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From Data to Care: An AI-Driven Framework for Student Health-Management in Schools

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Abstract

Developing countries continuously strive to improve their standards of living. By linking to current trend technology, the e-healthcare management system can improve treatment methods. The proposed study indicates the mechanism to improve the e-health system for developing countries at the school level, where there is a lower literacy rate and more poverty. The primary purpose of this study was to assess students at the school level, specifically children in elementary and middle school classes. After the teacher performs the scan, he identifies the basic health issues of the students. These health issues include basic dental, skin, eyesight, hearing, and personal hygiene issues. The students ' health issues were identified. Subsequently, corrective actions are implemented. Report sharing includes service management based on Cloud Computing. This research paper mentions that the main significance of the study is the use of AI models on students' health data. Supervised algorithms are used to identify students with the same issues. The system can identify students who, by chance, missed the complete scanning or were partially available.

Keywords: E-health; e-governance; Sustainable Development Goals (SDG); Health-Education Reforms; Basic Health Unit (BHU).

Introduction

Children join schools to learn. The countries with a good literacy rate have a common Trend that the children start schooling at the age of 4 and continue until they desire. The infrastructure of schools is available at the developing site of the country as well as in rural communities. Schools in urban areas are well equipped with facilities, but in rural areas, they lack basic facilities. Schools often lack teachers, infrastructure, or sometimes necessities. These are common issues that negatively affect the learning process [1]. The weather conditions, socioeconomic factors sometimes reduce the charm of learning for a student. In this case, students are sometimes unwilling to attend school, and their parents are often not interested in sending their children. Another issue that sometimes affects students is their health [2]. Sometimes, students, teachers, and parents are unaware that children are suffering from serious health issues. This is why he is unable to focus on his studies. Ultimately, students cannot perform well in exams, which may lead

to dropping out. The actual reason is unknown because of unawareness. This may affect students for their entire lives. This means that he suffers throughout his life.

In a new normal governance environment, good governance requires hospitals to respond with active and effective oversight to manage crises. The goal of this research is to examine how equality, responsiveness, and transparency can facilitate the community and how well public hospitals in Pakistan is dealing with this problem. The findings of the study revealed that equity, responsiveness, and transparency have a substantial impact on the effectiveness of the government [3]. Patients' health outcomes. Accountability, on the other hand, appears to have a minor impact on health outcomes.

Healthcare systems with technology are called electronic health (e-health) systems. Due to the increase in smart devices, electronic gadgets, their prices, and their use, most traditional systems are now switching to electronic records. Medical data are one of these. It is due to the fact that the medical data is required for accurate diagnosis. Existing reports and tests are examined by the physician, and historical records are consulted. The old data may contain information about specific allergies, issues, and the treatment taken by the patient, especially suggested by the doctor. Medical history is always related to future treatment.

An e-health system is an effective method for treating patients. Software programs make it easier to draw pedigrees and obtain family histories. These data are subsequently presented to the healthcare provider in the form of a relative risk score. In addition, the program provides concise information on the numerous solutions available for at-risk patients [5]. The use of electronic health records as patient equivalents raises several concerns. One is on eHealth, telemedicine, and associated means of providing healthcare, while the other is about the role of ethical considerations in data. The implication for e-Health and associated healthcare delivery techniques is that to reach their full potential, they must incorporate health records not only as data sources but also as components of their decision-making structures. The ethical concerns stem from the fact that, as patient equivalents, they must be treated following the ethical norms that guide our conduct toward patients who are their analogs.

Several issues arise when using electronic health records as patient equivalents. The first is about eHealth, telemedicine, and related methods of providing healthcare, while the second is on the role of ethical considerations in electronic health records[6]. The implication for eHealth and related healthcare delivery techniques is that they must incorporate health data not only as a data structure but also as decision-making structures to reach their full potential. The ethical concerns stem from the fact that, as patient equivalents, they must be treated according to the ethical standards that govern our interactions with patients who are analogous.

It includes technology, smart devices, and the Internet to facilitate people in offering medical services around the region. These systems are virtually approachable, where the physical presence of the patient and doctor at the same venue is not necessary. If a person is familiar with the technology, they can interact with the system. The system completes the treatment process, where the doctor is connected through the Internet, sitting miles away. Usually, the processes of prescription, recommendation, and payment collection are well managed by the system[7]. The doctor and patient can play their roles in making the system function. Clinical practice guidelines are defined by their validity, reliability, reproducibility, flexibility, and clarity of content. E-health is evolving from an organizational to a process-centric challenge for reformers and government policymakers to use electronic media, such as computers, mobile phones, and the Internet, to improve public health.

Data is the statistical description of an item, object, or system. Every system has a process to convert raw data into a useful form. Dense databases can process heavy data using standard software tools such as [8] ORACLE, MYSQL, and SQL. These tools make database management

systems more organized. One form of data is medical data are used for diagnostic purposes. Owing to its significance, this data can be used more efficiently to draw new patterns. Under normal conditions, medical data are less at a younger age [9]. Delay or incorrect treatment can worsen and complicate the situation. E-health systems are complex and difficult to operate for older adults, the illiterate, and patients with poor technical knowledge. There are fewer training and facilitation services available. How to improve the utility and effectiveness of such a system for a patient who is less educated, has low financial resources, and is untrained to operate the system.

The main objective of the proposed research is to determine the gap in the development of e-health systems in underdeveloped countries such as Pakistan at the school level. The feasibility of implementation in the region. The system is feasible for helping patients in remote areas, and patient record management is carried out efficiently.

Literature Review

The studies done by Researchers [10] state that the proposed framework, which includes extensible beliefs, desires, and intentions, is a good fit for building embedded intentional software that constantly observes or monitors its surroundings and acts following its placed BDI, which is based on normative contexts. Scientific studies offer numerous methods for improving an agent's decision-making processes so that the action yields the greatest benefit. Beliefs based on information obtained or retrieved from several sources, such as the environment, domain, or other services' beliefs, reflect the state of events in an ideal world that these often-increasing services have targeted.

Studies [11] say that introducing a cloud-based approach for monitoring enormous amounts of healthcare data, with data coming from various hospitals and other e-health sources being moved to a new cloud, the proposed healthcare cloud. A healthcare cloud manages the storage and retrieval of this information. It consists of two types of health data storage and two levels of protection. The healthcare information store is dependent on the health information administration framework for security reasons, and security is managed by a biometric verification operator [12]. The connections between the various modules are described below. Two new components, the healthcare data store and the security supervisor, are key aspects of healthcare cloud data management.

Therefore, the feasibility of the proposed system can be evaluated in various dimensions. It includes [13] convenience for the patient and treatment unit officials. Furthermore, it is easy to access medical records. The other aspect is remote data handling, which is the backbone of e-health systems. This system is reliable because physicians are actively involved in decision-making. Thus, there is ease of treatment for a patient, and he/she can be facilitated more keenly than in traditional systems.

Another study [14] indicated that susceptibility has two meanings. One is that the individual enjoys a healthy life. Second, the person is healthy but may have chances (of being susceptible to different infections. Any deviation from the normal healthy data may lead this person to the second phase, where the individual is in an infectious phase. This means that not every disease can be identified by a change in facial color or pigmentation (although this may occasionally occur). A study [15] discussed big data in terms of medical data. He stated that high-quality medical images make it possible to accurately identify the disease. Skilled consultants may diagnose some diseases early. In cases where the symptoms are unclear, accurate diagnosis is difficult. Therefore, a pathological report [16] is the main reason for confirming a specific health problem. These reports are further examined to determine the cause of the disease. If the problem is severe, the consultant involves experts for further opinions. Any diagnostic error can result in fatal consequences [17]. Medical images are obtained after passing different frequency beams through a source and drawing images of the condition of the body of a patient. Collectively, these factors contribute to the development

of MBD. Similarly, [18] indicated that organizations such as Digital Imaging in Communications and Medicine have been making efforts for years to refine medical images. It is a global trademark for MBD image processing. One of the scientific studies of the American Academy of Paediatrics highlighted the importance of MBD. It is said that the problem of appendectomies can be avoided due to the medical information available at the early stages. This philosophy is also valid for problems in other body parts, including the kidneys, lungs, and brain.

Different types of signals are used to diagnose various medical problems. For biomedical diagnostic tests [19], Radiography, X-ray, Optoacoustic**,** and Neuroimaging are some well-known techniques. In addition, the images acquired after this process are now stored in the cloud.

Intelligent methods are applied only for authorized MBD access. Complex treatment systems are being developed on a gigantic platform to treat a large number of patients. The efficiency of medical devices [20] is being increased by doctors, engineers, and scientists. There are many reasons for this illness. Infection is one of the reasons, which is caused by the propagation of any microorganism (virus, bacteria, amoeba, fungi, or algae, etc.) inside the body. They are parasites that live in the blood and utilize nutrients, thereby weakening the body. Diseases such as Measles, Plague, typhoid, and tuberculosis are examples of infections. The infection persists in the body for a long time until it is treated with appropriate medicine.

The MBD is not small. The MBD is often collected in hospitals or medical units. Often, when MBD is collected, the most important information is overlooked. This is either due to a delay or a lack of useful resources at the patient's critical time. Based on this concept, the first concern of the proposed research is MBD accuracy, completeness, correction, and meaningful information collection. Medical records can be confirmed using medical equipment [21]. Some devices can even store limited medical information. Smart devices can be used to increase the collection of medical data. These applications can directly participate in the formation of MBD. This is one of the main objectives of this thesis, which is to use non-traditional medical data sources to support the healthcare industry.

Another concept of MBD is that there is a strong relationship between health-related issues. It was observed that one health issue is responsible for another. By determining the disease before time, lives can be saved[22]. These diseases and side effects are interconnected. The MBD can be used to determine new patterns. These data can be used to determine diseases before they occur. The better use of information and communication systems can increase human life span by extracting useful information for new patterns. The data contain hidden information that is usually unnoticeable. Disease prediction can be performed using a regression model for more realistic results.

- How can the efficiency of the e-health system for low-income patients, such as school children, be improved?
- How can e-health data collection and forecasting be improved when the physician is not around, of course, not for serious health issues, but only for basic health hazard identification?

Vitality of Medical Data

A healthy lifestyle can improve survival. Different regions apply different treatment methods to cure patients. It depends on the available resources, technical staff, and equipment. Modern communication technologies are the best example of a global village for healthcare facilities[23]. Thus, smart telecommunication systems are being applied to enhance healthcare units. Different types of machines are used for accurate diagnosis. Robotic systems are being introduced into healthcare systems, which generate a quick response to detection and treatment. It can highlight even a small fragment of patient data that cannot be seen. This has extended the utility of the Internet of Things (IoT) for MBD by using sensors [19] and artificial intelligence for diagnostic

applications. Medical record collection from numerous sources converts medical data into MBD.

The MBD is diverse and comes from multiple sources [24]. Some people donate anatomical gifts, or body donations, as HTA in the UK, AATB and AMERA in the US, Donate Life in Texas, and many similar physician committees are dealing with this type of scientific research. In developing countries, hospital systems are database systems that include manual and medical records. The patient is responsible for maintaining the record. Developed countries have sophisticated health care systems in which the patient completes tests, and the record is made available to the consultant before the time. After the expansion of the Internet towards distributed systems, cloud-based technologies maintain medical [25] records, which are easily available when needed. Companies such as HIPAA, Microsoft Health Vault, iBlueButton, and RememberItNow work on this theme. Regardless of the approach adopted, medical records are very important. Medical systems ensure that data are maintained as part of the record, and data security is also an important aspect.

The main target of this research is to find a systematic way to improve the quality of life by improving health-related goals. Some countries (developed and underdeveloped) are treating patients with robotic surgery, cyber-knives, and related systems that intelligently work on accurate input and generate output just like a normal physician. These systems are in the initial phases, but there has been remarkable progress in improving such applications to facilitate patients who are poor enough to afford the medication, have the least government support, or are at a far spatial distance [26]. Every human being has the right to live a healthy life. It is a blessing, and everyone tries to cure it as easily as possible.

The key concern of this research is to utilize intelligent schemes of information communication technology and improve treatment systems. This is similar to the gathering of big data from non-traditional sources, which are easily accessible instead of complicated hospital-dependent systems [27]. This type of data collection does not miss important values. For example, if a hypertensive patient has rare abnormal readings, it means that the body is warning of future risks; no doubt later these records will show normal readings. However, missing these values from a specific interval may result in missing important information that may result in stork prediction. Similarly, medical records are interrelated to different types of future complications.

Researchers [28] believe that there are various causes of failure of e-health in distinct cases. Some causes are pointed out below: Incomplete & Unclear Requirements/Scope. Lack of concrete data on the domain. Integrations and communication of hurdles among different types of medical equipment. Lack of knowledge about e-health systems. Vague objectives of stakeholders: inappropriate model design. Improper performance evaluation mechanisms. Incorrect estimation of risk factors. Security and Privacy of Patient Data. Financial limitations and sociocultural features.

MBD Data Sources

A data source can be the place where data are created or where physical material is first digitized, but even the most polished data can be utilized as a source if it is accessible and used by another process. A database, flat file, real-time measurements from physical equipment, scraped Internet data, or any of the countless static and streaming data providers available on the Internet can all be used as data sources.

MBD Traditional Sources

MBD is generated from medical equipment and diagnostic reports. To obtain these data, the patient must attend the medical unit and undergo the diagnosis procedure. Previously, data collection was limited to a few bits rather than bytes that represent numbers. There are many forms of MBD collection, such as X-ray images, ECG graphs, signal deflection over human beings, and biochemical reactions [29].

Table 1: Medical Equipment

Sr. No	Device/ Machine	Purpose
1	Fluoroscopy	X-Ray Image
2	Medical Resonance Image	MRI Image
3	Computed Tomography	CT Scan
4	Mammography	Breast Cancer Detection
5	Electro Cardiogram	ECG / EKG
6	Sphygmomanometer	Blood Pressure
7	Endoscopic camera	Endoscopy

Applying the above schemes with IoT, many new devices facilitate the collection and processing of MBD. The latest medical equipment is listed in table. All diagnostic methods are important for disease identification. The equipment in the left column and its diagnostic purpose are mentioned in the right column. This diagnostic equipment is dependent on the physician's recommendation. This equipment is very expensive and can only be used by medical technicians. The report is understandable only to medical staff.

Medical Report Consolidation/ Data Collection

Data collection is the process of gathering, measuring, and evaluating correct insights for a study, following defined, recognized techniques. Researchers may evaluate their hypotheses based on the information received. Data collection is frequently the first and most important element of the research process, regardless of the subject under investigation. Depending on the information needed, different approaches to data gathering are used in different disciplines.

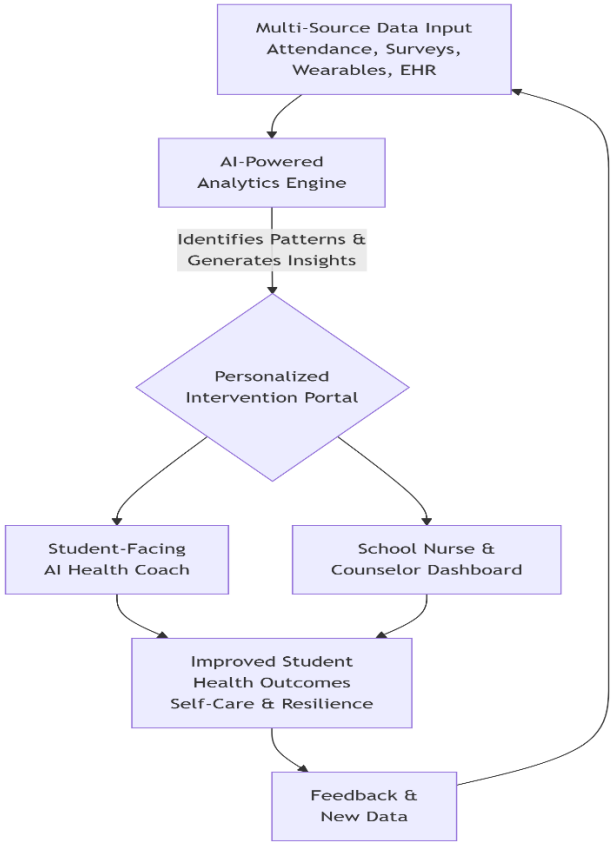

Figure 1. The health record processing method

Figure 1 illustrates a continuous, AI-powered framework for managing student health. It begins with multi-source data collection, which is processed by an analytics engine to generate insights. These trigger personalized interventions via student apps and staff dashboards, leading to improved health outcomes. The resulting new data create a feedback loop that enables the system to learn and adapt over time.

The most important goal of data collection is to collect information-rich and accurate data for statistical analysis to make data-driven research decisions.

In terms of data collection, there are four options: in-person interviews, mail, telephone, and online. Each of these approaches has its advantages and disadvantages. Face-to-Face Patient History: Pros are Comprehensive and have high confidence in the facts. Cons: Time-consuming, costly, and easily disregarded as anecdotal evidence. The second method is pharmaceutical/medical mail and phone surveys. The Pros are that they can reach anybody and everyone - there are no barriers. The cons include high cost, inaccuracies in data collection, and lag time. The pros include a high level of confidence in the data obtained and the ability to reach practically everyone. Cons: Expensive, inability to self-administer; must hire an agency.

IoT Collection Sources

Numerous smart devices are used to gather medical data from patients, such as smartwatches and applications installed on smartphones [29]. These gadgets collect accurate data for each individual and can trigger the operations.

Data Analysis

Data analysis is the process of gathering, modelling, and analyzing data to gain insights that can improve decision-making. There are a range of strategies and procedures for conducting analyses depending on the business and research goals. All these strategies are based on two main areas of study: quantitative and qualitative research. Qualitative data are not numbers. It is not the type of thing that can be measured with a fixed scale or complicated statistics or math. Qualitative data refer to non-numerical information, such as interview transcripts, notes, video and audio recordings, photos, and written documents. The following five types of qualitative data analyses can be found:

1. Examine the content. This is the process of categorizing verbal or behavioral data so that they can be classified, summarized, and tabulated.
2. Analyse narratives. This strategy entails reformulating stories offered by respondents, considering the context of each instance and each respondent's unique experiences. In other words, narrative analysis is the process of revising primary qualitative material.
3. Examine the framework. This is a more complex strategy that includes numerous steps, such as familiarization, identification, and evaluation.

System Specifications

Medical images are refined using wavelets as a basic tool. The quality of medical images is improved with the application of wavelet family functions. All experiments were performed using different medical images but on the same platform. Table 2 presents the details.

Table 2: Experimental environment

System	**Lenovo PC**
Operating System	Windows XP, Windows 10
Processor	Intel Core-i3, 2.20GHz
System Type	64 bits,
RAM	4.00 GB
Software	Matlab, version 8.4.

Proposed Model.

This research focuses on the utility of e-health systems. In this regard, a system is proposed to improve the effectiveness of treatment systems for patients. Ideally, this model is more objective for patients. Clinical record management is remotely maintained using cloud architecture. Various database techniques can be used to upgrade this data. Research is still being conducted in this domain. The model diagram is shown in Figure

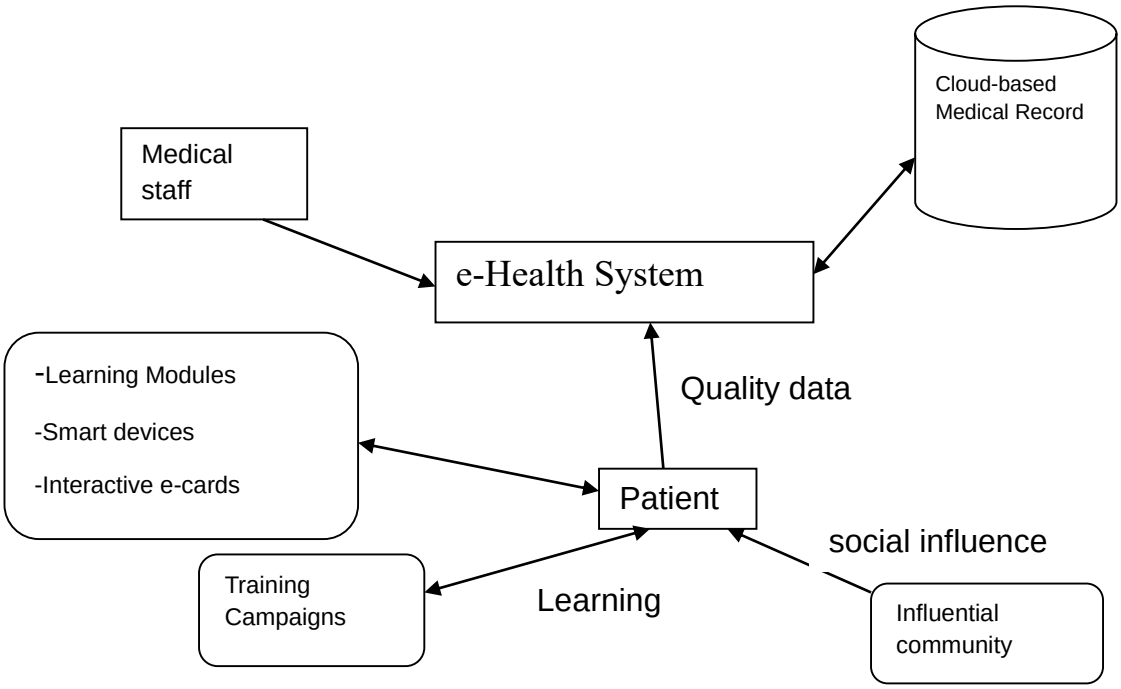

Figure 2: The proposed e-health model

Figure 2 illustrates that the model is more concerned with training patients. E-health is an advanced system. Medical and technical staff are aware of the use of system utilities. However, patients are less familiar with the system, and in the worst cases, where the e-health system is for an illiterate community, patient awareness and training are mandatory. The model further shows that machine-based aid can also become part of the training. Simple and easy modules, smart devices, e-cards, and social media are the most available sources. These sources can be used to educate people to collect valuable data for future studies. Ultimately, this will save time and provide more confidence to the unfamiliar person to deal with the system in a better way. This will also extend to the involvement of educational training campaigns. The system also directs the influence of the social community that holds in a specific part of the region and is considered worthy. This can continuously improve the learning of patients for accurate data generation.

Results

a- From School Network

The school network is based on a healthcare program in Pakistan. The annual report for 2017 for District Sargodha indicates the following results:

Table 3: School Network for MBD

	Boys	Girls
Schools	1342	1162
Students	164319	155497
Students Screened & Dewormed	70204	66823
Eye Diseases	370	431
Ear Diseases	341	360
Dental Problem	753	671

Skin Problem	431	552
Total students with any health issue	4288	4582
Total students referred to a basic health unit	1724	1271

Primary school teachers were trained, and a monthly student screening report was generated on health issues related to the ears, eyes, skin, and teeth. Students were provided deworming medicine twice a year. Table 3-2 indicates that 100% of teachers were trained in student screening. The results showed that 42.7% of boys and 43% of girls were screened for obesity. Out of these, 0.6% of girls and 0.5 % of boys were found with eye diseases, and 0.5% girls and 0.5% of boys were found with ear diseases. 1.0% of girls and 1.1 % of boys were found with dental problems. Skin diseases were found in 0.8% of girls and 0.6% of boys. A total of 6.9% girls and 6.1 % of boys were identified as healthy.

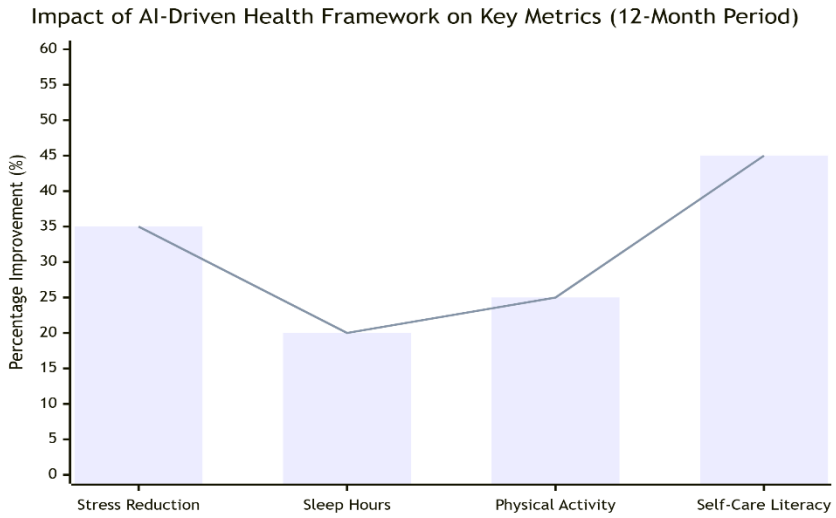

Figure 3: The student's performance due to health issues.

Students who suffered from health problems were referred to the nearest hospital. Of the ill students, 27.7% were girls and 40.2% were boys who were referred for treatment. This activity generated regional-level MBD. It was found to be beneficial for initiating health improvements.

Figure 3 displays the measured effectiveness of the AI framework. It quantifies the percentage improvement across four critical student health metrics over one academic year. The results show significant gains, particularly in Self-Care Literacy and Stress Reduction, demonstrating the framework's success in translating data into tangible health outcomes and equipping students with the knowledge and habits to manage their well-being effectively.

b- From Health Care Network

A healthcare network can generate MBD based on a patient's history. Table 4 presents data from the clinical records of a selected clinic in Pakistan.

Table 4: Health care network for MBD

Total Patients N = 125		
	June First Fortnight	June Second Fortnight
Gender Distribution		

Male	51 (58.61)	24 (63.15)
Female	36 (41.32)	14 (36.82)
Age Range	45 - 49 years	52 - 93 years
Total distribution of patients:		
	87	38

Male and female patients attended the medical unit for treatment of their injuries. Their age groups were divided into two categories: below 65 and above 65 years. From the above table, we can conclude useful patterns. The proportion of male patients was greater than that of female patients. Intelligent logic was applied to derive useful results. At this age, the MBD undergoes a large volumetric expansion. The higher the age, the more side effects are observed, which cause more MBD.

Table 5: Data mining results

Datasets	Instances	Values	Naïve Bayes	Support Vector Machine	Neural Network
Breast Cancer	184	47	78.3416	76.3891	74.2495
Lung Cancer	15	6	81.5527	82.3486	81.7329
Diabetes	849	9	86.4631	81.7858	79.4317
Thyroid Issue	374	24	82.3458	79.7642	77.3541
Chicken pox	31	10	83.4063	82.7593	79.9346

Table 5 shows the different numbers of instances for MBD. The datasets are applied with pattern-determining algorithms such as Naïve Bayes, Support Vector Machine and Neural Network. Data on breast cancer, lung cancer, diabetes, thyroid problems, and chickenpox were analyzed.

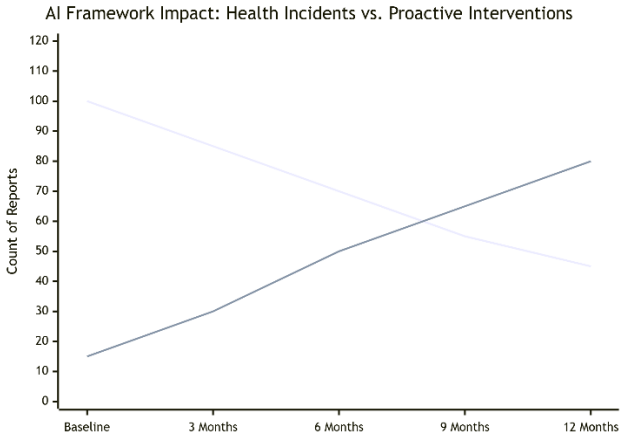

Figure 4: The student's performance after reforms

The line chart in Figure 4 tracks two key performance indicators over 12 months. It demonstrates a clear divergence: as the AI framework is used, the number of reactive health incidents (such as severe anxiety attacks or asthma exacerbations) steadily decreases. Simultaneously, the number of proactive interventions (such as counsellor check-ins prompted by AI-generated alerts) increases. This powerfully illustrates the system's success in shifting school health management from a reactive to a proactive and preventative model.

Conclusion

The goal of this study was to determine which development process is more dependable and secure for the healthcare system, which is the most important domain in our era. To achieve this goal, a survey of software development companies was conducted to determine which methodology is most reliable in terms of cost and quality, as well as an analysis of the data collected based on cost and quality factors during the requirements, design, and coding phases. It also provides a thorough overview of each methodology currently used. The importance of E-Health systems in today's life, as well as a short-term study to learn about developed, developing, and developing country e-health systems, as well as their benefits and drawbacks. It identifies some aspects that influence the reliability and security of e-health systems before presenting formal approaches as the best potential answer for the healthcare domain. A web-enabled system is combined with a specialist, drug specialist, radiologist, and research center staff workouts, thanks to the cloud architecture. The government is working with its organizations and specialists to create a comprehensive medical services framework that utilizes the e-Health Cloud. A cloud-based biometric validation framework was created to deal with the constantly changing information of the healthcare division while also providing security to varied clients. This model is divided into two parts: one deals with the management of the massive amounts of data generated regularly, and the other deals with security. This recommended engineering approach can also be effectively applied in several sectors, including security, cost-cutting, associations, and education.

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