
Non Serious	II	I	I

2.2.6.3. Criteria for Determining SaMD Category

Category	Criterias
IV	i) SaMD that provides information to treat or diagnose a disease or conditions in a critical situation or condition is a Category IV and is considered to be of very high impact.
III	i) SaMD that provides information to treat or diagnose a disease or conditions in a serious situation or condition is a Category III and is considered to be of high impact.
	ii) SaMD that provides information to drive clinical management of a disease or conditions in a critical situation or condition is a Category III and is considered to be of high impact.
II	i) SaMD that provides information to treat or diagnose a disease or conditions in a nonserious situation or condition is a Category II and is considered to be of medium impact
	ii) SaMD that provides information to treat or diagnose a disease or conditions in a nonserious situation or condition is a Category II and is considered to be of medium impact.
	iii) SaMD that provides information to drive clinical management of a disease or conditions in a serious situation or condition is a Category II and is considered to be of medium impact.
I	i) SaMD that provides information to drive clinical management of a disease or conditions in a non-serious situation or condition is a Category I and is considered to be of low impact.
	ii) SaMD that provides information to inform clinical management for a disease or conditions in a serious situation or condition is a Category I and is considered to be of low impact.
	iii) SaMD that provides information to inform clinical management for a disease or conditions in a non-serious situation or condition is a Category I and is considered to be of low impact.

2.2.6.4. Examples of SaMD

The examples below are intended to help illustrate the application of the framework and resulting categories.

Category IV

a) SaMD that performs diagnostic image analysis for making treatment decisions in patients with acute stroke, i.e., where fast and accurate differentiation between ischemic and hemorrhagic stroke is crucial to choose early initialization of brain-saving intravenous thrombolytic therapy or interventional revascularization.

   This example uses criteria IV.i from the above criteria table in that the information provided by the above SaMD is used to treat a fragile patient in a critical condition that is life threatening, may require major therapeutic intervention, and is time sensitive.

b) SaMD that calculates the fractal dimension of a lesion and surrounding skin and builds a structural map that reveals the different growth patterns to provide diagnosis or identify if the lesion is malignant or benign.

   This example uses criteria IV.i from the criteria table in that the information provided by the above SaMD is used to diagnose a disease that may be life threatening, may require major therapeutic intervention, and may be time sensitive.

c) SaMD that performs analysis of cerebrospinal fluid spectroscopy data to diagnose tuberculosis meningitis or viral meningitis in children.

   This example uses criteria IV.i from the above criteria table in that the information provided by the above SaMD is used to diagnose a disease in a fragile population with possible broader public health impact that may be life threatening, may require major therapeutic intervention, and may be time sensitive.

d) SaMD that combines data from immunoassays to screen for mutable pathogens/pandemic outbreak that can be highly communicable through direct contact or other means.

   This example uses criteria IV.i from the above criteria table in that the information provided by the above SaMD is used to screen for a disease or condition with public health impact that may be life threatening, may require therapeutic intervention and may be time critical.

Category III

a) SaMD that uses the microphone of a smart device to detect interrupted breathing during sleep and sounds a tone to rouse the sleeper.

   This example uses criteria III.i from the above criteria table in that the information provided by the above SaMD is used to treat a condition where intervention is normally not expected to be time critical in order to avoid death, long term disability or other serious deterioration of health.

b) SaMD that is intended to provide sound therapy to treat, mitigate or reduce effects of tinnitus for which minor therapeutic intervention is useful.

   This example uses criteria III.i from the above criteria table in that the information provided by the above SaMD is used to treat a condition that may be moderate in progression, may not require therapeutic intervention and whose treatment is normally not expected to be time critical.

c) SaMD that is intended as a radiation treatment planning system as an aid in treatment by using information from a patient and provides specific parameters that are tailored for a particular tumor and patient for treatment using a radiation medical device.

This example uses criteria III.ii from the above criteria table in that the information provided by the above SaMD is used as an aid in treatment by providing enhanced support to the safe and effective use of a medical device to a patient in a critical condition that may be life threatening and requires major therapeutic intervention.

d) SaMD that uses data from individuals for predicting risk score in high-risk population for developing preventive intervention strategies for colorectal cancer.

This example uses criteria III.ii from the above criteria table in that the information provided by the above SaMD is used to detect early signs of a disease to treat a condition that may be life-threatening disease impacting high-risk populations, may require therapeutic intervention and may be time critical.

e) SaMD that is used to provide information by taking pictures, monitoring the growth or other data to supplement other information that a healthcare provider uses to diagnose if a skin lesion is malignant or benign.

This example uses criteria III.ii from the above criteria table in that the information provided by the above SaMD is used as an aid to diagnosing a condition that may be life-threatening, may require therapeutic intervention and may be time critical by aggregating relevant information to detect early signs of a disease.

Category II

a) SaMD that analyzes heart rate data intended for a clinician as an aid in diagnosis of arrhythmia.

This example uses criteria from II.ii from the above criteria table in that the information provided by the above SaMD is used to aid in the diagnosis of a disease of a condition that may be moderate in progression, may not require therapeutic intervention and whose treatment is normally not expected to be time critical.

b) SaMD that interpolates data to provide 3D reconstruction of a patient's computer tomography scan image, to aid in the placement of catheters by visualization of the interior of the bronchial tree; in lung tissue; and placement of markers into soft lung tissue to guide radiosurgery and thoracic surgery.

This example uses criteria II.ii from the above criteria table in that the information provided by the above SaMD is used to aid in the next treatment intervention of a patient where the intervention is not normally expected to be time critical in order to avoid death, longterm disability, or other serious deterioration of health.

c) SaMD that uses data from individuals for predicting risk score for developing stroke or heart disease for creating prevention or interventional strategies.

This example uses criteria II.iii from the above criteria table in that the information provided by the above SaMD is used to detect early signs of a disease to treat a condition that is not normally expected to be time critical in order to avoid death, long-term disability, or other serious deterioration of health.

d) SaMD that integrates and analyzes multiple tests utilizing standardized rules to provide recommendations for diagnosis in certain clinical indications, e.g., kidney function, cardiac risk, iron and anemia assessment.

This example uses criteria II.ii from the above criteria table in that the information provided by the above SaMD is used to detect early signs of a disease to treat a condition that is not normally expected to be time critical in order to avoid death, long-term disability, or other serious deterioration of health.

Note: This example includes both serious and potentially non-serious conditions but per the categorization principle when a manufacturer's SaMD definition statement states that the SaMD can be used across multiple healthcare situations or condition it will be categorized at the highest category according to the SaMD definition statement.

e) SaMD that helps diabetic patients by calculating bolus insulin dose based on carbohydrate intake, pre-meal blood glucose, and anticipated physical activity reported to adjust carbohydrate ratio and basal insulin.

This example uses criteria II.ii from the above criteria table in that the information provided by the above SaMD is used to aid in treatment of a condition not normally expected to be time critical in order to avoid death, long-term disability, or other serious deterioration of health.

Category I

a) SaMD that sends ECG rate, walking speed, heart rate, elapsed distance, and location for an exercise-based cardiac rehabilitation patient to a server for monitoring by a qualified professional.

This example uses criteria I.ii from the above criteria table in that the information provided by the above SaMD is an aggregation of data to provide clinical information that will not trigger an immediate or near term action for the treatment of a patient condition that is not normally expected to be time critical in order to avoid death, long-term disability, or other serious deterioration of health.

b) SaMD that collects data from peak-flow meter and symptom diaries to provide information to anticipate an occurrence of an asthma episode.

This example uses criteria I.ii from the above criteria table in that the information provided by the above SaMD is an aggregation of data to provide best option to mitigate a condition that is not normally expected to be time critical in order to avoid death, long-term disability, or other serious deterioration of health.

c) SaMD that analyzes images, movement of the eye or other information to guide next diagnostic action of astigmatism.

This example uses criteria I.i from the above criteria table in that the information provided by the above SaMD is an aggregation of data to provide clinical information that will not trigger an immediate or near term action for the treatment of a patient condition that even if not curable can be managed effectively and whose interventions are normally non-invasive in nature.

d) SaMD that uses data from individuals for predicting risk score (functionality) in healthy populations for developing the risk (medical purpose) of migraine (non-serious condition.

This example uses criteria I.i from the above criteria table in that the information provided by the above SaMD is an aggregation of data to provide clinical information that will not trigger

an immediate or near term action for the treatment of a patient condition that even if not curable can be managed effectively and whose interventions are normally non-invasive in nature.

e) SaMD that collects output from a ventilator about a patient's carbon dioxide level and transmits the information to a central patient data repository for further consideration.

This example uses criteria I.ii from the above criteria table in that the information provided by the above SaMD is an aggregation of data to provide clinical information that will not trigger an immediate or near term action for the treatment of a patient condition that is not normally expected to be time critical in order to avoid death, long-term disability, or other serious deterioration of health.

f) SaMD that stores historical blood pressure information for a health care provider's later review.

This example uses criteria I.ii from the above criteria table in that the information provided by the above SaMD is an aggregation of data to provide clinical information that will not trigger an immediate or near term action for the treatment of a patient condition that is not normally expected to be time critical in order to avoid death, long-term disability, or other serious deterioration of health.

g) SaMD intended for image analysis of body fluid preparations or digital slides to perform cell counts and morphology reviews.

This example uses criteria I.ii from the above criteria table in that the information provided by the above SaMD is an aggregation of data to provide clinical information that will not trigger an immediate or near term action for the treatment of a patient condition that is not normally expected to be time critical in order to avoid death, long-term disability, or other serious deterioration of health.

h) SaMD intended for use by elderly patients with multiple chronic conditions that receives data from wearable health sensors, transmits data to the monitoring server, and identifies higher-level information such as tachycardia and signs of respiratory infections based on established medical knowledge and communicates this information to caregivers.

This example uses criteria I.ii from the above criteria table in that the information provided by the above SaMD is an aggregation of data to provide clinical information that will not trigger an immediate or near term action for the treatment of a patient condition that is not normally expected to be time critical in order to avoid death, long-term disability, or other serious deterioration of health.

i) SaMD that uses hearing sensitivity, speech in noise, and answers to a questionnaire about common listening situations to self-assess for hearing loss.

This example uses criteria from I.ii the above criteria table in that the information provided by the above SaMD is an aggregation of data to provide clinical information that will not trigger an immediate or near term action for the treatment of a patient condition that is not normally expected to be time critical in order to avoid death, long-term disability, or other serious deterioration of health.

2.2.7. Special Considerations

a) **Adaptive AI Models**: Must describe learning boundaries and re-training frequency.

b) **Cloud-Based SaMD**: Must meet data privacy standards per Rwanda's ICT and Data Protection Laws.

c) **Comparative Evaluation**: Reference comparators and declare equivalence or generate new data.

2.2.8. Technical Documentation Requirements

Applicants shall submit a comprehensive technical documentation file to support the evaluation of their SaMD. This documentation shall include, the cover letter, application form, Executive Summary, Device details, Risk classification justification (compliance with ISO 14971), Software architecture and algorithm description, Clinical evaluation report, Verification and validation reports, Labeling and instruction for user (IFU), evidence of Cybersecurity and data protection measures, Post-Market Surveillance Plan and QMS compliance documentation (e.g., ISO 13485 certificate)

2.2.8.1. Cover letter and application form

Applicant should prepare a cover letter for each product application. The cover letter for product registration (***Refer to the APPENDIX I***) must be dated and signed by the applicant. It can be downloadable from Rwanda FDA website.

Each application for registration of a medical product for human use must be accompanied by a completed product application form (***refer to the APPENDIX II***). The application form downloadable from Rwanda FDA website should be accurately filled**,** dated**,** signed**,** stamped, and submitted with all relevant information and attachments.

2.2.8.2. Executive Summary

Overview of the SaMD, including information such as Name(s), Description, Category/classification, Intended Use/Indication, Instruction of Use, Contraindications, Warnings, Precautions, and Alternative Use (if applicable) …should be provided:

a) **Name and Version:** Specify the exact name and unique version identifier of the software product. This ensures traceability and distinguishes between different software iterations or updates.

b) **Description:** Provide a concise but comprehensive description of the software's core functionality and components.

c) **Category/Classification:** Indicate the risk classification of the SaMD based on the criteria outlined in section 1.10, and provide justification.

d) **Intended purpose/Indication**: Clearly define what the software is designed to do, including the specific medical function (e.g., diagnosis, monitoring, decision support). Include references to the medical condition, disease, or patient population the SaMD is meant to address.

e) **Target User Group**: Indicate who is intended to use the software such as healthcare professionals, patients, or caregivers, and specify any qualifications or training needed.

f) **Instruction for Use**: Outline how the SaMD is to be installed, operated, and interpreted by users, including access requirements and limitations.

g) **Contraindications**: Describe any conditions under which the SaMD should not be used.

h) **Warnings and Precautions**: Highlight any safety-related issues users need to be aware of, including limitations in accuracy, conditions that may cause errors, or environments where the software should not be used.

i) **Alternative Use** (if applicable): Indicate if the SaMD may also serve additional, non-primary functions (e.g., research use, patient engagement) and the regulatory considerations for such uses.

j) **Platform and Environment**: Specify the supported operating systems (e.g., Android, iOS, Windows), devices (e.g., smartphones, tablets, desktop), and hosting environments where the SaMD is intended to be deployed (e.g., cloud-based, on-premise).

k) **Clinical Context**: Describe the healthcare setting in which the SaMD is expected to be used (e.g., hospital, home, point-of-care) and how it integrates into existing clinical workflows.

l) **Limitations and Exclusions**: Provide any conditions or uses that the software is not intended for. In fact, you need to define any limitations of the SaMD and explicitly state the intended scope of use to avoid misuse or misinterpretation.

2.2.8.3. Device details

a) Functional and technical specifications

b) System architecture, including hardware requirements (if any), software platforms, and third-party dependencies.

The devices must have clear and well-defined functional and technical specifications. This includes a robust architecture detailing the specific hardware requirements necessary for optimal performance, as well as the software platforms that will support its operation.

Furthermore, it is crucial to outline any third-party dependencies that may influence the system's functionality and implementation.

2.2.8.4. Risk Management File

Risk analysis and mitigation measures should be conducted according to ISO 14971. This process includes hazard identification, risk estimation, evaluation, and the implementation of control measures.

Additionally, the risk analysis must provide a justification and rationale for the classification of the Software as a Medical Device (SaMD). This classification should be consistent with the rules outlined in the above relevant section. It informs the level of regulatory oversight required and should align with the device's intended use, as well as the potential impact on patient health if the device does not perform as expected.

2.2.8.5. Software Development Lifecycle (SDLC) Documentation

Applicants must provide comprehensive documentation of the Software Development Lifecycle (SDLC), demonstrating how quality management principles are applied throughout the development of the AI/ML-based SaMD. This includes:

a) **Planning for Software Design and Development:** Outline the necessary steps and strategies, explicitly integrating considerations for data acquisition, model development, and deployment for AI/ML components.

b) **Design Inputs and Requirements:** Document detailed requirements and specifications, including those related to AI/ML model performance, robustness, explainability (if applicable), data sources, and intended clinical use. This should cover requirements for:

   i) *Management Plan:* Procedures for data collection, storage, curation, annotation, and preprocessing, ensuring data quality, privacy, and representativeness.

   ii) *Model Development Plan*: Specifications for algorithm selection, model architecture, training methodology, and performance metrics.

c) **Design Outputs and Deliverables:** Document the results and deliverables from each design phase, including**;**

   i) *Trained Model Documentation:* Details of the trained AI/ML model, including its architecture, parameters, and version**.**

   ii) *Validation and Verification Reports:* Comprehensive reports on analytical and clinical validation, specifically addressing AI/ML performance, bias, and generalizability.

d) **Management of Software Versions and Configurations**: Essential for tracking changes, ensuring consistency, and managing different versions of the software and, crucially, the underlying AI/ML model (including the specific training data and code versions used to generate each model version).

e) **AI/ML Specific SDLC Considerations (MLOps):** Document how the following are managed within the SDLC:

   i) *Data Versioning and Lineage:* Tracking of all data (training, validation, test) used throughout the model's lifecycle.

   ii) *Model Re-training and Updates:* A defined process for when and how AI/ML models will be re-trained or updated, including validation protocols for new versions.

   iii) *Continuous Integration/Continuous Deployment (CI/CD) for AI/ML:* If automated deployment is used, describe the safeguards and validation steps.

   iv) *Model Monitoring in Deployment:* How the deployed model's performance will be monitored in real-world settings, and how deviations or drift will trigger re-evaluation or updates.

The SDLC documentation should clearly articulate the specific roles and responsibilities for AI/ML development, testing, and maintenance.

2.2.8.6. Software Architecture and Algorithm Description

Provide a detailed description of the software architecture and the AI/ML algorithms utilized including

1. **Model Type and Architecture**

   Specify the type of AI/ML model (e.g., neural network, decision tree, deep learning, classical machine learning) and its underlying architecture. Provide diagrams where necessary.

2. **Algorithm Details**

   i) *Input Data:* Clearly define the types of input data the algorithm processes (e.g., medical images, EHR data, sensor data) and their expected format and quality.

ii) *Output Data:* Describe the format and interpretation of the algorithm's outputs (e.g., probability scores, classifications, segments, predictions).

iii) *Clinical Rationale for Algorithm Design***:** Justify the choice of algorithm and model architecture based on the intended medical purpose and scientific literature.

iv) *Preprocessing and Feature Engineering:* Detail any data preprocessing steps, feature extraction, or engineering techniques applied to the raw input data before feeding it to the AI/ML model.

v) *Post-processing of Outputs:* Describe any post-processing steps applied to the model's raw outputs before presentation to the user or integration into clinical workflows.

3. **AI/ML Specifics:**

i) *Training Methodology:* Outline the training methodology, including algorithms used, optimization techniques, loss functions, and hyperparameters.

ii) *Training Data:* Provide detailed information on the training dataset(s) used, including their size, source, characteristics, and representativeness (e.g., demographics, disease prevalence). *Address potential biases in the training data and mitigation strategies.*

iii) *Validation Data:* Describe the independent validation dataset(s) used to evaluate model performance and generalization.

iv) *Locked vs. Adaptive Algorithms:* Clearly state whether the algorithm is "locked" (fixed) or "adaptive/continuously learning." For adaptive algorithms, describe the learning strategy, frequency of updates, and mechanisms to manage algorithm drift.

v) *Interpretability/Explainability:* Describe methods used to ensure and demonstrate the interpretability or explainability of the AI/ML model's decisions, especially for high-risk SaMDs, where applicable and feasible. This is increasingly critical for regulatory understanding and user trust.

vi) *Robustness and Generalizability:* Provide information on how the model's robustness to noisy or unexpected inputs has been assessed and how its generalizability to diverse patient populations and clinical settings has been evaluated.

vii) *Version Control for AI/ML Models:* Explain the strategy for versioning the AI/ML model, including tracking of training data, model parameters, and code changes.

2.2.8.7. Clinical Evaluation Report (CER)

Applicants must submit a comprehensive Clinical Evaluation Report (CER) that demonstrates the clinical performance, safety, and effectiveness of the AI/ML-based SaMD for its intended use and target population. The CER must explicitly address AI/ML-specific considerations:

a) **Evidence Supporting Clinical Performance and Safety:** Provide robust evidence, including clinical data, published literature, real-world evidence (RWE), and/or clinical trials. For AI/ML, this evidence must clearly demonstrate:

i) *Performance Stability:* How the AI/ML model's performance remains consistent across diverse and representative patient populations, clinical settings, and data variations.

ii) *Bias Analysis:* A thorough analysis of potential biases (e.g., demographic, algorithmic, dataset bias) and their impact on clinical performance across different subgroups. Describe

mitigation strategies employed and their effectiveness. (Refer to WHO (2021) Ethics and Governance of AI for Health, SFDA (2022), MFDS (2022)).

iii) Robustness: Evidence of the AI/ML model's resilience to variations, noise, or adversarial attacks in input data.

b) **Analytical and Clinical Validation**: Analytical (technical) and clinical validation reports must comprehensively support the intended use, ensuring the software accurately produces its intended outputs and achieves its clinical purpose. For AI/ML, this includes**:**

i) **Model Accuracy, Reliability, and Precision:** Detailed assessment of how the AI/ML model performs on independent validation datasets, including a range of relevant metrics

ii) **Generalizability:** Evidence that the model performs effectively on data from diverse sources and real-world conditions, reflecting the target population.

c) **Benefit-Risk Assessment:** Outline the potential clinical benefits and harms, supported by data. For AI/ML, this must consider:

i) The potential for misdiagnosis or delayed treatment due to AI/ML errors, including the impact of false positives/negatives.

ii) The impact of over-reliance or under-reliance on AI/ML outputs by users.

iii)The trade-offs between model complexity and interpretability in relation to clinical safety.

d) **Reporting Standards**: Clinical trials involving AI/ML-based SaMDs should adhere to recognized reporting guidelines such as CONSORT-AI and SPIRIT-AI to ensure transparency and completeness of reporting.

e) **Clinical Evaluation Plan (CEP**): A detailed plan outlining the scope of the clinical evaluation, the clinical data to be gathered, the methodology for data analysis, and the criteria for demonstrating clinical safety and performance for AI/ML components.

2.2.8.8. Verification and Validation (V&V) Report

a) **Functional testing results:** Detailed results from software unit, integration, system, and acceptance testing. The documentation should demonstrate that the software performs according to its design specifications under expected conditions. This must include testing of the AI/ML model's integration within the software system and its data pipelines

b) **AI/ML Model Specific Validation:**

i) *Performance Validation*: Detailed results of the AI/ML model's performance on independent, previously unseen test datasets. This should include quantitative metrics (e.g., accuracy, precision, recall, F1-score, ROC-AUC) across various subpopulations and use cases, performance benchmarking against predefined acceptance criteria, and analysis of performance characteristics relevant to the model's intended clinical use (e.g., false positive/negative rates, sensitivity to noise).

ii) *Robustness Testing:* Evidence of the AI/ML model's resilience to variations, anomalies, or adversarial manipulations in input data. This can include Testing with synthetic or perturbed data and, Assessment of performance under edge cases or out-of-distribution data.

iii) *Bias Testing:* Specific tests to identify and quantify potential biases in the AI/ML model's performance across relevant subgroups (e.g., age, gender, ethnicity, disease severity), with documented mitigation strategies and their effectiveness.

iv) *Generalizability Testing:* Validation that the AI/ML model performs effectively across different clinical environments, hardware, or patient cohorts not seen during training.

v) *Explainability/Interpretability Verification (if applicable):* Where interpretability is a design requirement, provide verification that the model's explanations are consistent, accurate, and useful to the intended user.

c) **Usability and Human Factor Validation:** Provide evidence that the SaMD is intuitive and usable by the intended user population, considering how users interact with and interpret AI/ML outputs, and addressing potential over-reliance or under-reliance on the AI system.

d) **Cybersecurity Testing and Penetration Testing Reports:** Include documentation of threat modeling, vulnerability scanning, penetration testing, and other cybersecurity assessments, explicitly addressing threats unique to AI/ML systems (e.g., data poisoning, model inversion attacks).

e) The evidence should describe the robustness of the software's data protection features and demonstrate that it complies with applicable data security standards and can withstand potential cyber threats. Labeling and Instructions for Use (IFU)

The submitted User manuals, installation guides, and operating instructions must be comprehensive and clearly presented. It is essential to prominently include all warnings, precautions, and intended uses to ensure safe and effective usage.

2.2.8.9. Cybersecurity and Privacy Safeguards

Applicants must demonstrate robust cybersecurity and data privacy measures throughout the SaMD's lifecycle, with particular emphasis on AI/ML components and the data used for their development and operation.

Security Architecture and Encryption Protocols: Describe the overall security framework of the SaMD, including authentication mechanisms, access controls, encryption methods (e.g., AES-256), secure data transmission protocols (e.g., HTTPS, TLS), and secure coding practices.

a) Measures to protect against AI/ML-specific cyber threats, such as data poisoning, model evasion, and model extraction attacks.

b) Include architecture diagrams where applicable and explain how these measures protect against unauthorized access and data breaches.

Data Protection Compliance

c) Provide a comprehensive description of how the SaMD complies with national and international data privacy laws throughout the entire data lifecycle (collection, processing, storage, use, sharing, deletion), including consent management, user data rights, data retention policies, and cross-border data transfer mechanisms.

d) *Privacy for AI/ML Training Data:* Explicitly detail measures to ensure the privacy and confidentiality of data used for training and validating AI/ML models. This includes Robust data anonymization or pseudonymization techniques applied to sensitive training data, Mechanisms for managing data consent for both development and clinical use and Policies on data retention and destruction for training and operational data.

e) *Privacy-Preserving AI Techniques (if applicable):* Describe any advanced techniques used (e.g., federated learning, differential privacy) to enhance privacy while developing or operating AI/ML models.

f) Reference any comprehensive privacy impact assessments conducted, considering the specific data flows and processing activities of AI/ML components.

2.2.8.10. Post-Market Surveillance Plan

Plan for monitoring software performance and handling adverse events.

Detail the procedures and tools for ongoing monitoring of the SaMD's real-world performance, including software updates and user-reported incidents. Information should include indicators for software functionality, failure rates, unexpected behaviour, and clinical outcomes.

Mechanisms for feedback collection, analysis, and reporting;

Provide a structured framework for collecting feedback from users (e.g., healthcare providers, patients), including communication channels, response time, and triage protocols. Describe how the feedback is analysed (e.g., trend analysis, root cause analysis), and outline the procedures for reporting adverse events to the Rwanda FDA following post-market surveillance requirements.

For MLMDs, Real-world performance metrics including AUC decay, demographic performance disparities), Automated monitoring for input/output drift, and Quarterly reports on model stability

2.2.8.11. QMS Compliance Documentation

ISO 13485 Certificate or Equivalent:

Submit a valid ISO 13485 certificate or other recognized certification demonstrating the implementation of a QMS specific to the development and maintenance of SaMD.

Include the scope of certification, issuing body, validity period, and any audit findings or corrective actions.

*Internal QMS Procedures Summary**:***

Provide a summary of procedures covering software lifecycle management, design controls, risk management (in alignment with ISO 14971), version control, corrective and preventive actions (CAPA), and post-market surveillance responsibilities.

Describe how these processes are implemented within the organization to ensure product quality and regulatory compliance throughout the software development lifecycle.

All technical documentation must be submitted in English and uploaded in the IRIMS portal under clearly labelled sections to facilitate efficient review by Rwanda FDA.

2.2.8.12. Risk Management File

Risk analysis and mitigation measures must be conducted according to ISO 14971, with particular attention to risks unique to AI/ML-based SaMDs. This process includes:

a) **Hazard Identification:** Identify hazards related to AI/ML functionality, such as:

   i) **Algorithmic Bias:** Risks arising from biased training data leading to unfair or inaccurate performance across different demographic groups or patient subgroups.

   ii) **Lack of Transparency/Explainability:** Risks from inability to understand how the AI/ML model arrives at its outputs, particularly in critical clinical decisions.

   iii) **Algorithm Drift:** Risks associated with the degradation of model performance over time due to changes in real-world data or environmental conditions.

iv) **Overfitting/Underfitting:** Risks related to poor generalization of the model to new, unseen data.

v) **Data Quality and Integrity:** Risks stemming from poor quality, missing, or corrupted input data leading to erroneous outputs.

vi) **Cybersecurity Vulnerabilities:** Specific vulnerabilities related to AI/ML components, such as adversarial attacks (data poisoning, model evasion) or model theft.

vii) **Unintended Performance:** Risks of the AI/ML model producing unexpected or clinically inappropriate outputs under certain conditions.

b) **Risk Estimation, Evaluation, and Control Measures:** Implement control measures proportionate to the identified risks. For AI/ML risks, these may include:

i) Strategies for bias detection and mitigation in data and algorithms.

ii) Mechanisms for continuous performance monitoring (e.g., real-world performance monitoring, drift detection).

iii) Robust validation and verification processes for model generalization.

iv) Explainability features (where appropriate) and clear user instructions regarding model limitations.

v) Secure data handling protocols and robust cybersecurity measures against AI-specific threats.

vi) Post-market surveillance plans specifically designed to detect and address AI/ML-related performance issues and algorithm drift.

c) The risk analysis must provide a justification and rationale for the classification of the SaMD, aligning with the device's intended use and potential impact on patient health.

2.2.9. RECOGNITION OF FOREIGN APPROVALS AND PREQUALIFIED SaMD

Rwanda FDA may consider an abridged evaluation pathway for SaMD products that have been Prequalified by the World Health Organization (WHO) and for SaMD products that have Approved or authorized by recognized regulatory authorities, such as the US FDA, EMA, MHRA, Health Canada, PMDA, or any other member of the International Medical Device Regulators Forum (IMDRF).

To qualify for this pathway:

a) The applicant must submit a valid certificate or proof of prequalification/approval.

b) Consent of WHO prequalification holder for WHO to confidentially and Expression of interest to be provided to the Authority along with the application.

c) The SaMD must be the same in design, intended use, and functionality as the one reviewed by the foreign authority.

d) Local public health relevance must be demonstrated.

Prequalified SaMDs must still be registered with Rwanda FDA but Rwanda FDA reserves the right to conduct a full technical review or request supplementary data where necessary.

2.3. POST-MARKETING SURVEILLANCE

To ensure the highest standards of safety and efficacy, post-marketing regulatory responsibilities for SaMD must rigorously align with recognized international standards, including the WHO 2021 Framework and the IMDRF/SaMD WG/N74 guidance. This alignment is essential for maintaining trust and upholding quality in the rapidly evolving field of software as a medical device.

2.3.1. Requirements for Vigilance and Post Marketing Surveillance

Applicants shall establish and maintain a robust vigilance and post-market surveillance (PMS) system for Software as a Medical Device (SaMD) to ensure continued safety, quality, and performance throughout its lifecycle. This system shall include mechanisms for monitoring, collecting, analyzing, and reporting adverse events, incidents, and software malfunctions that could compromise patient safety or device performance. Applicants are required to promptly notify the regulatory authority of any serious incidents or field safety corrective actions

In order to ensure the quality of SaMD, the Authority could request PMS reports summarizing findings, trend analyses, and corrective or preventive actions implemented up on the reported and identified quality defect of SaMD. The PMS system should also incorporate real-world performance data and user feedback to support continuous improvement and regulatory compliance

Manufacturers or Developer must implement robust, risk-based PMS systems to ensure the ongoing safety, performance, and effectiveness of Software as a Medical Device (SaMD) in real-world applications. These systems must meet specific requirements:

a) **Risk-based PMS procedures:** Systems must be proportionate to the device's risk classification and usage context.
b) **Real-world performance and usability monitoring:** Include methods such as active surveillance, registries, or automated monitoring tools.
c) **Periodic Safety Update Reports (PSUR):** These must be submitted at defined intervals, summarizing cumulative safety data, adverse events, software issues, and actions taken.
d) **Complaint and adverse event recording:** All safety-related complaints and incident reports must be documented and investigated.
e) **Post-update validation:** Each significant software update must be assessed for safety, performance impact, and clinical validity prior to release.

The software developers shall comply with timelines prescribed in Rwanda FDA's pharmacovigilance and medical device vigilance guidelines for the reporting of adverse events. They shall maintain traceability and documentation of all PMS activities for inspection and audit.

These measures ensure that the SaMD continues to meet safety, effectiveness, and quality expectations throughout its life cycle. In fact, the developer shall establish PMS systems to Monitor real-world performance and Detect safety or usability issues

2.3.2. ADVERSE EVENT REPORTING

2.3.2.1. Types of reportable Adverse Events for SaMD

In the context of Software as a Medical Device (SaMD), an adverse event refers to any malfunction, performance deviation, or incorrect output that either directly or indirectly compromises patient safety, delays care, or misguides clinical decisions.

Examples include but not limited to Inaccurate or misleading diagnostic/treatment output, Unanticipated software shutdowns or errors during use, Incorrect data processing, display, or storage, Failures in user interface that lead to misinterpretation and Version control or update failures impacting performance

All such events must be assessed for seriousness and reported according to Rwanda FDA's timelines and vigilance procedures.

2.3.2.2. Reporting Requirements and Timelines

Developpers must ensure that all adverse events, especially those classified as serious incidents are documented, assessed, and reported to Rwanda FDA according to the applicable regulatory timelines. These timelines align with Rwanda FDA's pharmacovigilance and medical device vigilance frameworks.

S/N	Type of Adverse Event	Reporting Timeline	Reporting Tool/Method
1	Serious Adverse Event	10 calendar days	SaMD Adverse Event Form
2	Non-serious Adverse Event	30 calendar days	SaMD Adverse Event Form
3	Safety-related Complaint	15 calendar days	Complaint Log or Form
4	Software Malfunction Resulting in Harm	10 calendar days	Incident Notification Form

Reports should include Description of the incident or complaint, Date and location of occurrence, Device version or update (if applicable), Consequences for the patient or user and Any corrective or preventive actions taken

Note:

1. All submissions must be retained for audit purposes and aligned with good post-market surveillance practices.
2. All serious incidents must be reported to Rwanda FDA within specified timelines.

2.3.2.3. Software Updates and Change Notification

Software updates and change notifications are grouped under a unified process to ensure clarity and compliance. All updates shall be managed under post-market surveillance through a formal change control system and assessed for regulatory reporting requirements.

Applicants are required to establish a documented change management process for all software updates, including:

a) **Categorization of Updates/Changes**

Change classification should follow the principles outlined in the IMDRF SaMD WG/N23 guidance on software modification types

S/N	Change Type	Description	Regulatory Impact
1	Major Change	Modifies intended purpose, clinical algorithm, or output interpretation, input data types, or risk classification	Requires prior approval by Rwanda FDA, may necessitate new clinical validation data.
2	Moderate Change	Affects functionality or performance but not the intended purpose.	Notification may be required.
3	Minor Change	Affects non-clinical features (e.g., UI, cosmetic fixes, technical optimizations that do not affect clinical performance).	Document internally; report in PSUR.

Manufacturers must assess each change and document the justification for its classification.

b) **Documentation and Version Control**

i) Maintain a version history with change logs.

ii) Describe the nature and rationale of each change.

iii) Indicate whether new training data were introduced and the scope of the data.

iv) Summarize re-validation and regression testing results.

v) Provide an updated risk analysis aligned with the change.

c) **Submission and Notification Process**

i) Major changes must be submitted to Rwanda FDA via IRIMS for prior approval, with supporting documentation

ii) Minor changes must be logged internally and included in the Periodic Safety Update Reports (PSURs)

iii) Changes must be classified according to IMDRF SaMD WG/N23 guidance on software modification types.

d) **Timing and Surveillance**

i) Notification of major changes or updates should be submitted prior to implementation (market release)

ii) Post-deployment monitoring must continue for all versions to detect safety signals or usability degradation.

iii) These measures ensure that any modification to SaMD does not compromise its safety, effectiveness, or intended use after-market authorization.

2.3.3. ALGORITHMIC STABILITY MONITORING

For Machine Learning-enabled Medical Devices (MLMD), manufacturers must implement proactive monitoring to ensure ongoing algorithmic safety and performance in real-world use. Requirements include:

a) **Performance Drift Detection**: Track metrics (e.g., AUC, PPV, NPV) against baseline validation data and Flag deviations exceeding predefined thresholds (refer to per IMDRF/SaMD WG/N41).

b) **Bias Mitigation**: Conduct quarterly audits of outputs across demographic subgroups (age, gender, ethnicity or geographic subgroups) and Document corrective actions if bias detected exceeds thresholds

c) **Version Control and Rollback Protocols**: Maintain a version history of all algorithm updates and Define criteria and procedures for reverting to a prior stable version if performance degrades.

d) **Reporting**: Submit stability reports biannually (or quarterly for Category III/IV SaMD) via IRIMS which include Summary of performance metrics, Actions taken to address drift or bias and User feedback analysis

2.3.4. SUBMISSION OF APPLICATION

All applications for SaMD registration of either locally or foreign developed, shall be made in writing via a cover letter and application form dated and signed by the applicant.

The application shall be submitted through the Rwanda FDA online Portal available at Rwanda FDA website

A reference number is automatically assigned to the application and it will be used in all subsequent correspondences relating to the application.

The software should be submitted to Rwanda FDA accompanied with a cover letter together with a printed notification email clearly stating the application reference number generated from the portal at the time of submission.

1.1.1. RECEIVING NEW APPLICATIONS

Rwanda FDA shall acknowledge receipt of applications submitted and an acknowledgement receipt will be issued to the applicants. In addition, the disk drive containing SaMD shall be received at Rwanda FDA Head office, and only complete applications will proceed to evaluation. However, the incomplete submissions will be flagged within the system and returned to the applicant for correction.

ENDORSEMENT OF THE GUIDELINES

	Prepared by	**Checked by**		**Approved by**
Title	**Division manager…..**	**Head of Department**	**Division Manager for QMS**	**Director General**
Names	Dr. Steven NKUSI	Dr. Vedaste HABYALIMAN	Marie Ange UWASE	Prof. Emile BIENVENU
Date & Signature				

APPENDICES

APPENDIX I: Cover Letter

QMS Nº: DD/HMDR/FMT/001 Revision No: 0 Effective Date: 25/08/2025

<Applicant>
<Address>
<Postal Code><Town>
<Date>

<Applicant's reference>
<Rwanda FDA>
<P.O. Box:1948><Kigali_Rwanda>

Dear Sir/Madam,

Subject: Submission of Application Dossier(s) for Marketing Authorization of < Medical device(s) >

We are pleased to submit our Application Dossier(s) for the registration of medical devices/In Vitro Diagnostics Devices (IVDDs) that details are as follows:

Name of Software as Medical device (SaMD):
……..

Classification of the Software as Medical device (SaMD):
……

Intended use of the Medical Device(s):
…….....

You will find enclosed the submission dossier as specified hereafter

- ☐ Two (2) CD rom/external driver that contains the summary of technical documentation (STED) in selectable PDF format
- ☐ The proof of payment.
- ☐ We confirm that the electronic submission has been checked with up-to-date and state-of-the-art antivirus software.

☐ Type of Submission ☐ Full registration Application ☐ Abridged Application ☐ notification

☐ sample(s) submitted

☐ I confirm that the Product Dossier information submitted is the same in all aspects as the product registered with the relevant SRA, WHO PQ and EAC (Only for Abridged Applications)

I, the undersigned certify that all the information in this form and accompanying documentation is correct, complete and true to the best of my knowledge

Yours sincerely,

<Signature>

<Name>

<Title>

<Phone number(s)>

<Email address>

APPENDIX II: PRODUCT REGISTRATION APPLICATION FORM

1.0PARTICULARS OF THE MEDICAL DEVICE (Bold or Tick the right type of application)	
1.1.	Type of application: • Full registration •Abridged registration
1.2.	
• New • Renewal • Variation* * If variation has been made, information supporting the changes should be submitted.	
1.3.	Name of the Software as Medical (SaMD):
1.4.	Classification of the Software as Medical (SaMD):
1.5.	Intended use of the Software as Medical (SaMD) *Clearly defined medical purpose, user group, and setting*
1.6.	Name and address (physical and postal) of Applicant
Address: Country: Telephone: Telefax: E-Mail:	
1.7.	Name and address (physical and postal) of the manufacturer
Address: Country: Telephone: Telefax: E-Mail:	

1.8.	Description of UI and functionalities of the Software as Medical (SaMD)
1.9.	Device Lifecycle Information:
1.10.	Other sister/variants of the Software as Medical (SaMD) registered or applied for registration
1.11.	List all accessories that are manufactured/ sold with the devices
1.12.	EAC Market Authorisation Status for other another SaMD (if applicable)
SaMD name: Regulatory Authority(ies) where the product is authorized: Marketing authorization number(s): Indication(s):	
1.13.	Have you applied for Marketing Authorization(s) of Software as Medical (SaMD) in any of the countries of the East African Community (EAC)? • Yes • No If yes state Software as Medical (SaMD): Regulatory Authority(ies) where you have applied for registration: Indication(s):
1.14.	Country of origin (where the device was manufactured):
1.15.	Device Marketing Authorization in the country of origin (Attach Marketing Authorization of the Software as Medical (SaMD) from the National Regulatory Authority). If not registered, state the reasons

	• Authorized Country: Date of authorization: Authorization number: • Refused Country: Date of refusal: Reason for refusal:	• Withdrawn (by the applicant after authorization) Country: Date of withdrawal: Reason for withdrawal • Suspended/revoked (by competent authority) Country: Date of suspension/revocation: Reason for suspension/revocation:
1.16.	Name(s) and physical address(es) of the manufacturing site(s) of Software as Medical (SaMD). Alternative sites should be also declared here. All manufacturing sites involved in the manufacturing process of the device, stating the role of each including the quality control / in-process testing sites should be listed.	
Address: Country: Telephone: Telefax: E-Mail:		
1.17.	Name and address (physical and postal) of the Agent/Local Technical Representative (LTR) (Attach a valid appointment letter notarized from the country of origin)	
Address: Country: Telephone: Telefax: E-Mail:		
1.18.	Declaration of Conformity specifying all international and national standards used in the manufacturing of the Software as Medical (SaMD)	

1.19.	Name and address (physical and postal) of the Contract Research Organisation(s) where the clinical studies of the Software as Medical (SaMD) were conducted. (If applicable)

Address:

Country:

Study ID:

Telephone:

Telefax:

E-Mail:

2.0DECLARATION BY THE APPLICANT

I, , the undersigned certify that all the information in this form and accompanying documentation is correct, complete and true to the best of my knowledge. I further confirm that the information referred to in my application dossier is available for verification during the Quality audit inspection. I also agree that I shall carry out pharmacovigilance and Post-Marketing Surveillance to monitor the safety, quality and performance of the device on the market and provide safety, quality and performance update reports to Rwanda FDA.

I further agree that I am obliged to follow the requirements of Rwanda's Legislation and Regulations, which are applicable to Software as Medical (SaMD). I also consent to the processing of information provided to Rwanda FDA. It is hereby confirmed that fees will be paid/have been paid according to the authority's rules*

Signature:

Date

* Note: If fees have been paid, attach proof of payment

APPENDIX III: SaMD ADVERSE EVENT REPORTING FORM

	Section	Details to be Provided
1.	**Report Type**	☐ Initial Report ☐ Follow-up Report ☐ Final Report
2.	**Date of Report Submission**	[DD/MM/YYYY]
3.	**Reporter Details**	
	Name	
	Institution/Organization	
	Position/Title	
	Telephone	
	Email	
4.	**SaMD Details**	
	Device Name	
	Registration Number (if applicable)	
	Software Version	
	Manufacturer	
	Intended Use	
5.	**Description of the Adverse Event**	
	Date of Event	
	Location of Event	
	Event Summary	Provide a concise, factual description of the event and how it was detected.
	Consequences	Describe impact on patient, user, or workflow (e.g., delay in treatment, misdiagnosis).
	Classification	☐ Serious ☐ Non-serious ☐ Software malfunction with harm
6.	**Actions Taken**	
	Corrective Actions	Describe actions already taken or planned by the manufacturer or applicant.
	Software Update (if applicable)	☐ Yes ☐ No If Yes, provide version and date of release.
7.	**Risk Mitigation Implemented**	
8.	**Supporting Documentation**	Attach logs, screenshots, update history, validation reports, or relevant investigation data
9.	**Declaration**	I hereby declare that the information provided above is accurate to the best of my knowledge.
	Signature Date	

APPENDIX IV: SaMD RISK CLASSIFICATION CRITERIA

Risk Class	State of Healthcare Situation/Condition	Significance of Information Provided by SaMD	Example Use Case
Class I	Non-serious	Inform clinical management	Wellness monitoring app
Class II	Serious	Drive clinical management	Decision support tool for diabetes
Class III	Critical	Treat/Diagnose	AI-based cancer diagnosis software

APPENDIX V: TEMPLATE FOR CLINICAL EVALUATION SUMMARY

1.	**Device Information**	
1.1.	Device Name	
1.2.	Manufacturer	
1.3.	Intended Use	
2.	**Clinical Association**	
2.1.	Describe the clinical context and need	
2.2.	Reference published scientific literature	
3.	**Analytical/Technical Validation**	
3.1.	Input/output specifications	
3.2.	System architecture overview	
3.3.	Testing methods and results	
4.	**Clinical Validation**	
4.1.	Study type: *retrospective/prospective/hybrid*	
4.2.	Study population and setting	
4.3.	Statistical analysis (sensitivity, specificity, ROC, AUC)	
4.4.	Comparative performance if applicable	
5.	**Conclusion**	
5.1.	Summary of safety, performance, and benefit-risk profile	

APPENDIX VI: VERSION CONTROL TEMPLATE FOR SaMD

Version Number	Date	Type of Change	Description of Change	Validation Performed	Impact Assessment	Rwanda FDA Notification
v1.0	YYYY-MM-DD	Initial release	N/A	Verification & validation	Baseline	Initial submission
v1.1	YYYY-MM-DD	Minor update	Bug fixes, improved UI	Internal testing	None	Annual report
v2.0	YYYY-MM-DD	Major update	New ML model for diagnosis	Clinical validation	Affects diagnosis	Pre-approval required

APPENDIX VII: CHANGE/UPDATE NOTIFICATION FORM

A standard form must be used to notify Rwanda FDA of any major or moderate changes:

S/N	FIELD	DESCRIPTION
1	Device Name and Registration Number	Official name of the SaMD and its assigned registration code
2	Manufacturer/Applicant Name	Company submitting the notification
3	Current Software Version	Version number prior to change
4	Updated Software Version	New version number after change
5	Change Classification	Indicate Major, Moderate, or Minor with justification
6	Risk Assessment Summary	Overview of any safety or performance risks introduced
7	Validation/Test Summary	Summary of verification, validation, or regression testing performed
8	Date of Planned Implementation	Expected deployment date of the updated version
9	Submission Type	New notification, follow-up, or additional information
10	Submitted By	Name, title, and contact of the responsible person
11	Date of Submission	The date the form is submitted via IRIMS

This form must be submitted via IRIMS for major changes and retained for audit purposes in the case of minor changes.

APPENDIX VIII: **AI BIAS ASSESSMENT TEMPLATE**

Metric	Pre-Deployment	Post-Market	Acceptable Threshold
Demographic Parity	[Data]	[Real-world]	≤10% disparity
Equalized Odds	[Data]	[Real-world]	p-value >0.05

REFERENCES

1. IMDRF/SaMD WG/N10:2013 – Key Definitions
2. IMDRF/SaMD WG/N12:2014 – Risk Categorization Framework
3. IMDRF/SaMD WG/N23:2015 – Application of Quality Management System
4. IMDRF/SaMD WG/N41:2017 – Clinical Evaluation of SaMD
5. WHO (2021). Ethics and Governance of Artificial Intelligence for Health
6. SFDA (2022). Guidance on AI and ML-based Medical Devices
7. MFDS (2022). Guidance on the Review and Approval of MLMD
8. Rwanda FDA Guidelines for registration Medical Devices and IVDs (2023, 2024)
9. FDA (2021). Good Machine Learning Practice for Medical Device Development."
10. EU AI Act (2024). Risk-Based Classification Framework.