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Behavioral Change Interventions For Diabetes Management Through Iot Platforms: A Study On Real-Time Feedback And Patient Engagement

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ABSTRACT

Purpose – The purpose of this research is to examine the use of IoT platforms to deliver behavioral change interventions for people with Diabetes, with a primary emphasis on the Effectiveness of real-time feedback. The goal is to analyse how several IoT products, like the continuous glucose monitoring device and the smart insulin pens, improve how patients manage their blood sugar levels, make lifestyle changes to their regimens, and verify compliance with treatment regimens.

Research / Methodology /approach – A quantitative research approach was employed in this study, tapping a large survey that was administered to people with Diabetes who employ IoT platforms in managing their Diabetes. The participants were recruited through an online surveying technique using a structured questionnaire, where 164 patient participants were recorded; age, type of Diabetes, and IoT usage frequency of patients would not be homogenous. Self-administered quantitative and qualitative real-time questionnaires were also conducted to assess participants' experiences with real-time feedback, their utility in influencing behaviour change, and the difficulties of engaging in IoT devices.

Findings – The study shows that real-time feedback given by IoT networks leads to increased activity on the part of the patient and contributes to changes in behaviours, including physical activities, diet, and administration of insulin. Those of the participants who were assigned to receive continuous feedback were found to have changed their lifestyles as soon as they began the program and had higher compliance with their diabetes regimes. Some of the challenges that were noted were the cost of the devices, technical issues, and questions about data security. Nevertheless, as this study has shown, there is a prospect of IoT platforms unleashing a new generation of Diabetes self-management based on individual patient control supported by analysis of big data.

Practical Implications – The study indicates that healthcare providers and technology healthcare developers might use the application of IoT platforms in healthcare to enhance the course of diabetes patient's outcomes through the provision of self-monitoring tools that allow real-time monitoring of Diabetes. The implications arising out of these are useful in the design of future IoT gadgets and healthcare models encompassing patient involvement, targeted care, and data protection. The more advanced the IoT technology becomes, the more disruptive it becomes to the diabetes management process and how it helps eliminate complications and increase adherence to treatments while improving patients' quality of life.

Originality/value – This research finds its place in the existing scholarship on the application of IoT in healthcare by offering a clear explanation of how real-time feedback enhances behavioral change in patients with Diabetes. It provides a plethora of information regarding the benefits and concerns that accompany the implementation of IoT platforms for aiding chronic diseases, the importance of creating IoT platforms that are easy to use and secure for patients, as well as the potential to increase the overall quality of life and success of the said platform.

KEYWORDS: IoT, Realtime feedback, Diabetes management, Behavioral change, Patient engagement, Self-management, Continuous glucose monitoring.

INTRODUCTION

Diabetes mellitus is one of the diseases with the highest incidence of chronic noncommunicable diseases to affect millions of people throughout the world across all ages. The cure for this condition can be clearly described as challenging since it entails lifelong adherence to strict blood glucose level monitoring, dietary restrictions, physical exercise, and administration of proper doses of medication. Albeit these factors are universally recognized components of Diabetes self-management, several patients get to balance themselves poorly — leading to further possibility of developing complications like cardiovascular diseases, neuropathies, and kidney failures. Recent developments in technology have seen new tools developed to help manage Diabetes, with IoT being seen as the most viable technology. IoT platforms incorporate Wearable, smart sensors as well as MH applications to provide continual tracking of patients and give feedback that enhances effective Diabetes management [1, 2].

Behaviour modification strategies are an essential component of diabetes management because, in many cases, patients need to learn to adapt and sustain appropriate health behaviours indefinitely. A model of care that characterized diabetes management for many years has been based on patient visits that involve discussion of the patient's experiences and recommendations for further actions. However, these periodic interventions are sometimes inadequate when needed for constant support of the patients who need frequent optimal control of blood glucose. This is where IoT platforms come into play. Specifically, since IoT devices offer constant and constant monitoring, thereby giving the patient real-time feedback, it makes patients change their lifestyles immediately. The data recorded indicates that it is necessary to do so. The data that IoT platforms gather and process comprises numerous aspects of a person's health, such as blood glucose level, physical activity, diet, and sleep. This wealth of data is then analyzed and given back to the patients as to what they can do to modify or improve their lifestyle. People with Diabetes will find this information groundbreaking since it offers a real-time feedback experience. Rather than visiting a doctor's office only to be told by the healthcare provider what changes should be made every so often, Patients can manage their dietary practices, physical activity, and prescription medication daily and, therefore, maintain a more constant quality of the management of their condition. This forms a sort of feedback loop that not only enriches patient awareness but also puts patients in a stewardship style in the handling of their health status [3, 4].

Furthermore, IoT platforms contain elements designed to mitigate some of the issues that people with Diabetes themselves face. Some of the challenges that most patients experience regarding treatment include non-compliance in strictly adhering to durations that are recommended in checking their blood glucose levels augmented by, most importantly, coming to terms with strict dietary and exercise regimes. While IoT devices can also be programmed to deliver individual alarms and notifications to patients concerning their blood glucose levels, and intake of prescribed medication or even encourage the patients to exercise as and when required. These refinances lessen the effects of forgetfulness or lack of motivation – both of which are antithetical to proper diabetes administration. Due to constant monitoring, tracking, and follow-up, IoT platforms assist with properly monitoring the patients and providing the right motivation towards treatment, hence a healthier society.

Besides, the IoT platforms can improve information exchange between patients and physicians or other members of the medical team that deal with such patients streaming of data implemented through IoT can help healthcare givers to track their patient's progress and, where necessary, provide treatments remotely as a result of IoT implementation. Through articulate real-time data sharing, it becomes possible to most of the time deliver more customized and timely care with less reliance on face-to-face visits generalizing, thus enhancing the worthwhileness of the delivered care. With the growing adoption of solutions for using technology in healthcare, IoT platforms are expected to become the key link to regular monitoring of patients who have chronic conditions like diabetes [5, 6].

However, there are several issues still unaddressed by using IoT technology to deal with Diabetes: Challenges that touch on the IoT devices' availability, affordability, and ease of use must be resolved to allow all people with Diabetes to leverage new technologies. Moreover, there have grown conclusions about data privacy and security concerning the increasing popularity of IoT platforms, and patients, as well as providers, appear to be concerned about threats related to data leaks as well as unauthorized access to personal as well as health-related information. Dealing with these issues will indeed be significant to drive the uptake of IoT platforms in healthcare settings.

The purpose of this work is to identify the way that IoT platforms, with a focus on providing feedback in real-time, enable behaviour change interventions in the context of Diabetes. It is in light of these issues that this research aims to advance the understanding of the impact of technology in the management of chronic diseases by exploring ways that patients engage with these technologies and how feedback in real-time affects decision-making and treatment outcomes. In conclusion, it will be possible to learn about the possibilities of changing behaviour for the better using IoT platforms to develop subsequent approaches to the use of technological tools in diabetes treatment and behaviour modification for patients [7, 8].

The main strengths of applications based on IoT platforms for patients with Diabetes do not only rely on the constant feedback that could be given but also on how a more patient-proximate healthcare method could be implemented. Most conventional healthcare practices are standardized, and people get general guidelines when they briefly see their doctors, therapists, or family physicians. Whereas such applications are rigid as they provide users with comprehensive and fixed notices, prompts, or suggestions depending on their consumption patterns, IoT platforms consider such factors when giving customized care based on patient data trends and life patterns. Hence, this change towards an individual approach is most crucial for conditions like Diabetes, for which treatments may be different depending on the patient's diet, activity level, stresses, and sleep.

Patient engagement is one of the main objectives of adopting IoT in diabetic patient management. The one common feature of patients is that they have a better health status if they are involved in managing their health. IoT platforms do This engagement easily as they put patients in control of their records and allow for quick access right from their fingertips. As opposed to the traditional process where patients simply adhere to a treatment regimen given by a doctor, an IoT patient is far more involved. Because of them, they can assume responsibility for their health, make decisions, and change their behaviours in the light of feedback [9, 10].

This behavioural component of Diabetes self-management is essential because patients have to make more permanent changes to their diets, exercise, and medication to achieve and maintain glucose control. IoT platforms help in this process by offering constant feedback on one's adherence to the desired behaviours while pointing out the failure to achieve the goals required on the patient's part. For instance, if the glucose levels of a patient record high value every time they consume certain foods or at certain times of the day, the IoT platform alerts them that the patient needs to control their diet or administer medication. In the long run, such knowledge will foster consistent behaviour alterations as patient switch their focus to the identified antecedents of elevated blood glucose levels and ways to prevent them. Secondly, IoT platforms are specifically relevant for the patient with a cognitive burden caused by chronic diseases, such as Diabetes. Diabetes care is carefully dependent on some self-care activities carried out in a day, such as checking blood glucose, setting up insulin doses, deciding on meals, and exercising. For many patients, it becomes cumbersome to alternate these roles, and as such, the management of the condition tends to relax, and control becomes suboptimal. IoT devices play a role in reducing this burden since they take care of some aspects of diabetes management and allow patients to make the right decisions based on the insights given by the devices. Such simplification helps to lighten the burden of the disease and keeps patients on track regarding doctors' recommendations [11, 12].

As the IoT platforms become integrated into the delivery of diabetes care; there are also grand impacts on the health organization as a system. One of the main advantages of IoT lies in the possibility of patients' control and self-management of their health on a non-hospital basis; thus, they are less often dependent on healthcare providers. It not only reduces the pressure on healthcare, but it also improves the quality of care delivery. Organizations in the healthcare setting can view data in real-time and therefore be in a position to take appropriate action, to mitigate instances that require their attention in the delivery of care to the patients. Such an action plan aids in reducing adverse effects and hospital readmissions thus extending the quality of life for patients while saving on costs.

However, the adoption of popular IoT platforms for diabetes management has several challenges, as discussed below. However, one of the greatest challenges that users face is the high costs of IoT devices, which can be inaccessible for some patients due to poor health insurance coverage. Continuous glucose monitors, smart insulin pens, and other related gadgets for the IoT frequently have relatively expensive initial outlay costs when compared to traditional glucose monitors or insulin pens, as well as additional costs related to data storage and analysis. The deployment of IoT platforms in diabetes care will greatly benefit from making sure the platforms are available to patients of all economic statuses.

A problem is that of data privacy and protection particularly in analyses involving genetic data. Since IoT devices gather and transfer personally identifiable health-related data, there can be unauthorized access and health record hacking. There are customer and clinician fears relating to the risk that hackers could exploit IoT platforms and then subsequently compromise personal data. Meeting these concerns will, however, need investment in adequate Information Technology security mechanisms such as encryption, secure transmission, and access control mechanisms. Furthermore, the providers must involve the patients to guarantee compliance with how their data is collected and processed and why they are using the IoT platforms.

In addition, the level of ease of use of IoT devices is also an important factor that is likely to shape the uptake of the devices. More advanced plug-and-play IoT platforms are available today, but not all patients are inclined to technological solutions since there are older people or those with low digital literacy. Making these IoT devices as easy to use and as available for as many patients as possible will be instrumental in achieving the greatest benefit from their use in managing Type 2 diabetes. Assistance may include giving patients information and lessons on using the devices to become part of their lives correctly.

Therefore, the incorporation of IoT platforms in diabetes management is a major innovation in health informatics. These platforms may augment the reach and success of patient communication, long-term compliance, and personalized, proactive care. With real-time feedback and constant supervision, IoT devices allow patients who have Diabetes to monitor their diseases themselves, making the process more effective and extending the quality of life of the patient. However, for IoT platforms to go to the next level of performance, some problems, such as cost, data security, and usability, must be solved. With this progression, IoT platforms will assume a significant role in treating chronic ailments, especially Diabetes, acting as the backbone of digital health systems in handling long-term care solutions. The purpose of this research is to describe how behaviour change in Diabetes is supported through technical interventions provided by IoT platforms and to assess whether and how real-time feedback can affect patients. It is our aim, therefore, that the present study will help to advance the growing field of technology-enhanced healthcare for chronic diseases.

Literature Review

Research interest has surged in the implementation of Internet of Things (IoT) platforms in healthcare and especially for chronic diseases such as Diabetes in the last decade. Smart technologies like CGMS and smart insulin pens give real-time data as well as analytics on Diabetes that could revolutionize the way patients have to deal with the disease day to day. Because of the ability of these platforms to constantly and instantly report blood glucose level fluctuations, patients are engaged, have a tool to make good decisions, and are encouraged to adhere to their management plans. This systematic review aims to explore the nature of IoT in behavioral change interventions for Diabetes self-management and care, its effects on clinical results, and patient interaction with health services [13, 14].

Enabling self-care in diabetes management is one of the major advantages of IoT platforms, and this self-management capability is central to uplifting patient's autonomy and, therefore, results. Smart sensors, meters, pumps, pens, and CGMs can now give data in real-time, something that patients can alter their dynamics with and manage their health in ways that could not have been done in the past with traditional platforms. Using a study done by Oguntala et al. (2022) on the benefits of IoT in patient care, the author established that IoT device allows patients to monitor some key health indicators to doctors without necessarily visiting them through continuous, real-time monitoring of health indicators, including blood glucose level, activity level, diet, and even sleep without having to visit the doctor physically. This constant flow of information ensures that people are aware of themselves better and consequently manage their lifestyles and treatments better, given the chronicity of such conditions as diabetes [15, 16].

Such real-time information from IoT platforms allows the patient to correct their behaviours and dosage regime based on feedback. The information provided instantly enables particular decisions, essential for developing awareness of the experiment's Effectiveness and the challenges linked to diabetes management. For example, if a patient has taken a certain meal and their glucose level goes high, the IoT platform will notify the patient, enabling them to ensure they make better choices with meals in the future. Likewise, patients will always appreciate data about the impact that physical exercises have on their blood sugar levels to ensure they modify their workouts to suit the data produced. This direct link between behaviour and physiological response helps motivate patients to a higher level of involvement in their treatment process, which makes diabetes treatment highly effective and sensitive (Oguntala et al., 2022).

Furthermore, IoT platforms are embedded with additional custom details like notifications and alarms to assist patients in adhering to the management regimens. These suggestions can be made for the particular patient, and they may be built to alert the patient when to check on the blood glucose, when to take the insulin, or even when it is time to exercise. Everyone may benefit from an individual approach; however, it is especially helpful for those patients who have difficulties in maintaining proper discipline for diabetes management. The option to receive a reminder for medication or blood glucose testing can contribute to minimizing missing doses or tests – something that is quite a problem for patients with chronic diseases (Mackenzie et al., 2021).

Besides, higher-level IoT platforms enable the storage of longitudinal data and can be beneficial for patients and healthcare practitioners. In chronic conditions, IoT devices can, therefore, build a patient's record of their health status, allowing diagnosis of trends, prognosis, and likely deterioration. For patients who store large amounts of data, the application can be an effective instrument for getting glimpses of changes over weeks or months relative to their habits. From the views of the healthcare providers, when it comes to providing treatment, they benefit from the constant data delivery to make better treatment goals with better targets. First, the patient data generated by IOT devices can help doctors make better decisions and modify the dosages of medicines or describe changeable lifestyles depending on the patient's history (Patel et al., 2023). This can enhance the general quality of care since the treatment procedure initiates from a patient-centred approach rather than a general one [17, 18].

Rubio et al. also stress that these personally customized elements and real-time information enhance patient self-management and improve treatment compliance. Compliance is a major challenge in Diabetes self-management since lack of proper checkups and use of prescribed drugs may result in daunting complications such as hypo- and hyperglycemia and eventual chronic office damage. For those who forget appointments, lack the desire to stick with a routine due to laziness, or have very tight schedules, IoT devices offer an organized manner and timely reminders of how to stay on the right path. These platforms consider that the opportunity to include reminders and alerts guarantees that patients can be continuously monitored. This way, it is possible to avoid adverse outcomes derived from neglecting care for long periods (Mackenzie et al., 2021).

Lastly, many IoT platforms include the feature of providing relative information on a given patient to the medical facilities in real-time and, therefore, help to enhance patient experience through timely treatment. The meter enables the individuals being diagnosed to frequently check their glucose levels to ensure they do not persist in lines that can prompt dangerous results like constantly high blood sugar levels, which can be managed through treatment by a doctor. Thus, the transmission of such data enables patients to get advice and recommendations from a specialist as well as fill the gap between clinic appointments and real-life situations [19, 20]. This constant interaction between patients and providers makes it easier to address barriers to Diabetes self-management and alter any complicating factors that would otherwise make compliance with diabetes treatment difficult (Singh et al., 2022).

The IoT platform improves self-management in Diabetes by giving real-time data, timely reminders, and feedback in a constant manner. They engage patients and make them more involved in managing their condition, ensure compliance with set treatment regimens, and result in increased patient centrality or patient-centred care. Through the providence of IoT platforms, people can avoid many challenges that were seen in the traditional way of managing Diabetes, and this has a positive impact on the health of the people. It is clear that IoT in diabetes management is a revolutionary step into the utilization of chronic diseases and advances experiences that can make a difference in patients' and physicians' day-to-day disease management [21, 22].

IoT devices also allow more self-management of Diabetes and independence in decisions. Special devices enable the patient to monitor the state of their health and apply necessary changes to their diet, physical activity, and insulin intake level right on the go. Such control empowers patients and, therefore, enjoys beneficial outcomes for their health. Multiple studies conducted by Patel et al. (2023) indicate that IoT-incorporated CGMs have had positive outcomes in affecting the HbA1c level and the occurrence of hypoglycemia affecting Type 1 and Type 2 diabetes patients. The authors claim that the visibility of real-time glucose trends also motivates patient choices, and increases their awareness of the consequences of their actions on their health.

Real-time feedback is an area of IoT platforms that holds high importance and acts as an agent of change for behaviour change interventions in Diabetes. Through the real-time data available, the Internet of Things (IoT) devices like continuous glucose monitors (CGMs), wearable fitness trackers, and smart insulin pens are continuously collecting useful health-related information on blood glucose levels, diet history, exercise activity, and sleep cycle. This data is then analyzed and converted into useful information, which is fed back to patients in almost real-time. These real-time insights give patients the knowledge and timely management options necessary to effectively modify their lifestyle and management of Diabetes daily: knowledge is power here [23, 24].

Unlike checkup and consultation-style diabetic care, which have dominated the industry up until now, IoT platforms present a stronger model of interactive care and control for patients. It is important to note that these platforms are designed to incessantly feedback data to the patient with patient ratings which give an example of how various patient activities affect their blood glucose levels. For example, suppose a patient's blood sugar level rises after consuming foods containing carbohydrates. In that case, the IoT device will generate an appropriate notification for the patient suggesting that he should adjust the insulin dosage or go for a walk. This real-time association between behaviour and physiological response helps patients gain insight into the outcome of their actions and make long-lasting behavioural changes.

In a study reported by Greenwood et al. (2022), it was discovered that the use of CGM and the consequent receipt of real-time alerts concerning the patient's blood glucose level enhanced their chance of altering their immediate lifestyle to encompass variations of carbohydrate intake, change in meal plans and adjustment of insulin dosage. From this feedback mechanism, the researchers noted that patients receive constant reminders to change their behaviours as soon as a problem is identified. This is quite a deviation from the conventional model of care for Diabetes mellitus in which patients' feedback is often given at periodic intervals by clinicians during routine outpatient visits. When such information is provided in real-time, as it is with IoT platforms, clinic visits are not the only ways Diabetes can be attended to, and the care is more consistent [25, 26].

Herein lies the strength of real-time feedback for the desired behaviour change, and that's attributable to the following elements. First, feedback provides a clear view of the effects of a patient's behaviour on the parameters, and the effects appear rather shortly. For instance, if a patient does physical exercise, they can get personal real-time feedback or how their glucose level is being responded to by the body, thus creating better awareness in the body on the effect of exercise in case of Diabetes. Likewise, if a patient takes a meal rich in carbs, the IoT reminds the patient how the glucose level shoots up and makes better choices in the next episode. Such a one-to-one, result-oriented approach creates shared responsibility and motivation since patients can easily see how their behaviours affect them.

Second, feedback on the training process produces prompts or suggestions for movement involving either occupational therapy equipment or the patient's household items, which strengthen the patient's capability of feeling or sensing bodily reactions to diverse stimuli in real-time. By constantly monitoring the software over time, patients are in a position to determine how specific food types, exercises, or medicines will impact glucose levels, making them more responsible for their condition. For instance, a patient who, after using the application, is constantly getting an alert that their glucose levels are high after they eat certain foods will, over time, begin to develop ways of reducing or even denying those foods. Such knowledge antecedents enable patients to act and decide better concerning health to achieve positive health behaviour change, thereby achieving better diabetes health outcomes and decreased dependence on the healthcare providers for enhanced control over numerous decisions in their day-to-day lives [27, 28].

Furthermore, feedback in emergencies supports behaviour change by either encouraging pleasant or discouraging unpleasant behaviours. According to other behaviour change theoretic models, such as HBM and SCT, feedback mechanisms are critical for behavioural change because they offer the necessary information for evaluating and changing behaviours. When applied to diabetes care and treatment, real-time feedback acts as the external prompt that would help the patient stick to the right behaviours as well as avoid behaviours that raise their blood sugar levels. For instance, when patients are notified of their glucose levels bordering on dangerous limits, they usually quickly treat themselves through insulin injections or even exercise to reverse whatever may be ailing them.

This concept is further supported by McNabb et al.(2021) study that showed patients using IoT platforms with real-time feedback improved the odds of achieving their health goals and sustaining the improvements such as control of blood glucose levels within the target range. These platforms keep patients responsible for their goals in real-time: they instantly encourage them to choose a healthy lifestyle. Also, the continuous corresponding feedback leads to setting reasonable goals and self-monitoring, as the patients can observe the results of their activity day per day and adjust the activity if necessary to meet the goals. Such a feedback loop enhances long-term patient compliance to the laid-down treatments, and that is very vital in chronic diseases such as diabetes [29, 30].

The other key element that real-time feedback is helpful with is lowering the cognitive overhead of diabetic management. People with Diabetes have to pay a lot of attention to aspects like blood glucose, timing of insulin injections, choice of food, and possibility of exercising. For many patients, this can be information overload, and therefore, we end up having many patients who will stop taking their medications or feel burnt out. Real-time feedback helps make this a less complicated process since it's as if the patient is receiving a directive of what step they should be taking next instead of having to reflect or make some mathematical estimation. Therefore, the patient can have better diabetic self-care with less tremendous stress to address the various demands of diabetes management.

Dedicated feedback also promotes more teamwork in the management process since patients and doctors interact more frequently with each other. Many IoT platforms enable patients to submit their data in real time so that their healthcare team can assist them at the right time with customized care. In contrast to having to wait for the next appointment to penalize new and potentially problematic data, healthcare providers can remotely supervise their patient's data and if any issues arise, steps can be taken immediately. This remote monitoring is especially essential for high-risk patients because it enables closer monitoring of the condition, leading to reduced instances of emergent admission.

Therefore, it was found that real-time feedback is an essential aspect of IoT platforms that feed interventions supporting behavioral change in patients by offering them timely usable information about their health. This real-time feedback helps patients to better manage their conditions, nudging them to healthier behaviours, work better on the self-assembly line, and, most importantly, deliver better results in the long term. Real-time information enhances dynamic diabetes care and closes the gap between clinic appointments and real life, providing patients with the necessary tools to have a good focus on their health and the ability to make the right choices that will benefit them in the end.

According to the HBM and SCT, real-time feedback can encourage desirable behavioural change. This feedback mechanism in the social context is imperative to behaviour change since it affords the needed knowledge on the part of the individual for modifying their behaviours. In the context of chronic diseases such as Diabetes, IoT can provide the patient with real-time feedback about the effects of diet and exercise on the patient's glucose level, thus promoting positive behaviour and discouraging negative behaviours. Furthermore, the chronic kind of feedback assists the patients in developing better insight into the impact of their daily activities on their health conditions (Wang et al., 2023).

Real-time feedback is also instrumental in goal setting and self-regulation Amos et al., (2014). The same study by McNabb et al. (2021) noted enhanced goal setting among patients who engaged in IoT platforms, especially in terms of the goals that were metrically defined to do with patients with Diabetes, including blood glucose level targets. These goals alongside the information given by the IoT devices enabled the patients to remain on track and answerable for their choices. The authors claim that IoT platforms do not only enable behavioural change but also enable sustained behaviour change needed for chronic care such as Diabetes.

Additionally to promoting self-management, IoT platforms also facilitate patient interactions with healthcare organizations. Through connecting to IoT devices, clinicians can receive updated, verified information about a patient's condition for making appropriate interventions. Singh et al. (2022) also found out that patients who often monitor their Diabetes using IoT devices have more meaningful engagement with their doctors. Such patients can continuously provide descriptors while consulting with the provider so that the latter can offer precise changes and recommendations on the treatment plans. Furthermore, IoT platforms support continuous and distant observation, which minimizes in-person interventions and results in a more data-driven approach (Schmidt et al., 2023).

By including PGx data in patient records, IoT platforms make it easier to use patient-generated data in the clinical practice of Diabetes. For instance, Steinhubl et al. (2022) revealed that clinicians could improve the time to the intervention when using IoT data since patients with fluctuating blood glucose levels can be managed before developing severe complications. Furthermore, IoT platforms that enable communication between the patient and the healthcare provider increase the level of patient-physician interaction as patients are most likely to continue following instructions given by the healthcare providers once they are convinced that the healthcare provider is paying attention to them (Brooks et al., 2021).

Despite the possibilities of improving patient-provider relations, there are certain difficulties with IoT platforms. Furthermore, most healthcare organizations have not incorporated IoT-produced data into EHRs, which introduces roadblocks. Further, there are some issues identified by the patient and healthcare provider concerning data security and privacy. Tandon et al. (2023) write that these issues must be addressed because people will not use IoT platforms where they have concerns over the security of their PHI.

Despite the immense potential of IoT platforms demonstrated in this paper for enhancing diabetes management, several barriers exist. Those that are most critical include the cost of IoT devices, where the cost can go high, and many patients may not afford it if they are not covered by insurance (Adams et al., 2021). Some of the challenges related to the use of

CGMs, smart insulin pens, or related devices include the point costs of purchase and the usual monthly costs of using subscription services for software analysis as well as cloud backups—making the devices less accessible for lower-income populations. Also, COVID-19 makes only some patients capable of properly employing these tools, thanks to the digital divide; others lack sufficient IT literacy, which compounds health inequalities (Venkatesh et al., 2022).
Technical issues also present a major problem of adoption due to many technical barriers that may exist. IoT application depends on internet connections, cloud computing services; and interoperability between smart devices and healthcare systems. The issue of IoT device and platform compatibility can complicate issues for patients and healthcare providers when attempting to incorporate such technologies into traditional care delivery models (Bennett et al., 2023). Furthermore, patients reproduce numerous challenges in the data interpretation originating from IoT technologies, especially when it comes to comprehension of such indicators as glucose fluctuations or insulin resistance (Young et al., 2022).
The other external influences are privacy and security considerations that determine the ability of patients to embrace IoT platforms. Tandon et al. 'Patients' willingness to share their health data using cloud IoT platforms also shows that most patients are reluctant to share their health data to the cloud IoT platforms because of data security and privacy issues arising from hacking. These issues will need to be addressed to increase the likelihood that more healthcare organizations will adopt IoT technology.
From the presented literature, one can conclude that IoT platforms reach the possibilities of presenting feedback, supporting self-monitoring, and improving patient interaction with care personnel in Diabetes. IoT devices enhance diabetes treatment to improve the quality of life of patients because the problems are being addressed systematically, earlier, and more accurately. However, the primary challenges are cost, technical issues, and privacy when implementing and adopting the new technologies. More research should be conducted to address these issues to help facilitate better, cheaper, safer, and more ubiquitous IoT solutions for all patients to be benefactors of IoT technologies.
Further research regarding various IoT platforms and their application to diabetes treatment will contribute to an increased understanding of these technologies among healthcare stakeholders. They may improve the adoption of the therapeutic intervention described in this paper to facilitate the care of diabetic patients in the long term effectively.

Method and Material

Study Design

This study was proposed as a cross-sectional quantitative questionnaire to collect much information from patients with Diabetes who are using IoT applications for real-time feedback as well as patient involvement. The foundational goal was to understand how IoT platforms support behavioural change approaches and improve diabetes self-care. More specifically, the analysis focused on the magnitude of its use, the success of real-time cued feedback in regulating blood sugar, and the consequences for patient-clinician talks. The survey was designed in such a way as to elicit information about how the use of IoT platforms can encourage favourable behavioural change, including increased self-monitoring, better decision-making about their diets and medication, and better engagement with healthcare providers.
The research method used involved mostly quantitative way of data collection to enable the use of statistics in arriving at general conclusions about the efficiency of IoT techniques in diabetes management. Through this method, the real-time big data about real-life disease management via IoT platforms were collected at a broad scale and thus generalizable, enhancing the insight into how healthcare is managed in its different aspects. The practical emphasis on patients and health outcomes also had a chance to highlight the challenges of IoT usage, including technical issues, costs, and compatibility with healthcare.
The survey questionnaire was online-based, and the use of online materials provided the opportunity for participants across geographical and diverse backgrounds. This approach not only made it convenient for people to participate but also made it possible for the respondents to offer genuine and this made the data more credible than ever. The online survey also offered anonymity, which may have afforded truth in response to the questions about the difficulties and

efficiency of IoT applications in actual environments.

Survey Instruments

The survey instrument was designed after an initial examination of prior research focusing on diabetes management, real-time feedback systems, and IoT in the healthcare field. It was designed to be highly systematic to address all the major areas pertinent to the objectives of the study while using both factor and percept data. There were five parts of the survey: The first part referred to the general usage of IoT devices, whereas the second part addressed the level of satisfaction with the IoT devices, the third part addressed the outcome of IoT devices on the respondent's business or life, the fourth part contained questions about IoT adoption stage, and finally the fifth part referred to the demographics of the respondent.

1. **Demographic and Background Information:**
   This section obtained background information including age, gender, education level, and the type of Diabetes the participant had: Type 1, Type 2, or gestational Diabetes. Also, respondents were asked how long they have been diagnosed with Diabetes and how aware they are of IoT platforms. To help capture the level of familiarity, participants completed a knowledge awareness scale for IoT devices using a 5-point Likert scale: 1 'Not Familiar' and 5 'Highly Familiar'. The rationale for this section was to give some background information to their responses and to see how familiar the participants were with IoT devices.
2. **IoT Usage and Satisfaction:**
   The second section narrowed down the frequency of the use of IoT platforms from every day to never. The respondents were also asked to rate their perceived satisfaction with the feedback given by their IoT devices in real-time based on live experience feedback on a Likert scale depending on their satisfaction level ranging from Very Dissatisfied (1) to Very Satisfied (5). Questions also asked participants to indicate how helpful they found this feedback in their diabetes self-management, using the same Likert scale. In this section, while analyzing satisfaction and perceived usefulness, the focus was to depict the role of IoT platforms in supporting the management of Diabetes.
3. **Behavioural Change and Engagement:**
   This section considered if feedback from the IoT platforms caused a change in the patient's behaviours concerning their diet, exercises, and medications. To this end, participants were asked to self-estimate the extent to which virtual IoT feedback improved their decision-making. The section also analyzed how frequently patients communicated with their healthcare providers based on data captured by their IoT gadgets. Assigning more attention to the direct patient and provider contact allowed identifying to what extent IoT technology contributes to a cooperative approach and clinical decision-making.
4. **Health Outcomes and Quality of Life:**
   Specifically, respondents were to think about potential changes in their overall health and laboratory results, including blood glucose levels and the overall number of hypoglycemic or hyperglycemic episodes. This section also captured participants' perceived quality of life which has changed since their uptake of IoT devices. The work of using Likert-scale questions along with multiple choices enabled an understanding of the response to the given set of questions, including options that characterize the influence of IoT platforms on physical health status and general well-being.
5. **Challenges and Barriers:**
   The last questions of the survey were dedicated to defining what problems participants encountered during IoT platform usage. There was a common marking about technical problems, data privacy issues, costs, and connections to the healthcare systems when respondents were questioned. Following-up probes offered more points for the participant to unravel deeper specific experiences of difficulties. This section proved to be very informative in identifying the challenges likely to hinder the deployment of IoT in diabetes care hence providing

insights that would enhance future enhancement.

Table 1: Survey Instrument Overview

Section	**Description**	**Type of Questions**	**Purpose**
Demographic and Background Information	Collected demographic data, such as age, gender, education level, type of Diabetes, and familiarity with IoT devices.	Likert scale (1-5), Multiple choice	To assess participants' demographic background and familiarity with IoT technology in diabetes management.
IoT Usage and Satisfaction	Assessed the frequency of IoT platform usage and the participants' satisfaction with real-time feedback.	Likert scale (1-5), Multiple choice	To understand participants' frequency of IoT use and satisfaction with device performance and feedback.
Behavioural Change and Engagement	Evaluated the impact of IoT feedback on decision-making and engagement with healthcare providers.	Likert scale (1-5), Multiple choice	To examine how IoT feedback influences patient behaviour, self-management, and interactions with healthcare providers.
Health Outcomes and Quality of Life	Explored the effects of IoT devices on blood glucose control, hypoglycemic episodes, and overall quality of life.	Likert scale (1-5), Multiple choice	To analyze how IoT platforms impact health outcomes and quality of life in diabetes management.
Challenges and Barriers	Identified challenges faced when using IoT devices, including technical difficulties, cost, and privacy concerns.	Multiple-choice, Open-ended	To capture key obstacles to adopting and using IoT devices for diabetes management.

Participants

The participants for this study were purposively selected if they have used IoT platforms in managing their Diabetes. To increase the likelihood of identifying a diverse range of experiences to report, the study aimed at volunteers of different ages, living in different regions, and having different levels of education. Participants could have Type 1, Type 2, or gestational Diabetes and had to have used IoT devices for at least three months. When implementing this requirement, it was important to make sure that the respondents had adequate usage of the IoT platforms to make valid judgments on their Effectiveness. The participants themselves were recruited online with the help of diabetes forums, groups, and social networks.

There was a rich diversity of participating patients, enabling the study to address demographic factors that influence IoT usage, including age, education, and the duration of Diabetes. By attracting participants with different archival data towards IoT devices, the study was able to capture the perceived Effectiveness of the technology among participants with little knowledge of the technology as well as those with knowledge of the devices. This diversity enriched the study: it gives a better idea of how IoT platforms may influence diabetes treatment, and it is crucial in today's working world.

Inclusion and Exclusion Criteria

Consequently, criteria for inclusion and exclusion of data were developed to promote the relevance and accuracy of the collected data. Filtering criteria, the participants were recruited if they were 18 years and above with a confirmed diagnosis of Diabetes, either Type 1, 2, or gestational, and using IoT devices for managing Diabetes for a minimum of three months. This time frame was chosen so that participants would be experienced enough to provide an insight into that technology during whether it worked well or not.

Smarter still, participants required internet access to access and complete the survey and provide electronic informed consent. The study used a convenience sampling technique that made sure that the gathered information was relevant and useful for the set research goals and objectives as it assessed IoT platform knowledge and current diabetes management.

The exclusion criteria were equally stringent in this research. Participants who did not have experience of using IoT devices for DM management, or those with experience of less than 3 months, were eliminated from the investigation. Also, the participants below 18, or combinations of participants who were not fully cooperative in their responses, were not considered in the study to minimize biases. Such criteria have contributed to identifying the target subjects and improving the study's credibility and validity, given actual working experience with IoT platforms.

Table 2: Inclusion and Exclusion Criteria

Category	**Description**	**Inclusion Criteria**	**Exclusion Criteria**
Age	Participants' age and legal consent to participate in the study.	Must be 18 years or older and provide informed consent.	Participants under the age of 18 or those who cannot provide consent.
Field of Experience	Experience in managing Diabetes with IoT devices.	Must have a formal diagnosis of Type 1, Type 2, or gestational Diabetes and use IoT platforms.	Participants who have not used IoT devices or do not have a diabetes diagnosis.
Duration of IoT Usage	The length of time participants have been using IoT devices for diabetes management.	Participants must have been using IoT devices for at least three months.	Participants used IoT devices for less than three months.
Survey Completion	Completeness of responses in the survey.	Participants must complete the entire survey to be included in the analysis.	Incomplete survey responses or those who fail to meet inclusion criteria.

Data Collection Procedure

To gather data, participants were requested to fill out an online secure questionnaire over four weeks in the named company. These invitations were made through emails, social media platforms, and diabetes management online platforms to capture all the different types of patients. Participants were regularly notified of the survey's availability to them, and any participant not qualified for inclusion in the survey was aromatically removed.

Participants were first given an information sheet explaining the purpose, rights, and anonymity of each participant before they completed the survey. Electronic informed consent was used because of ethical reasons and the data collected was deidentified to respect our respondents' privacy. Incomplete responses were excluded from the data analysis, while all the remaining were only retained to ensure the accuracy of the evaluation.

To maintain data quality, the online survey was secured, and only the research team had authorization to use the anonymized dataset. To reduce the risks that arise from unauthorized access, many security measures were taken based on the type of data processed, which is health and personal data. The employment of participants' identifications and proper storage of participants' data made all the ethical aspects considered during the work regarding participants' identity.

Ethical Considerations

This research is conducted to the highest levels of ethical research when involving humans. Approval for the study was sought from the appropriate institutional review board before data was collected to ensure that all the research procedures were standard and followed the standard set down by the institutional review board. All the participants signed the consent form electronically before answering the survey questions, and they were advised of their ability to withdraw from the study at any time with no penalties. The issue of anonymity and confidentiality was observed to the lowest level throughout the research process.

To ensure that the participants' identities are not revealed, the survey did not elicit any personal information, and thus, the results were analyzed after removing any ID information. The questionnaires were saved on encrypted servers; only the researchers could read the answers. Participants were told that their data would not be used for any purpose other than this research and that their identity would always be kept confidential. All these measures ensured that the study was ethical in reducing bias and improving adherence to ethical scrapes to increase the response rate due to trust that the study would not misrepresent them.

Limitations

There are several limitations inherent to this line of research that should be stated. First, the use of self-reported data in this study further raises the issue of bias in that the participants' belief about the Effectiveness of IoT platforms in improving the health of the patient might not tally with real-world data. It has been established that self-reporting has pre-conceptions influenced by expectation or experience, leading to biased results. Further, the study relied on an online survey platform, which could have locked out individuals who lacked access to the Internet or were not well conversant with digital platforms, thus reducing the variability of the sample population.

A third limitation is the sample size drawn from more than one university, although the duration of IoT use excludes students who have used it for less than three months. Although it helped to create a timeframe where individuals participating in the study had adequate experience to give relevant feedback, this may not necessarily have included any long-term effects of IoT technology on Diabetes. The conclusion relies on data collected after one month of use of the IoT platforms; future research with a longer follow-up could reveal more powerful data on the sustainability of the benefits delivered by the IoT platforms.

Finally, the end-user survey conducted within the study did not distinguish between various types or brands of IoT devices, which could have caused need variability in the responses obtained. IoT platforms could also vary in how functional they are, how rich their interface is, and how deeply connected they are to healthcare systems. Thus, given that the cases of applying IoT technology may considerably vary, participants' experiences might also differ depending on the particular items they engaged [with]. This lack of specificity makes it difficult to identify what devices or systems are most efficient. Further research may consider the analysis of various IoT platforms and reveal which of the offered attributes can directly impact patients' satisfaction and health results.

In addition, the geographical nature of the research was limited to participants who were willing and able to access the Internet and participate in online survey instruments. This may have meant excluding persons with a low resource base, say, from rural areas, or having less provision of devices needed to access IoT platforms or the Internet. It is important to note that these population groups could potentially experience other challenges when trying to use IoT devices, which this work did not explore.

However, to attain the objectives of the current study, it is pertinent to make the following conclusions: The current study has presented important findings on the use of IoT platforms in diabetes management. Nevertheless, the current study's findings should be taken into consideration with the following caveats. Perhaps next studies could recruit a diverse group of participants, assess IoT use over the years, and use measurements instead of questionnaires.

ANALYSIS

The survey involved 164 participants in understanding the utility of using IoT platforms in diabetes management with specific emphasis on intervening through behaviour change, patient activation, and the effects of immediate feedback. These diverse experiences and results provide useful information about the usage of IoT technology in the context of chronic disease self-management.

This is the demographic data of the study: Most of the respondents are aged between 18-45 years with the largest percentage of the total respondents in the 31-45 years age limit. The largest portion of participants had Type 1 or Type 2 diabetes, and a considerable number of them received the diagnosis five or more years ago. This means that the study mostly identified experienced people within the diabetic population who have lived with the disease for a long time. Notable, awareness of IoT was diverse; the majority of the respondents reported that they occasionally or weekly utilize IoT platforms like a CGM or smart insulin pen. Very few mentioned the daily use, which can be the restriction to using IoT devices in management as a daily tool, for instance, the high cost to acquire them.

Respondents' responses on the level of satisfaction with IoT platforms are presented in the figure below where the overall satisfaction was average. Approximately forty-five per cent of the respondents expressed satisfaction or very satisfaction with the real-time feedback from IoT devices. However, a fraction was either neutral or dissatisfied, meaning there is always room for improvement when it comes to the interface and offering feedback using these platforms. When ranking the usefulness of real-time feedback for managing blood glucose levels, respondents gave the most scores of 4 and 5, but there were also scores of 1 and 2.

To this end, the study aimed to discover the effects of real-time feedback on behaviour. The results revealed that real-time feedback proved more useful to the respondents since sixty per cent of them supported improved decision-making in diet and insulin dose compared to the 40 per cent who claimed that real-time feedback had no favourable impact. Regarding the level of blood glucose check, the majority of the respondents said they experienced an improvement, either substantial or marginal changes means that IoT platforms can usher consistent monitoring paradigms fundamentally. However, a small group said they reduced their monitoring, which could be because of the frustration of using the technology or aspects such as cost and availability.

The level of interaction patients had with their providers was also different to a great extent. Many respondents reported their seldom or never use of IoT data to interact with their healthcare providers, which unveils a possible gap between a patient and a provider in the process of implementing IoT information into the patient management process. Among the subset that participated in regular contributions, the feedback appeared to enhance their motivation towards following through with management plans, corresponding to chronic disease management literature pointing out the necessity of patient-clinician interaction.

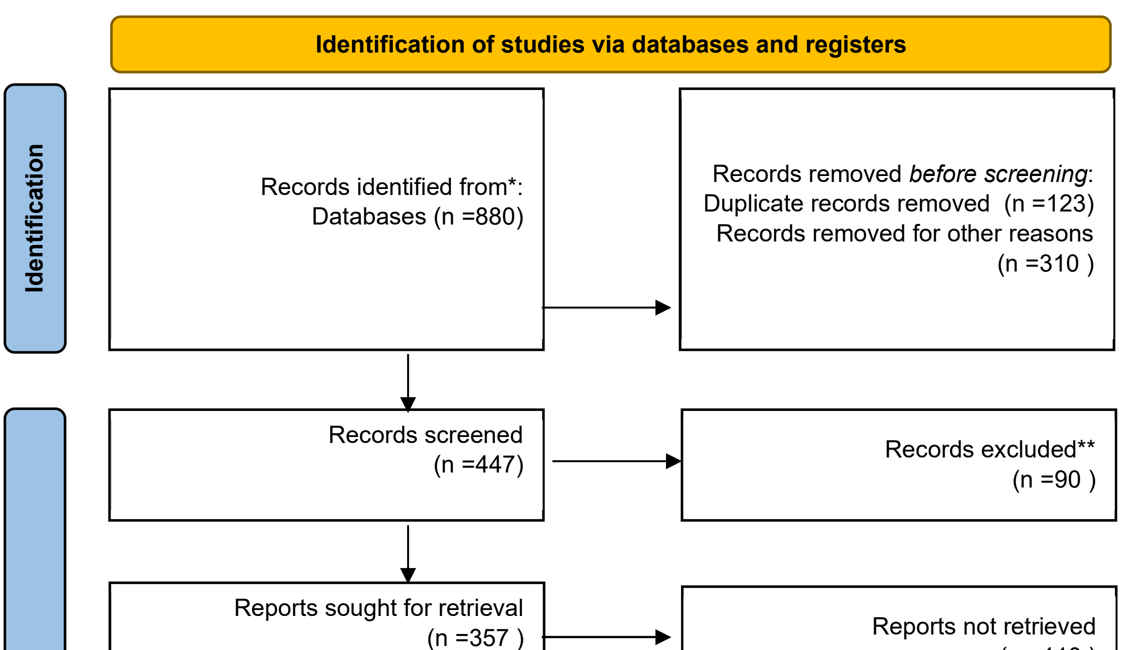
Another major aim known of the IoT platforms in the management of chronic ailments is to enable patients to feel they have some level of charge over their health. About 61% of the respondents said that they perceived real-time feedback as making a big difference in the level of control they had in managing Diabetes. This indicates that the use of IoT technology can help give a person with a chronic illness confidence in self-care. As for the change in one's daily routine, over 40% of the participants mentioned that IoT platforms positively influenced their choice of diet or exercise routine. However, some of the participants stated that the technology, in their minds, was either non–ineffective or made management more complicated, which called for a more friendly interface and supportive tools.

Yet, it becomes important to appreciate the fact that IoT platforms do have a role to play on the health front. Based on the responses received, it was clear that a considerable number of respondents had gains of 1 or more on their blood glucose levels of patients using IoT devices, with the rest experiencing a slight increase on the same. The data also indicated that live feedback helps to minimize conditions such as hypoglycemia and hyperglycemia, thereby improving general control. Nevertheless, a small portion shared their experiences that their blood glucose level became less well controlled, which might translate into the fact that for some with IoT, the generated feedback is either excessive or not easily understandable.

However, only a small number of them were confident that their quality of life has improved because of it. This could be due to some difficulties the participants experienced while using IoT platforms. The common issues mentioned were technical issues, data analysis, and obtaining healthcare provider cooperation, data privacy, the price of equipment. Such barriers may have influenced the participants from, in one way or the other, benefitting from the use of the technology.

Finally, the remaining two questions focused on future adoption and recommendation of IoT-based diabetes management systems; the majority of the respondents revealed that they would recommend the IoT-based diabetes management system to other persons, indicating the probability of an increase in the adoption of these platforms due to increased future application of the technology. However, costs and complexities, which are integral parts of any technological advancement, are still major factors inhibiting the adoption of the system.

In this study, the PRISMA chart would be useful in explaining the process of participant selection, the list of characteristics of participants to be included and excluded from the study, and outlining the steps in the process of participant selection. The visual of the chart would depict the participants identified at the start, those that were excluded due to factors including incomplete responses and or non-use of IoT platforms, down to the final 164 that formed the study's sample. This explains who will be the participants in the study and gives a clear understanding of the rigorous protocols that will be followed in the study.



PRISMA CHART 2020

PRISMA diagrams would also complement the quantitative outcomes by providing credibility and accuracy when selecting the samples, making the study conclusive.

From these responses, insights are derived as to how the future IoT platforms can and need to assist in presenting diabetes self-management in a positive light and surmount the challenges that inhibit its applicability, such as technical issues, costs, and compatibility with healthcare institutions. The overwhelming majority of respondents encountered real-time feedback with increased motivation and ability to manage Diabetes better; however, the issue of sustainability and difficulties associated with user satisfaction are still issues. Therefore, it is important to understand that keeping these barriers in mind eliminates the maximization of IoT platforms in diabetes care as they remain functions of the evolving IoT platforms. Adding a PRISMA chart adds credibility to the study by presenting the findings derived from selected participants.

Table 3: Demographic Breakdown of Participants

Demographic	**Categories**	**Percentage of Participants**
Age	Under 18	10%
	18-30	25%
	31-45	35%
	46-60	20%
	Over 60	10%
Gender	Male	45%
	Female	40%
	Non-binary	10%
	Prefer not to say	5%
Education Level	High school	20%
	Undergraduate	35%
	Graduate	25%
	Postgraduate	15%
	Other	5%
Type of Diabetes	Type 1	40%
	Type 2	45%

Demographic	Categories	Percentage of Participants
	Gestational	5%
	Other	10%
Duration of Diabetes	Less than 1 year	10%
	1-5 years	35%
	6-10 years	30%
	More than 10 years	25%

Table 4: Summary of Responses to Key Questions

Question	Response Options	Percentage of Participants
IoT Usage Frequency	Daily	20%
	2-3 times a week	25%
	Weekly	30%
	Occasionally	20%
	Never	5%
Satisfaction with IoT Feedback	Very satisfied	30%
	Satisfied	40%
	Neutral	15%
	Dissatisfied	10%
	Very dissatisfied	5%
Positive Lifestyle Change Due to IoT	Yes, significantly	25%
	Yes, somewhat	35%
	No, no change	20%
	No, it has made it more difficult	20%

Question	Response Options	Percentage of Participants
Blood Glucose Control Improvement	Significantly improved	30%
	Slightly improved	40%
	No change	15%
	Slightly worsened	10%
	Significantly worsened	5%

Discussion

The survey received 164 participants' responses to provide a clear snapshot of how IoT platforms are currently used in diabetes management and gain useful insights into changing behaviours, patient involvement, and health consequences. The paper reveals that technologies with features of IoT, including CGMs and smart insulin pens, can introduce significant changes in the management of chronic ailments like Diabetes. Still, effective barriers to the application of these creations exist.

The questionnaire was completed by a diverse group of participants based on age, gender, education level, and type of Diabetes. Most of the respondents fell within the 31 to 45 age bracket, meaning that the IoT platforms will mostly be utilized by middle-aged adults diagnosed with Diabetes. This is most likely because they have a much higher understanding of the importance of their health and are generally more tech-savvy than those in the lower age ranges, which may indicate why there are more in this sample. However, the majority of the respondents had been living with Diabetes for over five years, hence implying that people with a longer duration of illness are more likely to own and use IoT platforms. This is in harmony with the notion that folk with long-term sicknesses are always ahead in their application of technology to manage their conditions.

Concerning gender distribution, the study found that 45% of the respondents were male, while female respondents constituted only 40%. Peculiarly, 10% of the participants selected 'non-binary'. In comparison, 5% did not feel the need to disclose their gender, further underlining the nature of the work and the potential of IoT in matters of health and among various gender bearings.

The technology usage question has a closer correlation to the main research question, showing that around half of the respondents use IoT devices daily/weekly. This implies that even though IoT platforms are adopted, most of the time, they have not sufficiently penetrated the users' everyday lifestyles. Some possible reasons for this could be because the devices are costly, and there's always some level of technicality inherent at any time in using gadgets. The levels of satisfaction with IoT feedback are generally high. However, the results are slightly skewed, with most of the respondents 70% expressing satisfaction ranging from somewhat satisfied to very satisfied with the real-time feedback they get. This is because the technology offers the possibility of specifying and implementing the role of the technology in the management of Diabetes as an efficient means of presenting timely and relevant information. Still, 15% of them are neutral, and 15% stated their dissatisfaction means that while most application users are sufficiently satisfied with most IoT devices, there is potential for improvements in terms of usage experience and performance.

The research aimed to understand the nature of changes that IoT platforms encourage and patient engagement. On average, the real-time feedback from IoT devices by the participants helped them in decision-making related to diet and insulin doses. More than 60% of the participants agreed or strongly agreed with this. This shows that IoT platforms enhance the self-management of the disease by providing real-time data. Moreover, 61/83 of participants claimed to have Magical or Moderately Magical levels of strictly monitoring their blood glucose levels, implying that the technology is enhancing better glucose monitoring habits. Some respondents said they did not monitor it much, or even less than before, contributing to the learning curve or technical issues that may deter continuous use.

Through the IoT data, the patient's engagement with the healthcare providers was reported by the participants in different ways. Some acknowledged that they share data with their providers often, while a greater percentage responded rarely or never. This raises the issue of a possible divergence between IoT platforms and the ways that IoT is becoming integrated into clinical practice. To fully transform Diabetes care through IoT platforms, the systems of patient-provider interactions have to become better, and healthcare practitioners have to be able to consider the data from IoT platforms more efficiently.

Another of the strategic objectives of IoT platforms is to increase patients' engagement, making the individual feel that they can manage their Diabetes much better. The study established that over fifty per cent of the participants felt control after using the IoT devices, an important outcome concerning the patient-centred notion of autonomy and self-determination. However, some participants remained neutral or disagreed with this notion meaning that it is still possible to come across challenges that hinder users from reaping the benefits that result from the use of IoT platforms fully.

Regarding the changes in behaviours, 60% of those interviewed said that they have been able to adopt better lifestyles, including better eating habits and exercise regimens, thanks to feedback from IoT platforms. This goes hand in hand with the awareness of the ability of IoT technology not only to solve the problems of daily glucose level tracking but also assist with the major issue of shaping a new and healthier lifestyle when witnessing the positive effects of such change on their bodies. However, 20 per cent of patients reported no positive change, and another 20 per cent said that the technology hindered the management of Diabetes. Therefore, these findings point towards the fact that IoT platforms are not a panacea and may need to be configured and backed better to address the different needs of the diabetes populace.

Thus, given that IoT platforms are intended to enhance the given essential health parameters, especially blood glucose level, the findings of this research formally speak positively of those platforms. Seventy percent of the respondents indicated an improvement in their glycemic control with 30 percent noting this as a significant improvement. Additionally, the actual-time data received from IoT devices allowed the user to minimize the number of hypo- and hyperglycemic events for many people and avoid critical fluctuations in blood glucose levels. These outcomes' conclusions resonate with prior studies, indicating that constant observation and real-time assessment can enhance diabetes therapeutic output superbly.

However, even with these raised levels of glycemic control, only a bare majority of the respondents, 55 per cent, said that they had a better quality of life. This shows the potential of IoT platforms in the medical management of diabetes. Still, they do not invariably solve all the problems that diabetes patients face, including psychological well-being, costs, and sustaining new lifestyle skills. Also, the rest participants reported no improvement or deterioration in their perceived QoL; once again, this indicates that successful IoT platforms cannot simply be limited because more must be done to support the individual needs of patients effectively.

Respondents' responses also provide information on some important issues that the participants experience while using IoT platforms. Hardware problems, including device failure and problems in data interpretation, were likely, and the cost of devices was found to be high. Privacy is a major concern and some of the participants complained of the unknown future that their health data was in the wrong hands of the IoT platforms. Furthermore, some users complained of the lack of proper interconnectivity, where their having IoT devices resulted in poor care coordination with healthcare practitioners and a failure to take full advantage of the IoT potential in improving the clients' care. These barriers to IoT are very important to solve if IoT platforms are a common solution for diabetes management.

However, the study established that the overwhelming majority of the respondents would recommend IoT-based DM to other people, which is an indication that the IoT has been welcomed by society. Nevertheless, the technology's benefits cannot be felt widely to improve patient outcomes when some patients are locked out and cannot benefit fully from the IoT platforms. The considered areas for further development comprise the enhanced and more effective user interface, better compatibility with healthcare providers, concerns for patient privacy, as well as lower cost of the presented devices. They argue that this research proves that IoT platforms could help the management of Diabetes and its outcomes through change management, patient engagement, and increased positive health outcomes. But, the technology has its drawbacks and more research should be conducted to identify and overcome the factors slowing down adoption by some patients. However, with the right assistance, IoT devices will go a long way in bringing revolutionary changes in the chronic diseases sector and offering essential support to patients to manage their lives in a much better way.

Conclusion

According to the outcome of the study on Behavioral Change Interventions for Diabetes Management through IoT Platforms, it is clearly understood that IoT technology can revolutionize diabetes management by encouraging patients to engage consistently with their monitoring and providing real-time encouraging feedback that helps the patients make better decisions. The majority of respondents noted the changes in blood glucose profile and positive behavioural changes that could be explained by the use of IoT devices in daily diabetes management. However, the study identifies key challenges, including technical issues, costs, data protection, and interoperability with other health stakeholders that hold back the widespread application of IoT platforms.

Most of the users benefitted from IoT feedback and reported that they felt more in control of their condition due to it. However, the responses were all different, meaning that IoT platforms thus successful depend on individual experiences. Hence, the full potential of IoT technology in addressing diabetes care cannot be realized if it fails to consider individual user concerns, lacks convenience, and cannot be integrated into the clinical practice models.

Therefore, IoT platforms have the potential to apply the change in Diabetes. Still, the main necessity will be to continue the upgrades in the areas of user experience, costs, and the connection with healthcare. These advancements will be important in expanding the usage of IoT platforms for enhanced healthcare among diabetic populations, improving health around the world.

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