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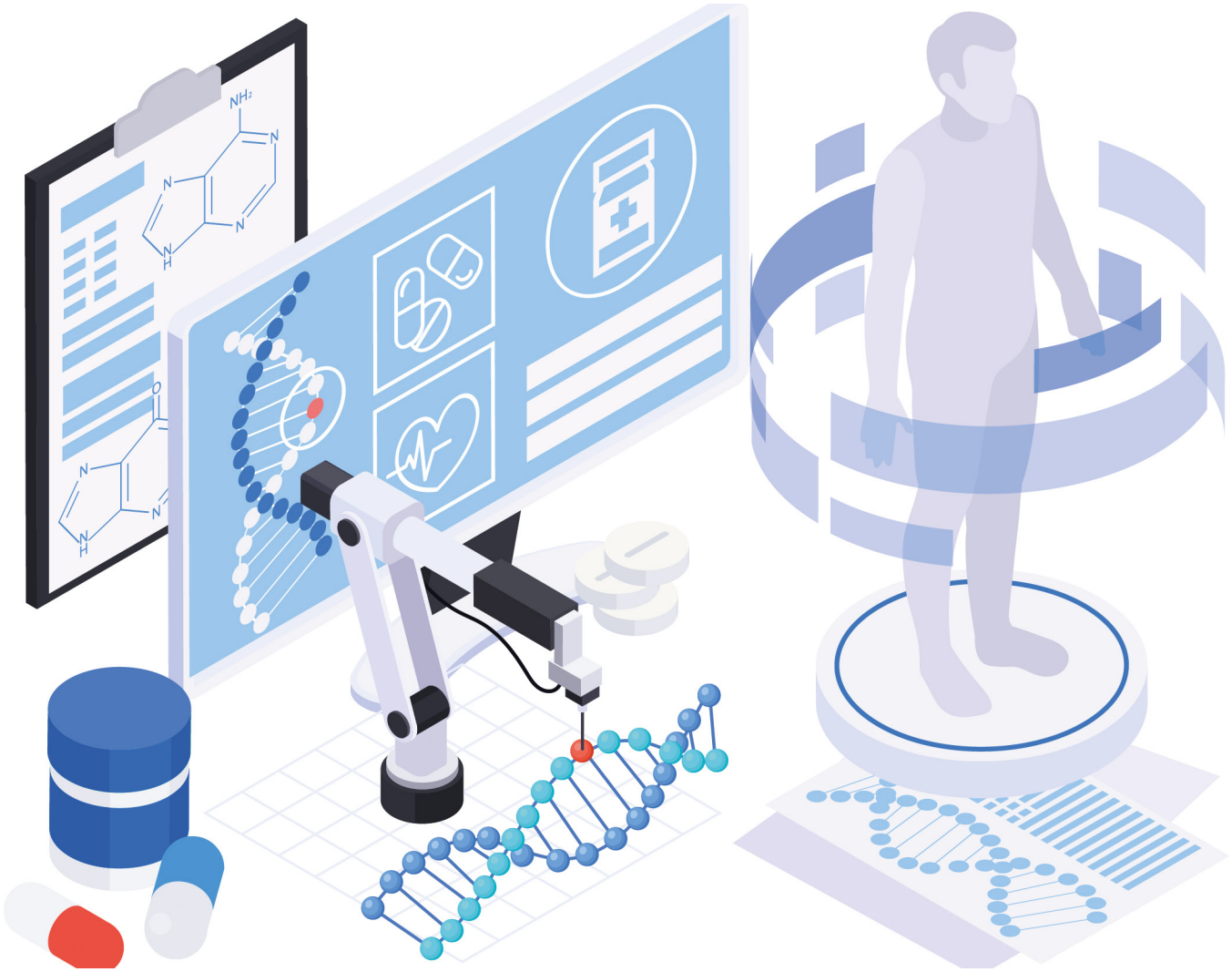


The Role of Artificial Intelligence in Diabetes

Artificial Intelligence (AI) is revolutionizing the field of medicine, particularly in diabetes management. It presents a golden opportunity to enhance treatment efficiency by optimizing medical resources and promoting patient self-management.

In the context of Primary Care, AI emerges as a powerful tool for improving diabetes management, offering a more personalized and efficient approach(1).

AI has been utilized in various areas of diabetes management, such as predicting diabetes risk, classifying different types of diabetes, monitoring blood glucose levels, and controlling modifiable risk factors(2). Additionally, AI-based clinical decision support systems have been implemented to enhance diagnosis and treatment, with a particular emphasis on machine learning and deep learning(3, 4).

Artificial intelligence (AI) is transforming how diabetes, especially type 2 diabetes mellitus, is managed. By analyzing large volumes of data and adapting to individual needs, AI is helping both patients and health care professionals improve treatment and quality of life.

Some AI-powered information search tools include ChatGPT, Gemini, and Copilot, available in web and app versions. These tools conduct more precise searches, interacting through prompts (requests designed to guide interaction with an AI system) accurately.

Key advancements in AI for diabetes management

1. INDIVIDUALIZATION OF DIABETES MANAGEMENT

AI enables the creation of treatment plans tailored to each patient's specific needs, due to its ability to analyze factors such as glucose levels, physical activity, and diet.

Examples:

- **Personalized treatment plans:** A patient using a continuous glucose monitor (CGM) can have AI analyze their glucose, diet, and exercise data, allowing for individualized insulin or medication adjustments.
- **Event prediction:** AI algorithms can anticipate hypoglycemia (low blood sugar) or hyperglycemia (high blood sugar) episodes based on historical data. For instance, an AI system may send an alert if it predicts low blood sugar due to recent physical activity.

2. IMPROVED MONITORING

CGM technology has significantly improved with AI, enabling detailed and real-time patient data analysis.

Examples:

- **Real-time analysis:** AI processes data from glucose sensors, identifying patterns that might otherwise go unnoticed.
- **Early complication detection:** AI can analyze medical images, such as retinal scans, to detect early signs of diabetic retinopathy before symptoms appear (5, 6).

3. ENHANCED DECISION-MAKING

AI helps both patients and physicians make more informed decisions regarding diabetes management.

Examples:

- **Individualize recommendations:** AI-powered apps can answer patient questions and provide immediate guidance. For instance, if a patient asks how to adjust their insulin dose after a high-carb meal, AI will suggest an appropriate adjustment.
- **Optimized insulin therapy:** AI algorithms can automatically adjust insulin doses based on glucose levels, physical activity, and other factors. A hybrid closed-loop system continuously delivers small insulin doses, mimicking the function of the endocrine pancreas(7).

4. IMPROVED TREATMENT ADHERENCE

AI plays a crucial role in helping patients follow their treatment plans consistently, which is essential for effective diabetes management.

Examples:

- **Motivational apps:** AI-based apps can track progress and send reminders for medication and glucose monitoring. »

ARTIFICIAL INTELLIGENCE IS TRANSFORMING THE WAY DIABETES, ESPECIALLY TYPE 2 DIABETES MELLITUS, IS MANAGED. THROUGH THE ANALYSIS OF LARGE DATA SETS AND THE ABILITY TO ADAPT TO INDIVIDUAL NEEDS, AI IS HELPING BOTH PATIENTS AND HEALTHCARE PROFESSIONALS IMPROVE TREATMENT AND QUALITY OF LIFE

AI ALSO PLAYS A CRUCIAL ROLE IN HELPING PATIENTS FOLLOW THEIR TREATMENT PLANS MORE CONSISTENTLY, WHICH IS ESSENTIAL FOR EFFECTIVE DIABETES CONTROL

- **Individualized reminders:** If a patient forgets to take their medication or measure glucose levels, AI can send reminders tailored to their habits and schedule. For example, an app might prompt a patient to check their blood sugar before meals.

5. LESS HEALTH CARE BURDEN

AI can automate many routine tasks that traditionally required human intervention, freeing up healthcare professionals to focus on more complex treatment aspects.

» **Examples:**

- **Task automation:** AI can handle insulin dose adjustments based on patient data, reducing the need for manual adjustments during each consultation(8).
- **Resource optimization:** By enabling more precise and personalized diabetes management, AI can help reduce long-term healthcare costs, preventing hospitalizations due to complications and improving treatment efficiency.

6. AI APPLICATIONS IN SPAIN

1. Mediktor: Intelligent Patient Triage

An AI-based tool that performs symptom-based triage, analyzing patient-reported symptoms to provide a list of potential diagnoses and recommendations on whether to seek emergency or primary care. Mediktor has demonstrated over 91% diagnostic accuracy and has been implemented in healthcare centers across several regions in Spain, including Catalonia and Madrid.

2. Cognitive Healthcare by Savana

Savana is a Spanish company using AI to analyze millions of health records for patterns and trends to enhance healthcare delivery. It employs natural language processing (NLP) to read and analyze unstructured medical texts. Studies show that Savana improves the early detection of undiagnosed diseases and optimizes patient follow-up, reducing complications from chronic illnesses.

3. Telemedicine and AI in the Catalan Health Service (CatSalut)

In Catalonia, the Catalan Health Service (CatSalut) has integrated AI and telemedicine to improve remote patient diagnosis and monitoring. AI systems analyze patient health data collected via connected devices, helping predict disease exacerbations and providing automated treatment recommendations to primary care physicians. This system has resulted in a 30% reduction in pre- »

TABLE 1. AI Applications in Healthcare Professionals for Diabetes Management

PROFESSIONALS	EXAMPLES
Diabetes Risk Prediction	Machine learning algorithms analyze genetic data, lifestyle habits, and environmental factors to predict the risk of developing type 2 diabetes.
Optimization of Insulin and Medication Doses	AI-based insulin calculators automatically adjust doses based on real-time glucose levels.
Early Detection of Complications	AI systems detect **diabetic retinopathy** and **neuropathy** by analyzing retinal images or medical examinations.
Decision-Support Systems	AI tools provide treatment recommendations based on patient history and global research data.
Analysis of Large Clinical Data Sets	AI rapidly processes electronic health records (EHR) to identify patterns and improve clinical management.

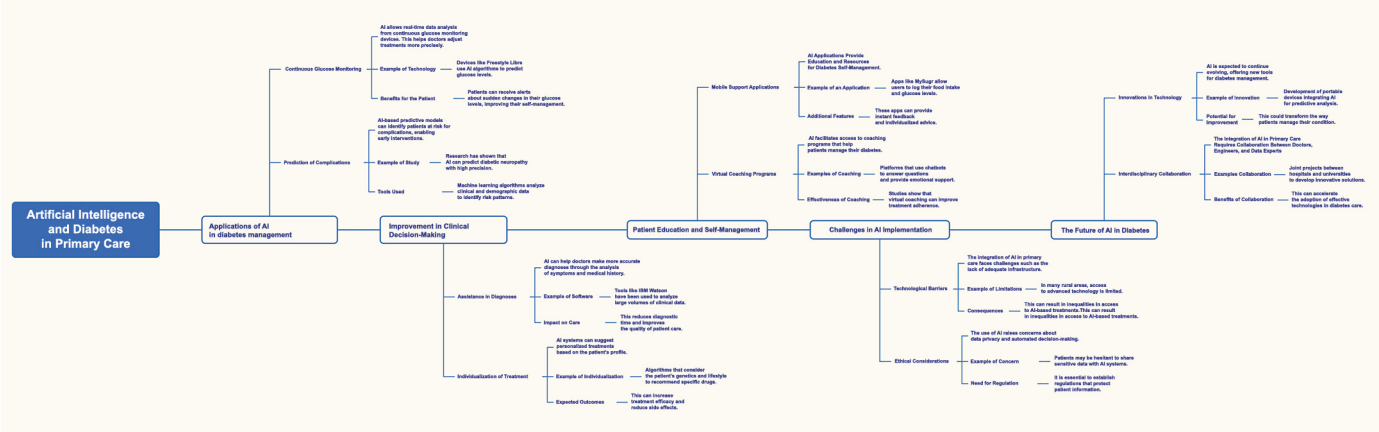
Author: Own elaboration

TABLE 2. Practical AI Applications for Patients with Diabetes

PATIENTS	EXAMPLES
Continuous Glucose Monitoring	AI-powered continuous glucose monitoring (CGM) devices, like the Guardian Connectsystem, predict glucose levels and alert users about hypoglycemia before it occurs.
Diet Automation	Apps like GoCARB use AI to estimate carbohydrate content in meals based on photos sent by the patient.
Personalized Education & Self-Management	AI programs provide personalized health recommendations, alerts, and education on diabetes management based on patient data.
Telemedicine & Remote Care	AI platforms allow real-time glucose data sharing with doctors and offer immediate advice without requiring an in-person consultation.
Predictive Alerts for Glycemic Events	AI predicts hyperglycemia or hypoglycemia events in advance and sends personalized alerts to the patient.

Autora: propia

THESE ADVANCES WILL NOT ONLY IMPROVE THE PATIENTS' QUALITY OF LIFE BUT ALSO MAKE DIABETES TREATMENT MORE ACCESSIBLE AND EQUITABLE, REDUCING THE FINANCIAL BURDEN FOR BOTH PATIENTS AND HEALTH CARE SYSTEMS



Final scheme by IA Mapify

» ventable hospitalizations for chronic patients and improved patient quality of life through continuous monitoring.

4. Florence

Florence is a chatbot that acts as a virtual nurse, providing medication reminders and health tracking assistance. It is particularly useful for diabetes patients who need to monitor glucose levels and administer medications regularly. The chatbot can also track weight and mood swings.

A summary of AI applications for healthcare professionals and patients is presented in Tables 1 and 2.

SOCIETAL IMPACT

These advancements will not only enhance patients' quality of life but also make diabetes treatment more accessible and equitable, reducing the financial burden on both patients and healthcare systems. D

CONCLUSIONS

The adaptation to AI is inevitable. It is not an option but a necessity.

AI will integrate into every aspect of life, from the simplest to the most complex tasks.

Rather than resisting it, we must embrace its potential and learn to use it to our advantage.

Adapting is the way forward.

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