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# Integration of EHR and PHR leveraging cloud services for approving treatments

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**Abstract**---Historically clinicians have been prescribing treatment to patients based on their visit to the hospital without referring to previous health records of the patients. This is primarily because clinicians do not have access to patient's medical records. Though, with digital revolution in healthcare domain, patient's medical history is available via Patient Health Records using Electronic Health Records (EHR) and Personal Health Records (PHR) systems. However, as EHR and PHR are maintained as separate systems in isolated manner, efficient accessibility of these systems is still very limited. To provide a unified view of patient data to the providers and the patients, integrated data resulting from such system not only allow to access past health records of patients, but further leverage PHRs data to provide quality treatment by examining the effect of treatment on patient's health. Data integration techniques such as ETL and Cloud based technologies can be used to develop a system which provides real-time integration of healthcare data sourced & streamed from various healthcare systems. It will leverage the recommendations of quality treatments to the patients as well as the clinicians from cohesive view of integrated EHR and PHR data. Clinicians refers to this processed data for prescribing treatments and patient leverages the data for self-care. This model leverage cloud-based technologies for efficient delivery of integrated data sourced from multiple healthcare repositories.

**Keywords**---electronic health records (EHR), personal health records (PHR), electronic medical records (EMR), cloud, ETL.

## Introduction

Today, the healthcare delivery paradigm is evolving from an organization-focused model to a patient-centered model [1]. Past scattered information of patients is now shifting to patient-centered information that allows patients to ubiquitously gather and view their fitness information through a personal health record (PHR) [2]. PHR is referred as a collection of computer-based resources that help people to retrieve as well as establish their lifetime health information and render applicable segments of it available to those in need of it [3,4]. There is no consensus or pattern as to what details the PHR can store [5]. Any shared knowledge supported by PHRs include issue lists, treatments, major diseases, lists of providers, allergy details, home-monitored data, personal background, social history and lifestyle, immunizations, drugs, and laboratory tests [6].

Cloud computing is a paradigm that allows ubiquitous and on-demand access to a common pool of services [7]. Ubiquitous access to knowledge not only helps people but also healthcare practitioners. Due to the high degree of expertise of mobility doctors, pervasive access to appropriate and timely patient data will help to make vital care decisions [8] and even save lives [9]. Ubiquity allows access to health information, which may contribute to privacy problems and unwanted access.

PHR holds confidential patient health details and thus, access to PHR data must confirm with the privacy policy established by the patient. That means it should be reliable enough to express the fulfillment of these privacy policies. Privacy is identified as the most delicate component of health record structures and must be achieved through an adequate mechanism [10]. Health data protection and safety are one of the main issues of e-health. Since Cloud Server Provider is typically a third-party component, health data should be maintained safely to protect privacy. Cloud servers are known to be semi-trusted since they do not deliberately seek to retain the records, however they do, for example, a traffic analysis that can reveal the details. Literature solutions provide protection of data prior to outsourcing to the cloud, access management, and legitimate party authentication of who is accessing it. The word integrated applies to cohesive knowledge that can be exchanged with approved health partners (e.g., physicians, nurses, medical organizations). PHR programs retain confidential health records that could serve to save life and are used in emergency scenarios. Because of this, patient's information should always be consistent to be reliable health stakeholders.

Traditionally, health providers have become heavily dependent on the traditional method for keeping patient health information in order to detect the situation and recommend care. The digitization of patient data has revolutionized healthcare over the last few decades. The three disparities found in healthcare are: wellness and well-being gaps, financing and productivity gaps, care gaps and consistency gaps. These disparities are the product of a lack of synergy between the medical

facilities offered by hospitals, clinics, etc. [11]. Improving the standard of healthcare is of the utmost significance in the real world in order to obtain the optimal result of the services provided to patients. The four main supports for delivering quality-based clinical care include patient-centered care, real-time patient tracking, predictive disease analysis, and improved treatment methods [12]. Patient-centered care by recommending therapy on the basis of proven historical health data, preventing overdose of medications, and increasing the likelihood of disease recovery.

Electronic Health Information Records, for example, EHR and PHR perform a crucial part in transforming medicine by digitizing health data that can be preserved and maintained throughout the life of patient, accessed anywhere, anytime. Using EHR, healthcare professionals can view historical patient details about the services they have earned in the past. Health practitioners can also appeal to the CDS (Clinical Decision Support) to recommend medication to patients referring to medical recommendations and to reduce the possibility of unfavorable health effects [13].

While EHR is open to health professionals and contains medical care information, a different form of health records – PHR – has now arisen. PHR provides the opinion of patients on the data and is owned/maintained by patients themselves. There are several suppliers of EHR and PHR services in operation. However, most of these providers manage EHR and PHR as a separate standalone system and there is no integration between them. But, due to the realization of transformative potential of the integration of EHR and PHR systems, integrated systems are preferred over standalone and tethered systems for providing better care to the patients and enhance their ability to manage their own care. A lot of study has already been done and is going on in this field:

- How PHR data can flow to EHR system?
- A seamless way to exchange data between EHR and PHR Systems

In order to get regular updates on how patients have responded to treatment, it's important for health providers to get access to personal health record (PHR) and data resulting from continuous health monitoring of patients. Mobile computing and wearable technology have provided access to personal health information contained in these applications, and PHR data will be further combined to offer a centralized view of medical data to health professionals. In addition, healthcare technologies such as PHR-based applications may be used successfully for patients to preserve and update their own clinical data, allowing them self-reliant in disease management [14].

However, EHR data is largely stored and managed by health professionals. Patients themselves may not have access to such information. As a result of which patients are largely relying on health services for their care and lifestyle, so that they can maintain a healthier lifestyle. Integrated data from EHR and PHR may also be moved to a data warehouse that can be used by patients through a patient self-care portal to track and sustain a healthier lifestyle. The advantages of combining EHRs and PHRs are enhanced and interactive decision-making through accessing real-time data, increased trust and trust due to seamless

access to knowledge, better health results by improved connectivity, portability of medical records, the introduction of material auto-populations to provide more reliable, detailed and timely content through eliminating recurrence [15].

This paper suggests a framework for combining data from diverse types of health reports, performing review of those data and presenting the resultant knowledge to health professionals and patients in order to increase the consistency of health care. In order to integrate the different EHR and PHR sources, cloud platforms are used for data aggregation, persistence, and review.

## Background

### Electronic Health Records

EHR consists of patient-centric knowledge processed online in a structured way that is open to healthcare professionals around the globe. EHR data consists of patient demographics (age, sex, etc.), laboratory results, immunization specifics, patient background, family history, medications provided, allergic patient information, billing information, etc. as seen in Table 1.

Table 1. Data format of HER

Attributes	Examples
Demographics	Age, Sex/Gender
Diagnoses	Diagnosis, Severity, Medical History
Problem List	Active diagnosis, Resolved diagnosis
Family History	Familial disorders, Risk factors
Allergies	Food and Medication allergy, Anaphylaxis
Medications	Prescriptions written
Procedures	Inpatient, Outpatient
Lab Order/Values	CBC results, HbA1C levels
Vital Signs	BMI (weight and height), blood pressure
Reports	Radiology, Pathology, and other reports
Utilization	Cost, Hospitalization
Immunization	DTaP, HepB, IPV

Selecting a right EHR system for an organization depends on various factors such as budget, patient's population, accessibility, security etc. There are two variations of Electronic Health Record of patient i.e. EHR and EMR. And both are maintained by health providers and Clinician. Former is an inter-organization record which is only accessible to specific health provider / clinic. A given healthcare provider only gets access to patient records which were treated by that provider and does not get access to treatment received by patient from other providers. EMR extends EHR and provides intra-organization view of Health Records, so that not only health providers get access to previous treatment recommended to patient by them but also the treatment that patient got from

other health providers. Also EHR systems must assure the patients regarding privacy, security and confidentiality which is one of the major challenge till now. Although HIPPA (Health Insurance Portability and Accountability Act) and PIHI (Privacy of Individually Identifiable Health Information) were introduced for ensuring security in transactions [16]. EHR data can vary greatly and can include vital signs (such as body temperature, pulse, respiration, and blood pressure), age, weight, medications, allergies, medical examination results, and radiology images that are used to diagnose conditions [17].

Broadly, the EHR systems can be classified into two types, which are as follows.

- a) Cloud-based EHR
- b) Server-based EHR

This Cloud-based and Server Based EHR are further categorized into various categories as shown in Fig. 1. below.

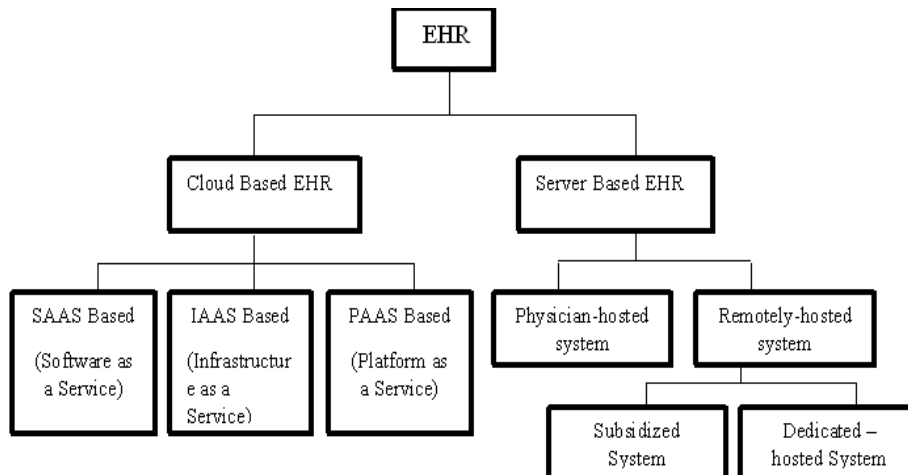


Fig. 1. Types of HER Systems

Cloud-based EHR is categorized into three categories [18]:

- SAAS Based- It means Software as a service based EHR. These EHRs are introduced remotely by a Cloud Service Provider and are made accessible to the end users like hospitals, healthcare providers, clinicians etc.
- IAAS Based-It means Infrastructure as a service based EHR. In this the infrastructure including storage, hardware, servers etc. are hosted by the cloud and used by the hospitals, healthcare providers, clinicians.
- PAAS Based - It means Platform as a service based EHR. In this, the platform is introduced in the cloud and retrieved through the browser.

Server Based EHR is of two types [19].

- Physician-hosted System-In this type of EHR, Physician has the overall responsibility of maintenance, security, and back-up. EHR is stored on their own servers.

- Remotely-hosted System- In this type of EHR, the third party has the overall responsibility of maintenance, security, and back-up as EHR data is stored on their servers.

It is further subdivided into two categories –Subsidized system and dedicated-hosted system.

- Subsidized System- Subsidizing entity has the overall control over the data as they are financing, and their servers are being utilized for storage of EHR data.
- Dedicated-hosted System- In this, EHR data is stored on vendor's specific server. Physicians do not have control over the data.

Various advantages associated with using Cloud-based EHR are cost effectiveness, security, privacy, interoperability, scalability, fast exchange and sharing ability [20]. Cloud-based EHR are also customizable according to the needs of the healthcare providers and the hospitals [21]. On the other hand, server based EHR is expensive in terms of handling, maintenance, prone to attacks. Apart from the various benefits of using cloud based EHR, it also suffers from some limitations which includes lack of standardization of data, complexity related to ownership of data, privacy issues, lack of strict laws for the protection of sensitive information of the patients, require good internet connectivity, risk related to compromising the critical data of the patients, existence of data for long time on cloud etc. are some of its concern [22]. One of the major challenges faced by the patients is the lack of access to their complete health records due to change in their locations, change in their physicians from which they are taking treatments. Sometimes they got admitted to the hospitals also due to some serious health problems. Similarly, healthcare providers also face certain problems like the lack of complete details of their patients, their medical history, other important information like allergies, treatments they undergone through also. As suggested in [23], every visit of a patient is recorded with a visit\_id and different encounters are created with every visit having details of encounter's id, time, locations and providers. With every encounter, different observations are created.

### **A Simple Electronic Health Record System**

The EHR contains much of the information included in a conventional health record, for example a patient's health status, behavioral and eco-friendly data. An Electronic Health Record is a real-time, unique statistical health record of a particular entity that contains his or her whole personal health records in a digital format, including medical data such as biography, medical evaluation, diagnosis, test findings, allergies, details of immunization, medication, and so on. Over the duration of his or her life, the record is entered manually by healthcare professionals. Fig. 2 depicts a basic electronic health record system. This contains information from several branches inside the Institution. Varying on the complexity of the EHR scheme, medical information from other departments could be used as well.

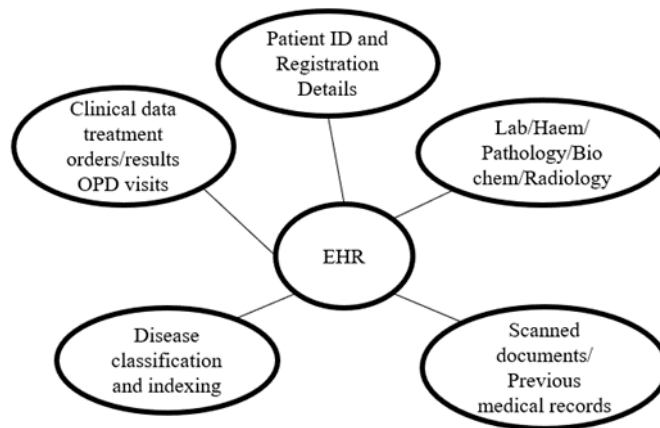


Fig. 2 . A Simple Electronic Health Record System

### Electronic Medical Record Adoption Model

EMRAM is an 8-stage (0-7) model that assesses how often an organization's electronic medical record (EMR) features are being adopted and used. This method allows healthcare organizations to equate their EMR implementation success to those of other organizations around the globe. Table 2 below shows the Electronic Medical Record Adoption Model (EMRAM). EMRAM is an 8-stage (0-7) model that evaluates the degree to which electronic medical record (EMR) functions are implemented and used in each healthcare organization. This approach allows healthcare organizations to compare the effectiveness of their EMR implementation to those of other healthcare corporations around the area.

Table 2. Electronic Medical Record Adoption Model (EMRAM)

Stage 7	Data analytics, governance, catastrophe relief, privacy, and stability are all aspects of the Electronic Medical Record.
Stage 6	Technology facilitates the administration of medication, blood products, and human milk; risk reporting; and a full CDS
Stage 5	Intrusion/Device Security; Structured Templates for Physician Documentation
Stage 4	Nursing and Allied Health Documentation; Basic Business Continuity; CPOE with CDS
Stage 3	Nursing and Allied Health Documentation; EMAR; Role-Based Security
Stage 2	CDR; Basic Security; Central Interoperability
Stage 1	Laboratory, Pharmacy, and Radiology/ Cardiology Information Systems; PACS; Digital Non-DICOM Image Management;
Stage 0	Laboratory, Pharmacy, and Radiology are the three ancillaries that are absent.

### Personal Health Records

Whilst EHR records are primarily maintained and controlled by health providers, PHR represents system of record for patients which are maintained by patients. PHR is completely controlled and maintained by patients. Patient's controls access to PHR data and on the needs basis they can allow different health

providers to access this data. PHR data reflects details such as patient heart rate, blood pressure level, blood sugar level, body temperature, etc. as seen in Table 3.

Table 3. Data format of PHR

Attributes	Examples
Activities	Patient activity data such as steps taken, calories burnt, distance covered etc.
Blood Pressure	Data on patient Heart rate, Diastolic etc.
Height	Data on patient height
Oximetry	Data regarding amount of oxygen in blood
Sleep	Patient sleeping pattern data
Weight	Patient weight, fat mass, bone mass etc.

The key difference between EHR and PHR is that the former is more standardized in nature depending on the assessment and treatment prescribed to the patients, whereas the latter is collaborative and sometimes updated by patients themselves. Recent technical advancements have now rendered it possible to monitor medical data on a regular basis through sensors that demonstrate how different facets of well-being develop over a period that can be immensely beneficial in treating disease and keeping a healthy lifestyle. There are several ways in which patient-generated health data may be used as part of their routine treatment and paired with EHR for increased diagnosis and quality care [24]. Pak and Song [25] projected a system called the Health Capability Maturity Model (HCMM) to measure human health constructed on their degree of health maturity. This model can be seen as a roadmap to help people develop their wellness by helping them reach the optimal maturity stage such that they can follow a PHRS to monitor their health and medical record. The degree of health sophistication is defined as seen in Table 4 below. These levels have also been extended to the acceptance of PHRS.

Table 4. Health Capability Maturity level and the use of PHRS

HCMM Level	Individual's perspective of their health	PHRS adoption
Level 0	Lacking: -Health self- management -Health Knowledge -Motivation	Not using PHRS
Level 1	-Awareness of the necessary changes -Willing to change to improve their health	Considering PHRS but not adopting it yet
Level 2	Take actions on: -Adopting some healthcare plan -Making decision related to their health management	Slow adoption of PHRS
Level 3	-Quantifiable approaches are used to: -Self-monitor and -Control output	Any PHRS features are being used.
Level 4	-Be proactive rather than reactive when it comes to your wellbeing. -Respond immediately to	Using PHRS, quantitatively track and regulate their fitness.

improvements in your health and potential for growth.
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### Types of PHR

Broadly, PHRs are classified into three categories as shown in Fig. 3:

- **Standalone PHR:** Standalone systems are isolated and not integrated with any other healthcare system. Data is stored either in patient's laptop/computer or cloud repositories. Data is monitored and patient's health behaviors such as exercise; diet plans etc. are tracked. Here, patients enter their own information and will decide with whom they want to share their information [26].
- **Tethered PHR:** Tethered systems are associated with some specific provider or healthcare institution. Here, patient's data is entered by provider or hospital. Such system offers some added features such as reminders, scheduling appointments with health providers to assist both patients and clinicians. These are not changeable records which contains lab reports, immunization records etc. [27].
- **Network PHR:** As name suggests, Network's systems access data from multiple other health systems.

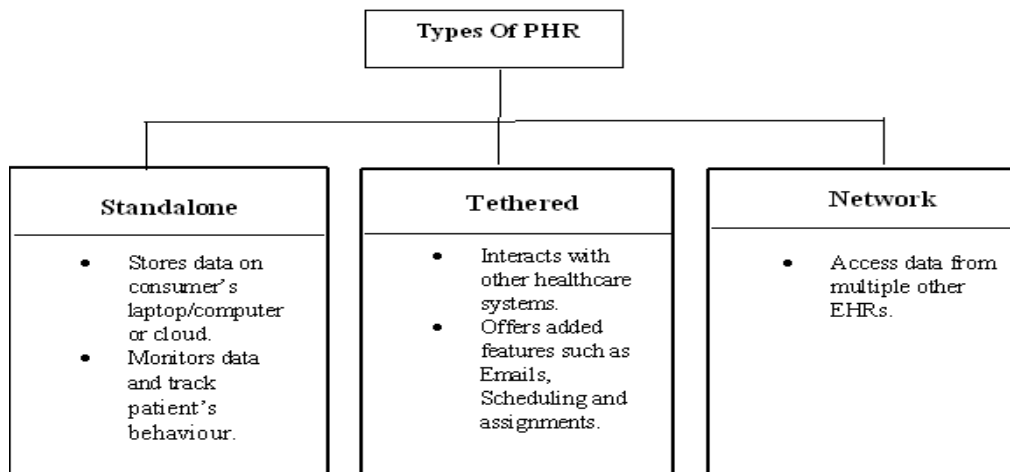


Fig. 3. Types of PHR

Further, there is a need for interoperability of PHR. Not only the PHR but the integration of EHR and the PHR should also be interoperable. There are further various architecture styles of PHRs which primarily refer to how PHR data is stored, consumed, and managed as shown in Fig. 4 below.

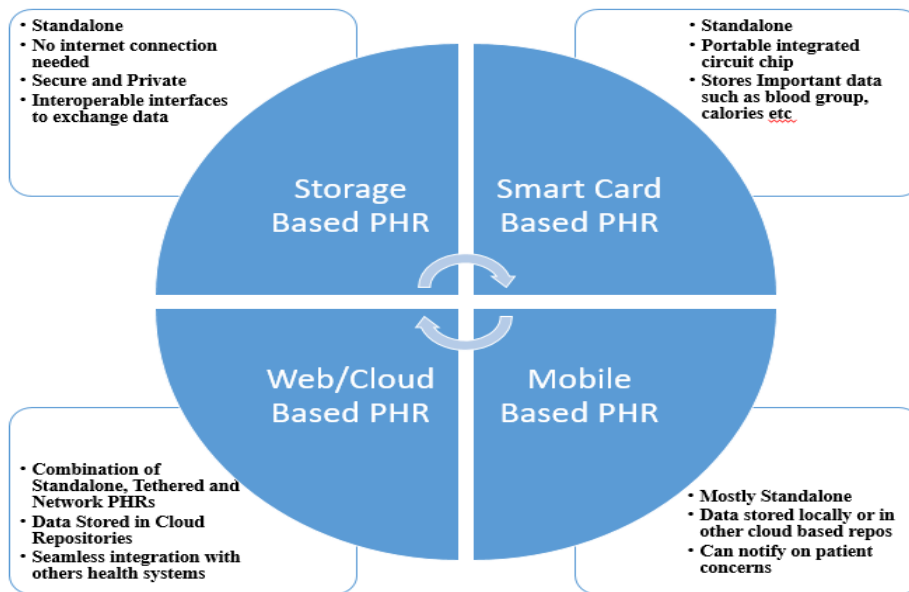


Fig. 4. PHR Architecture Styles

### Integration of Electronic and Personal Health Records

In order to integrate data from EHR and PHR repositories, a common data model needs to be developed to consolidate data from these multiple data repositories. In data science, data warehouse is used to consolidate data from multiple sources into a unified data model. In this paper, a unified schema is discussed that uses ETL method to integrate the healthcare data from various sources like EHR and PHR and collectively stores into data warehouse for further analysis as shown in Fig. 5. The role of ETL is explained as follows:

- Extract the data from multiple sources of healthcare data repositories
- Transform the data to bring it to consistent format
- Load the data into a unified data model in data warehouse

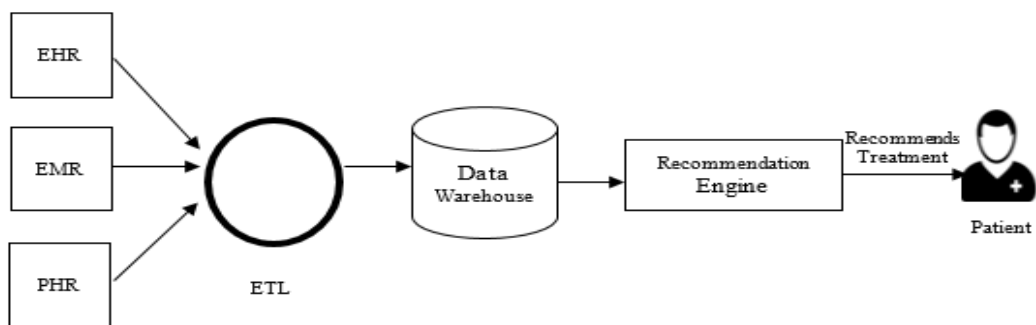


Fig. 5. Integration of EHR and PHR

## **Evolution of cloud**

Cloud computing is thriving in today's world, allowing people to use the internet more easily than ever before. Cloud storage has increasingly established a way for most companies to use its advantages. Amazon Web Services (AWS) is a group of proprietary web-based services maintained by Amazon.com. Both of these facilities, varying from basic storage to advanced database services, compose the cloud infrastructure provided by Amazon. The vast catalogue of AWS clients includes Dropbox, Unclever, Airbnb, Nasdaq, Netflix. As of 2007, more than 300K developers have been successfully utilizing AWS. It is one of the leaders who has taken cloud infrastructure closer to the mainstream helping a variety of startups boot their businesses. AWS is a direct testament of how an Internet-enabled enterprise has developed into a full-technology corporation competitive with dedicated technology firms – including Google, Microsoft, and Apple. In the following case analysis, discuss the different facets of AWS and the market and economic values that contributed to their development and design.

Patients in developed nations or remote areas have to fly to major hospitals with their paper health reports and across the world to access specialist doctors and medical services in large hospitals with EHR programs. In addition, patients enrolled in separate EHR schemes in various hospitals often suffer from the relocation of their files to other hospitals. Such problems may be overcome by incorporating EHR programs into healthcare organizations. However, the introduction of EHR (the method of transmitting patient details between health facilities and exchanging information over the Internet with other healthcare providers) remains a problem and a significant issue since it is exposed to hacking, security breaches and standardization difficulties.

## **Data protection**

Data is the most valuable commodity of the healthcare sector. Data leakage will trigger big damage in the health association, so all health association first considers of data protection in order to secure the confidential data of its patients. Failure to comply with data security rules could result in failure or misuse of intellectual property by the health agency, harm to the integrity of the organization, corporate or person fines and compromise the susceptibility of the scheme to malware infections or hacking. Regulated usage of the digital system in a health agency and the ability to move confidential evidence to and from the cloud plays a critical role for a health institution to perform and run effectively, easily and without limitations. However, this capability must be preserved by a comprehensive approach to data management that Amazon Web Services cloud holds by security measures and methods.

## **Flexibility**

The main advantages of cloud infrastructure are flexibility. Health enterprise may scale up or scale down, and data loads can need rapid adjustment, which is very versatile in the AWS cloud. Cloud infrastructure enables patients to be more mobile. Patients can view files anytime using web-enabled computers such as laptops, iPhone, notebooks, etc. Support for the association will also aid with the

opportunity to quickly exchange records and other files over the Internet. Cloud computing enables the usage of mobile devices. Enterprise mobile management systems will include useful administrative resources to defend the enterprise from phone failure, unintended data loss or faulty codes, necessary insight into modern security threats today, including ransomware and other device-centric assaults. Flexibility is one of the major causes that let healthcare organizations shift their company to the cloud.

### Concept of Hybrid Cloud

There are three types of Clouds: Public Cloud, Private Cloud and Hybrid Cloud. Hybrid clouds are a mixture of public and private clouds. They are made to work together, with data and software flowing freely from one network to the other. It is the ideal choice for a company or entity that requires a combination of all solutions, which is normally determined by market and scale. The main use of hybrid cloud is the ability to merge the scalability of a public cloud with the reliability and power of a private cloud. Data can be securely maintained in a private cloud environment behind firewalls and encryption protocols, then relocated securely into a public cloud environment as required. Hybrid Cloud is used here for the interaction of Patients and Clinicians with the cloud computing framework as shown in Figure 6 below.

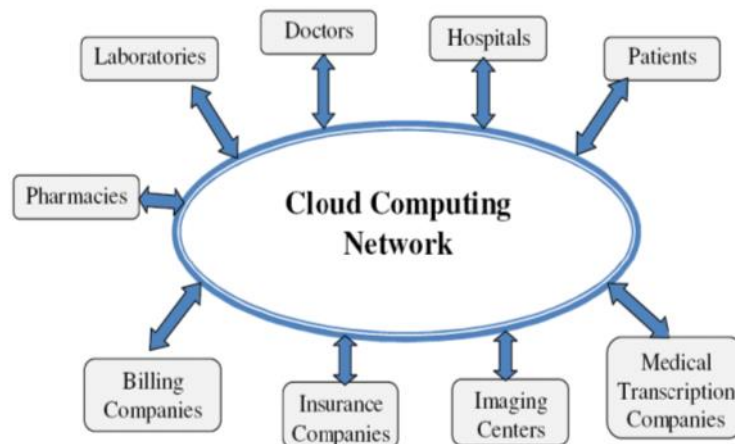


Fig. 6. Interaction of various CDO's and Patient with the cloud computing network

### Proposed Methodology

There are three key steps in the solution:

- Data Consolidation: Load the data from multiple healthcare data repositories into data warehouse.
- Data Insights: Run analysis over the data to extract recommendations for patients.
- Prescribed Treatment: Recommend the treatment to patients on patient-centric self-care portal.

The overall process is shown in Fig. 7 below is explained by the following steps:

### **Data Consolidation (Load data from EHR, EMR and PHR into Data warehouse)**

First step is data consolidation. In order to run comprehensive analysis on the healthcare data, it is important to consolidate multiple data sources into one. In case of healthcare, key data sources for healthcare data are EHR, EMR and PHR which needs to be consolidated. Records in EHR, EMR and PHR are likely to be in different shapes and format. First step in our solution is to bring them to consistent form and ingest the resulting data in data warehouse for further analysis. In order to load the records in the data warehouse, an ETL job is used which will:

- Extract the data from multiple sources
- Format the data to being in consistent format
- Load the data into Data warehouse

ETL process further added advantages like scalability and availability, by integrating large volume of data which is in diverse formats and extracted from various sources at one place using cloud which provides unlimited access to storage and resources economically [28].

### **Data Insights (Data Analysis)**

Once the records are consolidated into data warehouse, next step is to analyze the data to extract useful information. Recommendation engine will analyze the patient records in data warehouse. Data resulting from Recommendation Engine will be stored in the Elastic search marking the recommendation indicator. Storing the records in Elastic search will help in fast retrieval of the data to match with user inputs and recommending treatments

### **Prescribed Treatments (Recommending treatment to patients)**

In order to deliver self-care, a patient-centric portal will be developed. Patient would create their profile in the portal so that system can better understand them and provide the recommendations accordingly. Based on patient profile, it would be matched with profile of other patients to see what treatment is used to cure them. Treatment would be recommended to patients based on clinical records of similar patients.

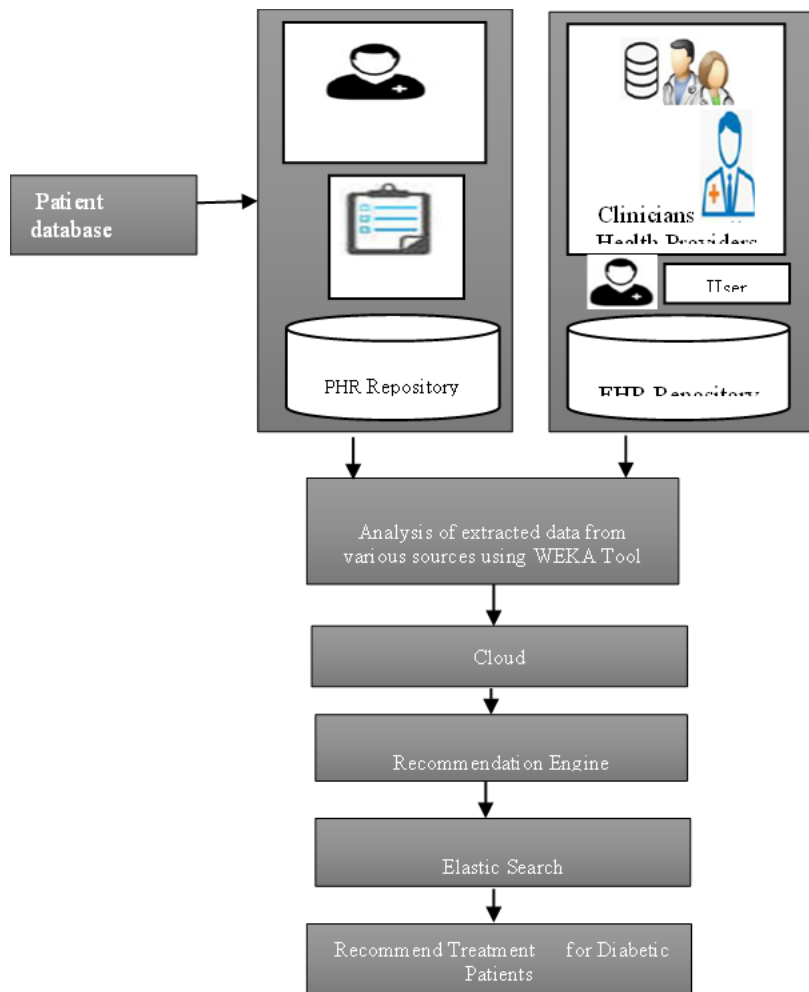


Fig. 7. Process Flow For Methodology

## Implementation Dataset Details

The aim of our research is to suggest a best prescription to a diabetes patient. For this purpose, taking five input attributes as shown in Table 5 given below.

Table 5. Attributes Details

S.no.	Attribute	Details
1	Plas	Plasma Glucose Concentration*
2	Mass	Body Mass Index*
3	Pedi	Diabetes Pedigree Function*
4	Age	Patient age in a year as of the date of treatment*
5	Symptoms	Symptoms demonstrated by diabetic patients*

On the basis of study, it was found that the most common symptoms of diabetic patients are- Frequent Urination, Extreme Hunger, Unintended weight loss, Increased thirst, Fatigue and weakness. Generally suggested prescriptions for these symptoms based on this dataset are:

- To minimize the chance of hypoglycemia, the patient was recommended to use rapid-acting insulin analogues.
- The quick insertion of insulin was measured as there was proof of continuing catabolism.
- Metformin is the chosen early pharmacologic mediator for the treatment.

This framework is developed for the above 5 attributes and corresponding prescriptions appears on the cloud based interface based on the queries of patients and the clinicians.

### Steps performed for the implementation

- a. First step is the registration on cloud.
- b. After registration, the console provided by the cloud.
- c. In that console several services are there like EC2 instance, UBUNTU image etc.
- d. The source code is converted into the JavaScript.
- e. The index.html library contain the overall layout of project.
- f. Script functions contain the overall conditional statements.
- g. For Backend tools: Language-PHP version 7.4, PHP Framework-Laravel 7.0 with MVC, Database-MySQL, Webserver: Apache.
- h. For Frontend Tools: HTML 4/ (Admin LTE backend HTML Package) CSS jQuery
- i. Now the project is ready to execute and prescription to patient is provided on the basis of attributes.

### Results and Analysis



## Diabetes Prescription

Fig. 8. Diabetes prescription interface over cloud

The above Fig. 8 shows the diabetes prescription interface over the cloud. Through which patient get prescription through online. The above Fig. 9 shows the registration portal for new patient. After the registration they can enter their credentials to get prescription from the doctor.

Diabetes Prescription Login Register

Register for Patient

Name

User ID

E-Mail Address

Password

Confirm Password

[Register](#)

Fig. 9. Patient registration portal

Diabetes Prescription User ▼

Please provide patient data.

Plasma Glucose Conc.* <input style="width: 90%;" type="text" value="130"/>	Body Mass Index* <input style="width: 90%;" type="text" value="28.8"/>	Pedegree Function* <input style="width: 90%;" type="text" value="0.2"/>
Age* <input style="width: 90%;" type="text" value="48"/>	Probable Symptom* <input style="width: 90%;" type="text" value="Fatigue and Weakne"/>	Click to submit data. <a href="#" style="background-color: #007bff; color: white; padding: 5px 15px; text-decoration: none;">Submit</a>

Your Recent Prescription

Symptom: Frequent Urination  
Glucose Con.: 5.00 BMI: 5.00  
Pedegree Fun: 5.00 Age: 5.00  
Prescription: No Symptom Found.  
Created: 1 day ago Updated: 1 day ago

[Edit](#)

Fig. 10. Diabetes patient prescription

In the above Fig. 10, patient have to enter 5 attributes of health for getting diabetes prescription:

1. Plasma Glucose Concentration
2. Body mass index
3. Pedegree Function
4. Age
5. Probable Symptom

After entering these attributes patient gets their required prescription.

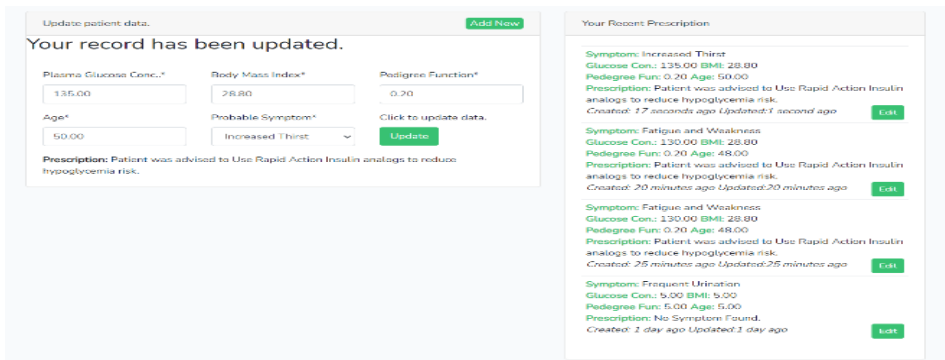


Fig. 11. Updating Portal

The above window in Fig. 11 is the updating window where patient can update their health as regular interval of time to get accurate prescription.

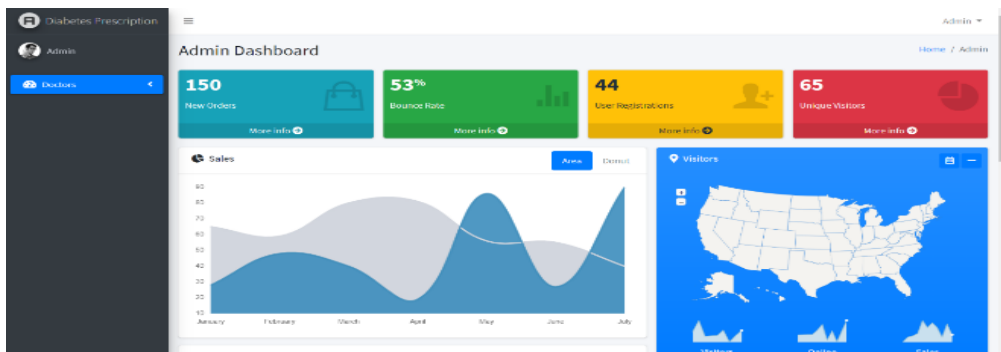


Fig. 12. Admin Dashboard

The above Fig. 12 is the interface where doctors and patient can interact with each other and doctor have all details of all the patient. This portal contains various features such as addition of new doctor, list of all doctor and sales related data.

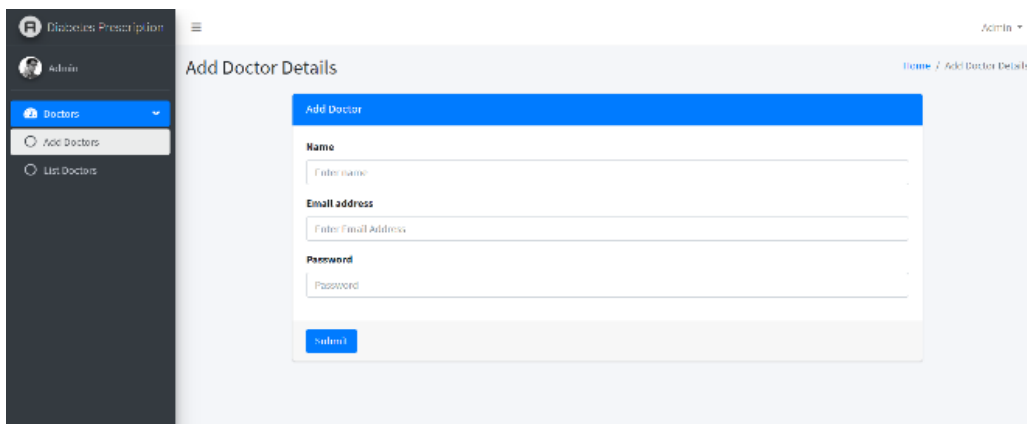


Fig. 13. Addition of doctor portal

The above portal in Fig. 13 is for adding new doctor. This portal contain name, email address and password for the doctor.

ID	UserID	Glucose_Con	BMI	Pedegree_Fun	Age	Symptoms	Prescription
4	User	135.00	28.80	0.20	50.00	Increased Thirst	Patient was advised to Use Rapid Action Insulin analogs to reduce hypoglycemia risk.
3	User	130.00	28.80	0.20	45.00	Fatigue and Weakness	Patient was advised to Use Rapid Action Insulin analogs to reduce hypoglycemia risk.
2	User	130.00	28.80	0.20	45.00	Fatigue and Weakness	Patient was advised to Use Rapid Action Insulin analogs to reduce hypoglycemia risk.
1	User	5.00	5.00	5.00	5.00	Frequent Urination	No Symptom Found.

Fig. 14. Patient History Portal

The above portal shown in Fig. 14 is the record of old and new patient so that symptoms can be identified from the past data and prescribed accurately. Every patient has unique user\_id to identified easily.

### Conclusion and Future Scope

EHR and PHR are the foundations for delivering high-quality services to patients. EHR data captures patient information at the time of therapy but does not capture effectiveness of treatment prescribed to patients. Personal health information obtained by patients are contained in the PHR data archive, which has grown in recent years. Data from these two repositories are scattered over different systems. Integrated and unified view of data from these repositories supports both patients and healthcare professional by important quality of the prescribed treatment. Healthcare professionals can leverage such data whilst prescribing the treatment to patient at the time of visit to hospital / clinics. Patients can leverage such data for patient centric self-care. Presently, though patient looking for self-care can search over the internet but those search results are more likely to be focused on keywords and does not consider patient medical history. Instead of focusing on several random, out-of-context searches, our approach considers patients' characteristics and allows decisions based on the medical records of other patients with identical characteristics. Machine learning systems may be used to retrieve additional insights from evidence, such as the effectiveness of drugs and therapies, so that health professionals can use it to better improve future treatments.

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