**Predict H1N1 and Seasonal Flu Vaccines**

**(As a part of ACTS Management System)**

**Functional Requirement Specification Document**

**Functional Requirements Document**

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| **Name of Document** | **Predict H1N1 and Seasonal Flu Vaccines** |
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| **Description of Content** | Goal is to predict how likely individuals are to receive their  H1N1 and seasonal flu vaccines |
| **Reference** |  |
| **Approved by** |  |
| **Date of Approval** |  |

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**List of Requirements Elicitation Discussions**

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**Abbreviations**

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| **H1N1** | **Hemagglutinin 1** **Neuraminidase 1** |
| **CDC** | **Centre for Disease Control and Prevention** |
| **WHO** | **World Health Organization** |
| **API** | **Application Programming Interface**. |
| **HIPAA** | **Health Insurance Portability and Accountability Act**. |

**CONTENTS**

**1. INTRODUCTION**

**1.1 Purpose   
1.2 Background   
1.3 Scope   
1.4 References   
1.5 Document Overview**

**2. VACCINE PREDICTION SYSTEM**

**3. FUNCTIONAL REQUIREMENTS   
3.1 Data Collection   
3.1.1 Collection of Demographic Data   
3.1.2 Collection of Health History   
3.1.3 Collection of Behavioral Data   
3.1.4 Field Validations and Business Rules   
3.2 Predictive Modelling for Vaccine Likelihood   
3.2.1 Description   
3.2.2 Cross Functional Diagram   
3.2.3 Functionalities Identified   
3.2.4 Pre- requisites, Assumptions, and Dependencies   
3.2.5 Field Validations and Business Rules**

**3.3 Reporting Features   
3.3.1 Description   
3.3.2 Functionalities Identified**

**3.3.3 Pre - requisites, Assumptions, and Dependencies   
3.3.4 Field Validations and Business Rules**

**3.4 External Interfaces   
3.4.1 Description   
3.4.2 Functionalities Identified   
3.4.3 Pre - requisites, Assumptions, and Dependencies   
3.4.4 Field Validations and Business Rules**

**4. EXTERNAL INTERFACES   
5. AUDIT AND PROVENANCE   
6. DATA MIGRATION AND USAGE**

**1. INTRODUCTION**

**1.1 Purpose**

The purpose of this report is to define the functional requirements for a system designed to predict the likelihood that individuals will receive their **H1N1** and **seasonal flu vaccines**. This prediction system aims to analyse various factors such as personal characteristics, medical history, and external influences to provide personalized vaccination predictions.

**1.2 Background**

Due to various factors, flu vaccination rates can vary particularly for seasonal flu and H1N1 vaccines. These factors include health condition of a person, general awareness, social and financial status and availability of medical care. A predictive analytic model can help medical providers target on vulnerable groups more efficiently, boost vaccination rates and improve community health outcomes.

The system will utilize data-driven learning techniques and accessible data (e.g., characteristics of a population, past vaccine dose records, health history) to access the probability of an individual choosing flu vaccine

**1.3 Scope**

This document covers the specific functions that a system must be able to perform for the vaccine prediction. It encompasses:

~ **Data gathering** (demographic information, medical records, previous vaccination history)

~ The use of statistical techniques, algorithms, and machine learning methods to analyze current and historical data to make predictions about future events or trends (for likelihood estimation)

~ Tools within a system that allow users to generate, customize and view reports on specific data (reporting features)

~ API (Application Programming Interface) merging with healthcare systems (e.g., vaccination data and health records)

~ Data transfer, saving and Inspection processes

**1.4 References**

~ **Centre for Disease Control and Prevention (CDC)** vaccine instructions

~ **World Health Organization (WHO) vaccine uptake data (for flu)**

~ Machine learning applications in healthcare articles

~ Health data API documentation

**1.5 Document Overview**

~ Section 1: Overview of the Vaccine Prediction System

~ Section 2: System Overview and Components

~ Section 3: Operational Requirements and Features

~ Section 4: External Connections and Data Integration

~ Section 5: Data Monitoring, Reporting, and Provenance Tracking

~ Section 6: Data Transfer and Historical Data Management

**2. VACCINE PREDICTION SYSTEM**

**To estimate an individual’s chance of receiving the H1N1 and flu immunizations, the Vaccine Prediction System utilizes advanced data analysis techniques. To assess the likelihood of vaccination, it merges historical medical data, personal demographic details, and health-related behaviors**

**3. FUNCTIONAL REQUIREMENTS**

**3.1 Data Collection**

**3.1.1 Collection of Demographic Data**

The system will collect demographic data such as:

~ Age group

~ Education

~ Gender

~ Location (region, urban/rural)

~Income level

**3.1.2 Collection of Health History**

Health data such as:

~ Chronic Medical Conditions

~ Vaccination History

~ Concern and Knowledge Related to H1N1

~ Belief and Opinion about Vaccination

**3.1.3 Collection of Behavioral Data**

Behavioural patterns like:

~ Antiviral Medication

~ Avoidance of Public Spaces

~ Use of Face Masks

**3.1.4 Field Validations and Business Rules**

* Before processing, ensure the accuracy and completeness of individual health profile
* Including confirmation of received vaccines, verify vaccination records
* Against official medical records, authenticate health status

**3.2 Predictive Modelling for Vaccine Likelihood**

**3.2.1 Description**

To Estimate the probability of an individual receiving the flu vaccines, the system will use a **machine learning model**. To make a prediction, it will use input data such as Personal details, prior flu shot behaviour, health conditions, and external factors (e.g., regional vaccination campaigns)

**3.2.2 Cross Functional Diagram**

Leading to the final prediction on vaccine likelihood, a cross-functional diagram will show how the input data is processed by the predictive model.

**3.2.3 Functionalities Identified**

* **Data pre -processing:** Clean, normalize (making it consistent), and transform data into a usable format.
* **Model training:** Train machine learning algorithms (e.g., decision trees, logistic regression) on historical vaccination data to learn the patterns.
* **Prediction generation:** To predict the likelihood of an individual receiving the vaccine, use the trained model.
* **Outcome interpretation:** Output the prediction along with confidence intervals (the range within which the prediction is likely to be accurate).

**3.2.4 Pre- requisites, Assumptions, and Dependencies**

* **Historical data** (vaccination, health history) must be available and properly formatted for the system to use it.
* The system will rely on external **healthcare databases** for real-time data (e.g., public health records, vaccination rates in the region).
* **Sufficient labelled data: Machine learning model** training requires sufficient labelled data to generate accurate predictions.

**3.2.5 Field Validations and Business Rules**

* Recent data sources: Ensure the model uses up-to-date data sources.
* Apply **fairness checks** to ensure no bias in the prediction model based on factors like gender, race, etc.
* Maintain the consistency of historical health data so the model can learn accurately and avoid errors.

**3.3 Reporting Features**

**3.3.1 Description**

On vaccine likelihood predictions, the system will provide comprehensive reports. To make informed decisions on how to prioritize vaccination efforts, these reports will be used by healthcare professionals and policy makers

* + 1. **Functionalities Identified**
* **Report generation:** Based on predicted vaccine likelihood, create reports for individuals or groups
* **Visualization:** For easy interpretation of results, provide graphical visualizations (e.g., bar charts, probability curves)
* **Recommendations:** Based on prediction results, generate recommendations for outreach or targeted vaccination campaigns.

**3.3.3 Pre- requisites, Assumptions, and Dependencies**

* Document creation requires current database with predictive analytics
* Data must be summarized and masked for privacy protection.

**3.3.4 Field Validations and Business Rules**

* During report creation, guarantee the confidentiality of personal data.
* Confirm that the report creation process follows data protection and security regulations.

**3.4 External Interfaces**

**3.4.1 Description**

**The Vaccine Prediction System will link up with multiple external systems for data flow, such as:**

* **Healthcare data systems (e.g., hospital records for vaccination information)**
* **Public health databases** for community-based flu vaccination campaigns
* **External API** for socioeconomic and health information

**3.4.2 Functionalities Identified**

* **Data exchange API**: Retrieve and send data between the predictive model and external databases
* **Integration with national immunization programs**: To gather real-time vaccination statistics and adjust predictions
* **Interfacing with AI tools**: Allow for AI-driven improvements in prediction accuracy.

**3.4.3 Pre - requisites, Assumptions, and Dependencies**

* Protected API links must be established with external systems.
* External systems must provide Up-to-date, precise data for accurate predictions.

**3.4.4 Field Validations and Business Rules**

* Check the integrity of incoming data from external API for correctness.
* Ensure observance with healthcare data privacy laws (e.g., HIPAA).

**4. EXTERNAL INTERFACES**

The system will interface with:

**~ Public Health API:** To fetch vaccination information

**~ Health Record Systems**: For acquiring vaccination details and previous vaccinations.

~ **Regional Health Campaigns**: For assessing the success of regional awareness campaigns

**5. AUDIT AND PROVENANCE**

The system will maintain history of prediction results and data alterations. These logs will be used for **audit purposes** and to ensure that predictions are based on the recent and accurate data available.

**6. DATA MIGRATION AND USAGE**

**Historical vaccination data (e.g., from national health surveys) will be uploaded into the system to train the machine learning model. This data will be purified, verified, and structured appropriately before usage.**