“PERCEPTION AND READINESS OF MEXICAN HEALTHCARE PROFESSIONALS AT DIFFERENT CAREER STAGES TO ADOPT WEARABLE DEVICES IN TYPE 2 DIABETES MANAGEMENT”.

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MSc in Digital Transformation

By

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CANDIDATE DECLARATION

I hereby declare that the dissertation entitled**: "PERCEPTION AND READINESS OF MEXICAN HEALTHCARE PROFESSIONALS AT DIFFERENT CAREER STAGES TO ADOPT WEARABLE DEVICES IN TYPE 2 DIABETES MANAGEMENT"** submitted in partial fulfillment of a MSc in Digital Transformation is the result of my own work and due acknowledgment is given. I also hereby I have not plagarised anyone else's work.

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Cristina Granados Alvarado

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ABBREVIATIONS

T2D	Type 2 Diabetes
CGMs	Continuous Glucose Monitors
IoT	Internet of Things
JASP	Jeffrey's Amazing Statistics Program
IDF	The International Diabetes Federation
AI	Artificial Intelligence
EHRs	Electronic Health Records
rtCGMs	Real-time Continuous Glucose Monitors
FDA	Food And Drug Administration
HL7	Health Level 7
FHIR	Fast Healthcare Interoperability Resources
SDT	Self-determination Theory
INEGI	Instituto Nacional De Estadistica Y Geografia (National Institute of Statistics and Geography)
IMSS	Instituto Nacional Del Seguro Social _(National Social Security Institute)
ISSSTE	Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (Institute for Social Security and Services for State Workers)
DRIP	Data Rich but Information Poor
PGHD	Patient-generated Health Data
FDPL	Federal Law on the Protection of Personal Data Held by Private Parties
COFEPRIS	Federal Commission for the Protection Against Sanitary Risks
CE	Conformite Europeenne
ISO	International Organization for Standardisation
mHealth	Mobile Health
CAGR	Compound Annual Growth Rate
HCPs	Healthcare Professionals
GDPR	General Data Protection Regulation

Abstract

Type 2 Diabetes (T2D) remains one of the most urgent health concerns in Mexico, with steadily rising prevalence, substantial treatment costs, and increasing pressure on healthcare services. As the burden of this condition grows, there is a pressing need for innovative strategies to improve patient monitoring, engagement, and outcomes.
Wearable health devices, capable of providing continuous, real-time data, are among the most promising technological tools for achieving these goals. However, successful adoption depends not only on the technology itself but also on healthcare professionals' perceptions, willingness, and capacity to integrate such tools into their practice.

This study examined the perceptions, readiness, and barriers/enablers to the adoption of wearable devices for type 2 diabetes (T2D) management among healthcare professionals in Mexico, comparing views between junior and senior practitioners. Four research objectives were established: (1) to access the perception and understanding of wearable devices, (2) to explore and compare perceived benefits, risks, and limitations between junior and senior professionals, (3) to observe readiness and willingness to integrate wearable devices into clinical practice, and (4) to identify the challenges and facilitators influencing adoption. The central hypothesis proposed that junior healthcare professionals would display a more favourable perception and greater readiness for adoption compared to senior counterparts.
A cross-sectional quantitative survey was conducted using an online structured questionnaire.
A sample size of 103 participants (55 junior and 48 senior) was recruited. The survey consisted of Likert-scale items, categorical and multiple-choice questions, and one open-ended question.

Results identified cost to patients, doubts about device accuracy, and lack of training as the most commonly mentioned challenges. The key facilitators included lower costs or insurance coverage, user-friendly devices compatible with existing systems, and training programs. Notable differences across career stages appeared in training needs, data privacy concerns, and the likelihood of recommending wearables to patients. Qualitative findings supported these results and highlighted barriers to adopting wearables in Mexico, including infrastructure shortages and limited professional familiarity with wearable technology.

These findings are consistent with international literature emphasising affordability, training, and institutional support as crucial for digital health adoption, while also highlighting unique considerations for the Mexican healthcare context. This study aims to contribute by informing policy, institutional strategies, and targeted interventions to improve T2D management through wearable devices in middle-income countries.

Keywords: Wearable devices, Type 2 Diabetes, Healthcare professionals, Junior, Senior, Mexico, adoption, challenges, facilitators, digital health

Chapter 1. Introduction

1.1 Overview

Diabetes mellitus continues to rise at alarming rates, being considered one of the top five causes of death by disease globally. The International Diabetes Federation reports an estimated 589 million adults were diagnosed with diabetes in 2024, of which 90% present Type 2 Diabetes (T2D), making it the most common type of diabetes worldwide *(Schwarz, 2025).*

In Mexico, diabetes ranks as one of the top three causes of death. It is a leading factor contributing to long-term illness and disability, according to the International Diabetes Federation, in 2024, 14 million adults were diagnosed with diabetes in Mexico *(Atlas de la Diabetes, 2025)*, of which T2D represents 95% of diabetes cases and is listed as the primary cause of health issues in adults, this has led to the search for new and alternatives methods for diabetes management, support, and prevention *(Contreras and Vehi, 2018).*

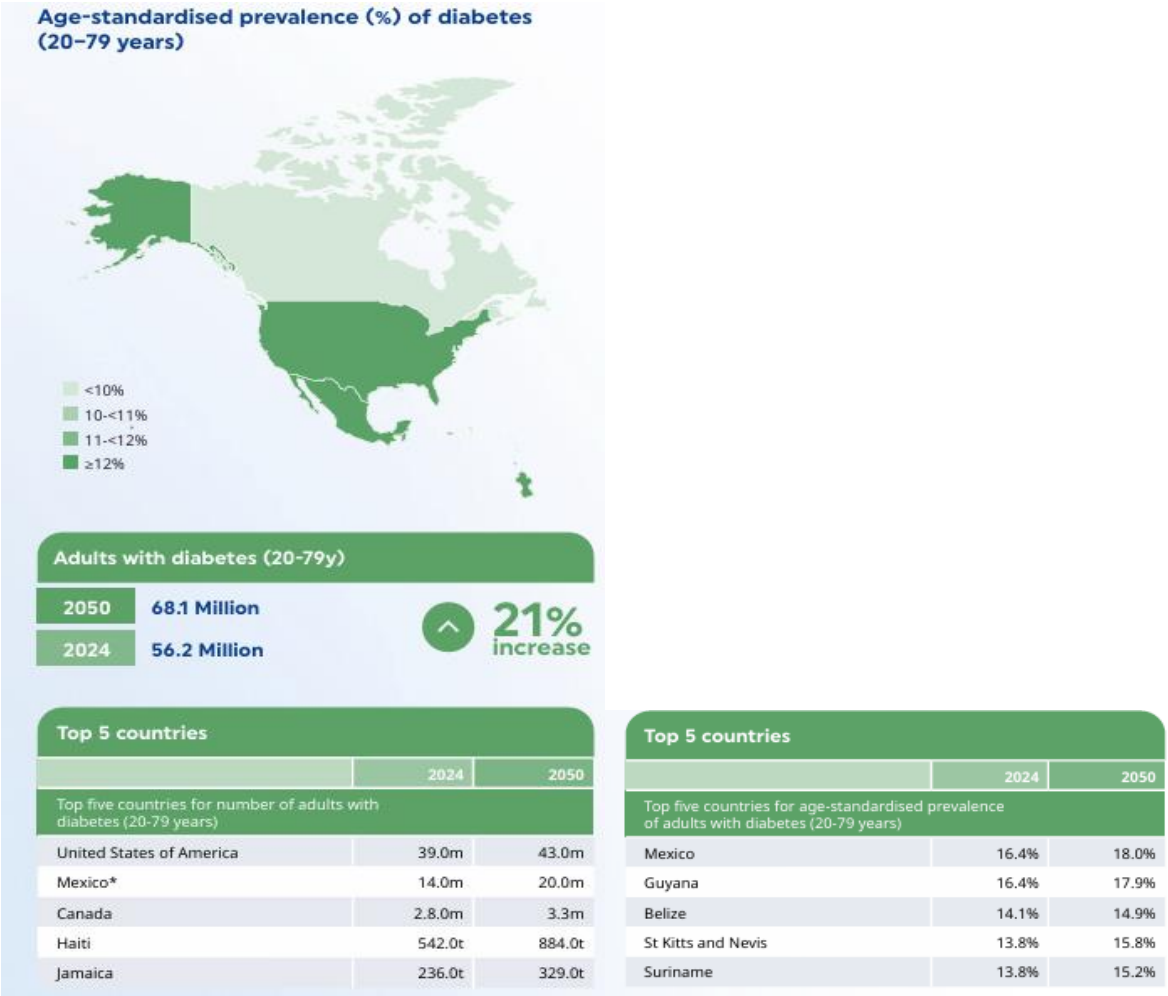

Figure 1: Diabetes in North America and Caribbean in 2024 (Diabetes Atlas, 2025).

The development of new technology has opened doors for improvements and opportunities in every sector, particularly in the life sciences industry. The introduction of digital tools has facilitated the prevention and discovery of diseases, such as Type 2 Diabetes (T2D). Among these digital health technologies, wearable devices such as continuous glucose monitors (CGMs) and smart watches with health-tracking apps provide real-time feedback on glucose levels, physical activity, and various health measures, making them valuable for tracking health metrics *(Mansour, Saeed Darweesh, and Soltan, 2024).*

The incorporation and use of digital tools are of growing importance; however, the success in the introduction and incorporation of wearables into healthcare systems depends on multiple factors, one of which is healthcare professionals' willingness and preparedness to integrate them into routine care, being the goalkeepers in the approval and guiding patient care treatments *(Mobility Foresights, 2025).*

In Mexico, where digital health implementation is still in the development phase, public sector institutions often face resource limitations, and integrating digital technologies is challenging across healthcare settings (Vivanco, Angel, *and Adame, 2017).* Furthermore, the digital integration can be significantly impacted by human factors, career stage may influence digital readiness: younger healthcare professionals, who are normally introduced to the use of digital tools during their education, tend to show greater levels of comfort and willingness to adopt new technologies, whereas their older peers might express more skepticism, often due to multiple concerns such as workflow changes, data security and reliability, and unfamiliarity with the use of emerging digital systems *(Jarva et al., 2022).*

1.2 Problem statement

Despite the increasing development and use of wearable technologies for managing chronic diseases, such as type 2 diabetes, in healthcare, their full adoption remains inconsistent, especially in low- and middle-income countries like Mexico. Differences in digital readiness, socioeconomic status, and healthcare systems contribute to the widening of this gap. This challenge is worsened by varying perceptions, experiences, and digital literacy among healthcare providers, particularly between younger and more experienced professionals, making integration more difficult. Without a clear understanding of these factors, efforts to implement wearable technologies in medical practice may fall short or prove ineffective, ultimately limiting their potential to improve patient care and T2D management.

1.3 Significance of the study

The development and integration of wearable digital technologies in healthcare management have gained significant recognition and growth across the global healthcare sector. These tools are transforming the management of chronic diseases by enabling patients to access real-time monitoring, improving health literacy, and facilitating early intervention *(Jadhav, 2024).* Type 2 Diabetes is a chronic condition that requires continuous behavioral monitoring and clinical follow-up, and the wearable market offers unique opportunities for enhancing patient engagement and treatment outcomes *(Ahmed et al., 2022).* This presents substantial opportunities for countries like Mexico, where type 2 Diabetes is a major health burden. However, various factors influence this process.

Understanding healthcare professionals' perceptions and readiness to adopt these tools is crucial, as they are ultimately the final decision-makers in recommending and integrating these technologies into clinical practice *(Lee and Lee, 2020).*

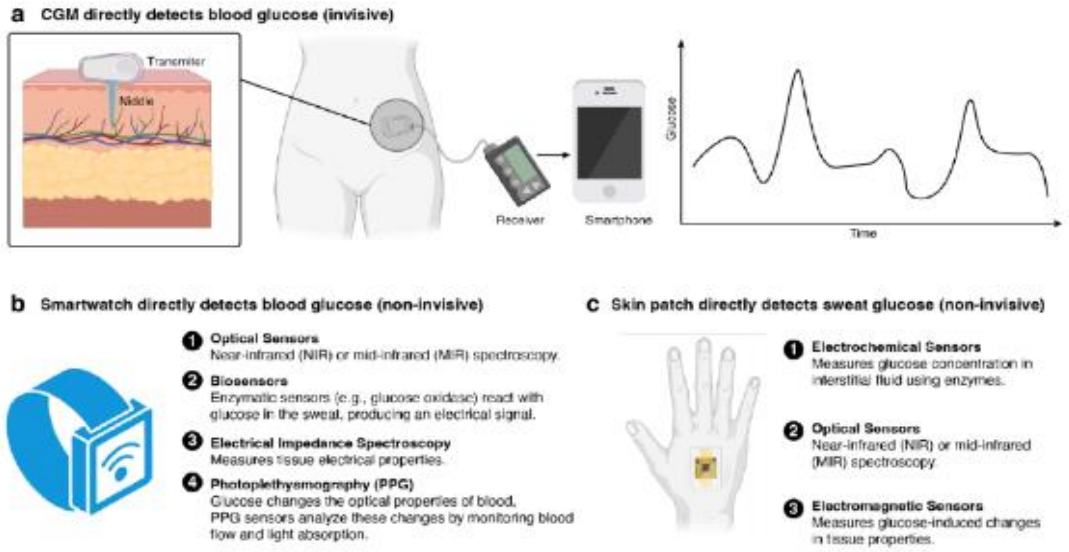

Figure 2: Wearable Device for Glucose Monitoring. (a) Continuous glucose Monitoring systems. (b) Smart Watches with biosensors to detect blood glucose. (c) non-invasive skin patches with sensors to detect glucose levels in sweat *(Du et al., 2025).*

While literature has documented multiple benefits of using wearable devices in healthcare management, a crucial gap remains that this study aims to address regarding the Mexican healthcare system, where infrastructural, cultural, and economic factors impact adoption. By examining differences between junior and senior healthcare professionals and recognizing that individuals' career stages may affect their digital literacy, openness to innovation, and trust in technology, tailored training and implementation strategies can be developed (Weidmann, 2024). Study findings will offer insights for healthcare institutions and technology developers on challenges like cost, facilities, data privacy concerns, and workflow integration to ensure smooth implementation. The study emphasises the importance of involving healthcare professionals in the design and functions of digital tools to improve adoption and effectiveness, as well as the ongoing need for continuous education and support, especially among older healthcare professionals who may be less familiar with digital technologies (Weidmann, 2024). Mexico's wearable technology market is rapidly expanding, driven by increasing health awareness and IoT integration *(Imarcgroup.com, 2025*). This study's findings will contribute to matching technological development to healthcare providers' practical needs and healthcare systems' capabilities, promoting a sustainable digital transformation in the management of chronic diseases. Ultimately, this research contributes to aligning health system modernization and supports global initiatives promoting technology-driven chronic disease management, particularly in underrepresented healthcare settings.

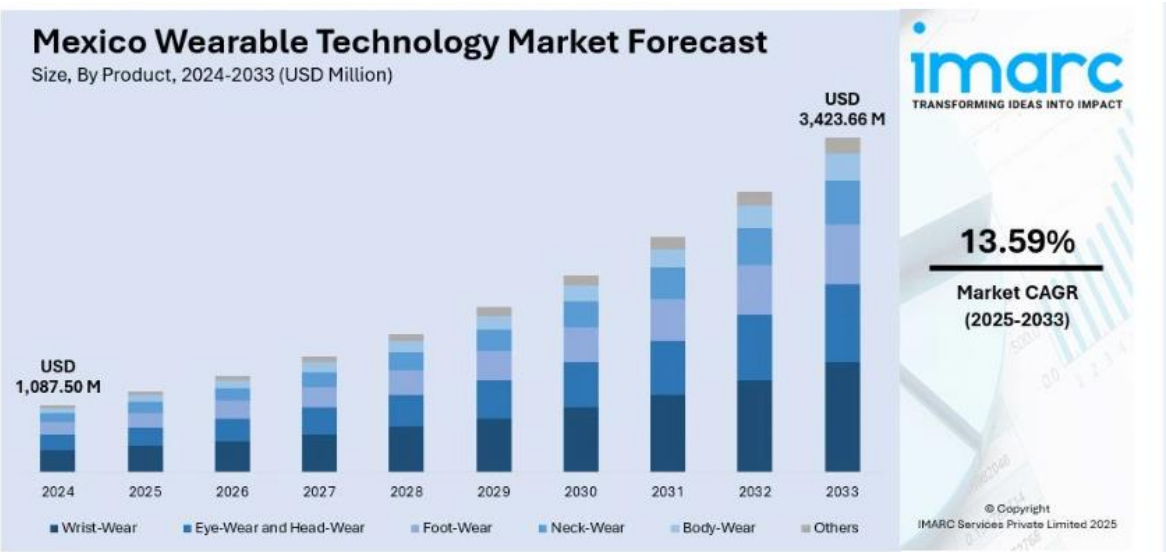

Figure 3: Mexico wearable Technology Market Forecast
(Imarcgroup.com, 2025).

1.4 Research Aim and Hypothesis

This research aims to explore and compare the perception and readiness between junior and senior healthcare professionals in Mexico regarding the use of wearable devices for type 2 Diabetes management.

Hypothesis: Junior healthcare professionals in Mexico will show a more favourable perception and readiness for the adoption of wearable devices for Type 2 Diabetes management than senior healthcare professionals.

1.5 Objectives

This research has the following objectives:

1- Assess the perception and understanding of wearable devices for type 2 diabetes management among junior and senior healthcare professionals in Mexico.
2- To explore and compare perceptions regarding benefits, risks, and limitations in using wearable technologies in the care and monitoring of diabetes between junior and senior healthcare practitioners.
3- To observe the readiness and willingness of these practitioners to integrate wearable devices into medical practice for diabetes management.
4- To explore and identify key challenges and enablers influencing the adoption of wearable devices in medical practice in Mexico from the perspectives of junior and senior professionals.
    - And observe if there is a difference in perspective between them.

1.6 Methodological overview

This research applies a positivism philosophy with a deductive approach, focusing on a mixed-methods quantitative strategy to explore the adoption of wearable

technologies in type 2 Diabetes management (T2D), focusing on healthcare professionals' perspectives and perceived readiness. This methodology enables a comprehensive understanding of the differences in perception and readiness between healthcare professionals by adopting the use of quantitative data in the form of surveys, which provides insight into patterns, trends, and correlations between medical professionals at different career stages in Mexico.
Data will be collected through online platforms applying surveys with the following characteristics: Likert-scale items to assess attitudes, perceived challenges/benefits, and readiness, closed-ended Yes/No questions for professional background, and open-ended questions to provide broader insights and enrich findings. The participants combined a mix of residents, early-career doctors, specialists, and clinicians with more than 10 years of experience working in Mexico.
Quantitative data from the surveys were analysed using descriptive statistics, utilizing Excel and JASP to identify trends, patterns, and correlations. The data from the dataset was then compared to triangulate and strengthen interpretations. The findings were presented through tables and charts, utilizing Excel and Tableau tools.

1.7 Structure of the study

This study is organized into five comprehensive chapters, each contributing to providing a systemic exploration of the research objectives.
Chapter one, the introduction establishes the foundation of the study, providing an overview of the research context, outlining the research problem, aims, objectives, and significance of the study. It also presents the guiding research questions and introduces the conceptual framework that informs the study. Chapter two critically examines existing literature relevant to the core research objectives, using a thematic approach. The review synthesises key findings, identifies theoretical debates, and highlights paramount gaps within the Mexican context.
The methodology chapter details the research design and methods applied to gather and analyse the primary data. The chapter also explains how data were collected, the procedures followed, and how ethical considerations were addressed. The next chapter, data analysis and findings, presents the results of the empirical research. The findings are organised thematically, highlighting similarities and differences in perspectives, level of awareness, and readiness to integrate wearable devices in T2D care. The final chapter conclusions and recommendations synthesise the main findings and reiterate the study's contributions to practice and theory literature. The discussion interprets the significance of observed differences across career stages, explores cultural factors influencing readiness and perception, and identifies potential challenges and enablers to wearable device adoption.

Chapter 2: Literature Review

2.1 Overview

Over the last few decades, type 2 diabetes (T2D) has become one of the most common chronic diseases worldwide, characterized by insulin resistance, progressive failure of pancreatic beta cells, and linked to multiple comorbidities, including cardiovascular diseases and neuropathy. The development of wearable devices has led to significant improvements and supports, allowing patients to manage their condition independently, monitor remotely, and assist in clinical decision-making. A key factor for integrating and using wearable devices in practice is healthcare professionals' opinions, as they influence patient adoption, and patients are much more likely to use these devices if recommended by their doctors. The literature highlights that while wearable devices have the potential to revolutionize diabetes care through real-time tracking, their effectiveness depends on overcoming challenges such as affordability, data privacy, ease of use, and support from healthcare providers. Understanding the perspectives and readiness of healthcare professionals, especially at different career stages and within specific settings like Mexico, is crucial for the successful implementation and wider adoption of these technologies.

2.2 The Rise in wearable devices and their involvement in type 2 diabetes management

In the past decade, we have witnessed a technological revolution with the invention and introduction of digital tools in the life sciences industry. Wearable technologies have transformed the traditional detection and management of chronic diseases by enabling real-time monitoring and enhancing patient engagement *(Adepoju et al, 2024).*

Diabetes type 2 ranks among the leading causes of disability and mortality in chronic disease. In 2023 alone, the International Diabetes Federation reported that 537 million adults were affected globally, out of which 90% have type 2 Diabetes *(Ahmed et al., 2023).* Managing this condition requires long-term monitoring of lifestyle factors, adherence to medication, and effective blood glucose control. The development of wearables, such as continuous glucose monitors (CGMs), AI-enhanced Smart watches, smart insulin pens, and AI-powered mobile health applications, has allowed patients to have real-time monitoring in various health metrics including blood sugar levels, personalized feedback, and an overall proactive management of their condition without the necessity of constantly recurring to traditional medical visits *(Alzghaibi, 2025).*

2.2.1 Evolution and types of wearable devices for Diabetes care

Traditionally, diabetes care has relied on self-monitoring of blood glucose through finger-stick tests, with insulin-dependent individuals often needing to check their levels multiple times throughout the day, making it exhausting and challenging for patients to maintain regimes and treatments. The concept of continuous, implementable glucose sensors emerged over 40 years ago, although early devices faced significant technical limitations *(Didyuk et al., 2020).*

Alongside the progress of continuous glucose monitors (CGM), insulin delivery methods have advanced significantly from basic syringes and pumps to modern patch-pumps and automated closed-loop systems. Today's patch pumps are compact, tubeless, and capable of being programmed to modulate insulin delivery in response to CGM data, minimizing the need for manual dosing and improving comfort and adherence *(Admin, 2025).*

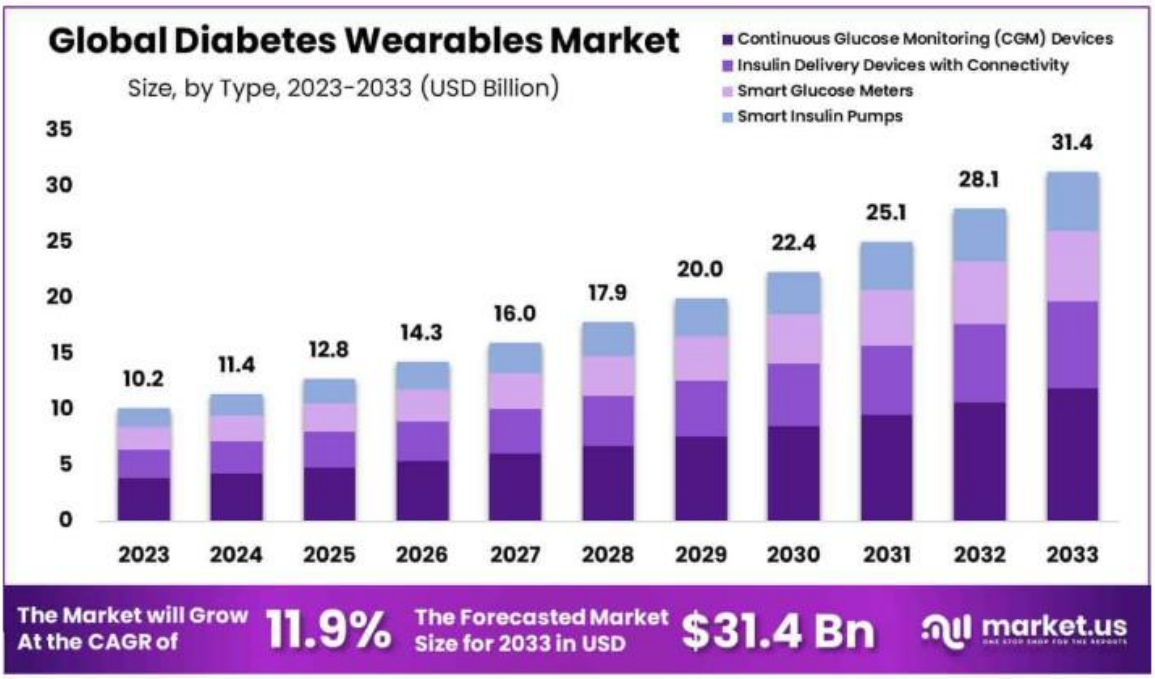

Figure 4: Forecasting of Global Diabetes Market sized by type of wearable *(Market.us, 2024).*

2.2.1.1 The introduction of digital ecosystems

One of the most significant advancements in Diabetes technology is the integration of wearable devices with smart phones and digital health platforms. Bluetooth-connected CGMs and insulin pumps now synchronise directly with mobile applications, combining glucose data, insulin delivery, dietary intake, and physical activity into a single, user-friendly interface. These apps offer customizable alerts, visual trend tracking, and support remote monitoring by healthcare professionals, enhancing clinical decisions and promoting personalized, data-driven care *(Halis Kaan Akturk and Anila Bindal, 2024).*

2.2.1.2 Rise of artificial intelligence and predictive analytics

The newest wave of wearable technology enables artificial intelligence (AI) and machine learning to interpret complex data and forecast glucose changes before they happen. These intelligent systems deliver personalized insights, predict hypoglycemia, and in some cases, automatically adjust insulin intake, transitioning diabetes management from a reactive to a proactive approach. As algorithms continuously learn from individual user patterns, they enhance prediction accuracy

and further tailor care, helping to minimize present complications over time *(Guk et al., 2019).*

Wearable technologies for diabetes management include:

- **Continuous glucose monitors (CGMs):** Are wearable devices that track glucose levels in the interstitial fluid (the fluid surrounding cells). They connect to smart watches, smart phones, and insulin pumps, enabling a more accurate real-time glucose reading *(Didyuk et al., 2020).*
- **Fitness trackers and smart watches:** These devices come with sensors that allow them to measure multiple parameters, like heart rate, sleep, and physical activity.
- **Smart insulin pens and patches:** Insulin pens are reusable devices that record in real-time when a person has to inject insulin, including the dosing and time. Patches are small digital devices that adhere to the skin; they can be programmed to release doses of insulin on a regular schedule automatically (*Loconti, 2024.)*

2.2.2 Integration into health practice

A key advantage of wearable devices is their capacity to enhance integrated care models. When connected to mobile applications or cloud services, they can transmit real-time data to healthcare professionals such as doctors and dietitians. This allows for precise and timely intervention, including medication adjustments or offering personalised dietary advice *(Bonoto et al., 2017).*

Wearable devices like CGM, smart watches, and smart insulin pens provide real-time monitoring of glucose levels, physical activity, and other health metrics. This continuous feedback helps boost patient engagement, encourages better compliance with treatment plans, and supports timely interventions *(Diabetes Resource Coalition of Long Island, 2024).*

Integration enables wearable data to be automatically shared with healthcare professionals, supporting remote monitoring and consultations; improving doctor-patient communication, minimizing the need for face-to-face visits, and increasing the accessibility and efficiency of diabetes management *(Smuck et al., 2021).* However, strategies must be implemented to ensure a successful adoption. The first step must start from identifying the health problem to address, such as optimizing blood sugar control or boosting medication adherence, then subsequently choosing the wearables that best adapt and support these objectives *(Smuck et al., 2021).*

Interoperability has been one of the main factors to address for integration. Wearables data is most valuable when incorporated into electronic health records (EHRs) and digital care platforms. Top healthcare organizations, such as Kaiser Permanente and Ochsner, have demonstrated that fully integrating wearables with Electronic Health Records (EHRs) enables clinicians to access real-time patient data, set automated alerts, and coordinate care more efficiently (Smuck et al., 2021). However, multiple challenges need to be overcome to ensure full integration and enable all the benefits of wearables, including the digital literacy of both patients and healthcare professionals, interoperability with current electronic health record (EHR) systems, and robust data security protocols *(Piwek et al., 2016).*

Integrating wearable technologies with hospital inventory systems and electronic

health records can be challenging, often requiring specialized technical skills and close collaboration with device manufacturers to ensure compatibility and seamless data exchange. Both patients and healthcare professionals have raised concerns about data management and privacy, not to mention the strict regulatory policies that must be followed to guarantee a safe implementation (Hospitals, 2024).
Effective use of wearable devices requires proper training for both healthcare professionals and patients, not only in operating the technology but also in accurately interpreting the data it generates to inform care decisions *(De et al., 2024).*
The integration of wearables into clinical practice is reshaping diabetes management by providing continuous health monitoring, enabling tailored interventions, and more efficient clinical workflows. Achieving this, however, requires well-defined clinical objectives, strong technical integration with health systems, collaboration across care teams, and ongoing attention to usability, data privacy, and clinician engagement. Addressing these elements effectively can maximize the potential of wearable devices for both patients and healthcare systems *(Alzghaibi, 2025).*

2.2.3 Documented clinical and patient-focused benefits

Researchers and professionals have documented the proven benefits that wearable devices have brought to patients in type 2 diabetes management.
The primary goal of clinicians who work in treating and managing type 2 diabetes is to control and maintain blood glucose levels within a range to prevent present and long-term complications. Wearable devices, like real-time continuous glucose monitors, have revolutionized the traditional aspects of management:

- Numerous studies have demonstrated that the use of real-time continuous glucose monitors (rtCGM) significantly lowers HbA1c (glycated hemoglobin) levels, which are regarded as the benchmark for assessing long-term blood sugar control. A reduction of 0.5-1.0% in HbA1c has been constantly reported in T2D patients undergoing intensive insulin therapy *(Beck et al., 2017).*

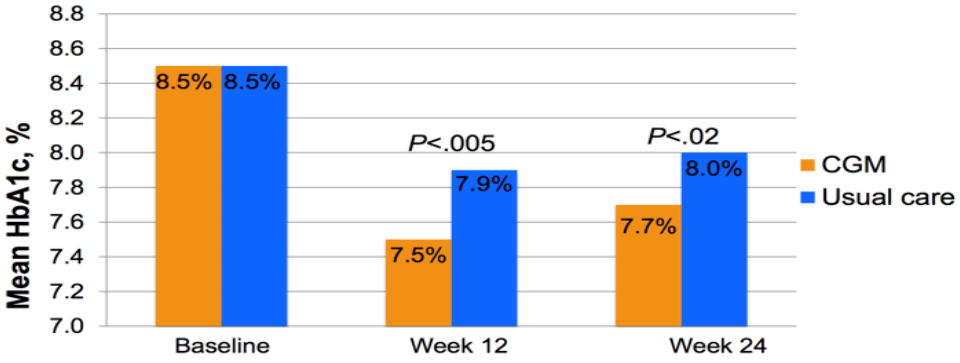

Figure 5. Comparation of HbA1c levels in patients with T2D between traditional care and use of CGMs *(MobiHealthNews, 2017).*

Wearable devices have not only demonstrated clinical improvements and benefits. They have also provided a catalyst for behavioral change and self-management for patients:

- CGMs and smart watches provide instant feedback on glucose levels, dietary habits, and physical activity, enabling users to track and respond to changes instantly. Survey data shows that 82% of users feel more confident in managing their diabetes, attributing this to the immediate and actionable feedback provided by wearable devices *(Alzghaibi, 2025).*
- Wearable devices enable patients to identify trends and patterns like post-meal glucose spikes or low blood sugar during the night, allowing them to make informed decisions about their diet or medication *(Peng et al., 2023).*

Although a vast majority of the literature focuses on the clinical benefits and patients' experiences, healthcare providers' opinions should be considered pivotal for a successful implementation of wearables into clinical practice. For healthcare professionals, wearables offer substantial benefits in clinical practice**:**

- Data from wearable devices enables clinicians to shift from sporadic, point-in-time glucose checks to a continuous, in-depth understanding of a patient's glycemic trends. This comprehensive view facilitates more accurate insulin dosing and personalized medication changes *(Tsao, 2025).*
- Advanced platforms leverage AI to process vast amounts of data, identifying key patterns or anomalies that warrant attention. These systems help reduce clinicians' cognitive load by highlighting high-risk patients, suggesting treatment modifications, and supporting population health management
- Numerous wearable platforms now promote an effortless integration with electronic health records (EHRs), streamlining documentation processes and supporting a more comprehensive approach to patient care *(See, 2025).*

2.3 Healthcare professionals' perceptions

Although most of the literature focuses on patients' experience and perspective, the opinions and readiness of healthcare professionals are paramount in the adoption and introduction of these devices. Medical practitioners are gatekeepers who recommend the use of wearables for monitoring and managing type 2 diabetes; their perceptions, acceptance, and readiness to incorporate these tools into patient care are influenced by a multifaceted mix of factors, including clinical demands, familiarity with technology, institutional support, and patient characteristics *(Pavlovic et al., 2021).*

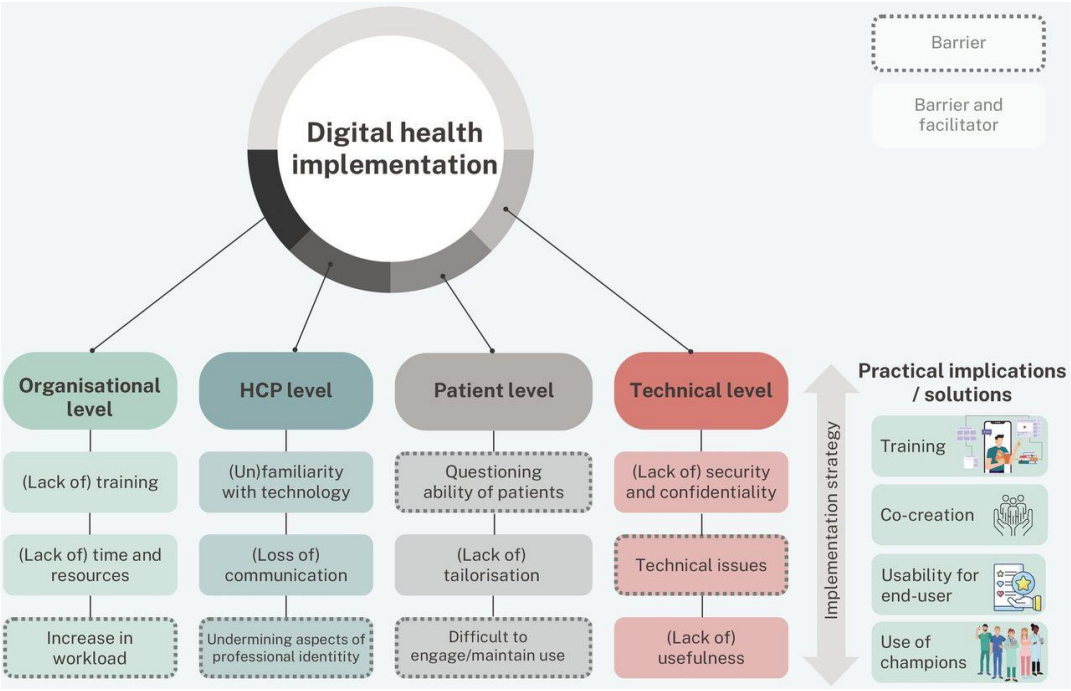

Figure 6. Top three barriers or facilitators on each level of digital health implementation, and practical solutions (Oudbier, 2024).

2.3.1 Perceived clinical value

A recurrent theme in literature is that professionals' endorsement of wearable devices largely depends on how clinically relevant and evidence-based they are. Research indicates that clinicians are more likely to embrace technologies that demonstrate improvement for patient outcomes, simplify data collection, and enhance clinical decision-making, particularly when these tools don't increase their existing workload (Alcántara-Aragón, 2019).

For many healthcare providers, particularly those involved with the management of chronic diseases like type 2 diabetes, the ability of wearable devices like continuous glucose monitors, fitness trackers, and smart insulin pens to provide real-time patient data can significantly improve personalization and prompt response of care. Improved access to continuous patient data enables health professionals to shift from reactive approaches to more proactive management strategies *(Klonoff et al., 2011).*

However, perceptions of wearable device benefits vary, particularly among general practitioners and clinicians in low-resources settings, where wearable devices may be viewed as burdensome rather than beneficial, especially when they are not compatible with existing electronic health records systems or when there is concern that patients may struggle to consistently use devices long term (Greenhalgh et al., 2017).

The presence of evidence-based clinical guidelines and peer-reviewed research significantly strengthens the perceived utility of wearable technologies. Endorsements from respected organizations like The American Diabetes Association or The Endocrine Society help validate the clinical relevance of wearables, creating greater trust and encouraging adoption into clinical routine *(Endocrine Society, 2018).* On the other hand, when supporting evidence is still

developing, especially regarding the newer models that lack FDA approval, healthcare professionals often respond with caution or scepticism, hesitating to integrate wearables into practice.
Ultimately, perceived clinical value is not fixed; it constantly evolves based on factors like device capabilities, ease of integration into existing workflows, patient compliance, institutional policies, and emerging clinical evidence. Therefore, encouraging the use of wearables in type 2 diabetes management goes beyond technological innovation; it also demands ongoing investment in training, guideline development, and system-level integration *(Alotaibi, Wilson, and Traynor, 2025).*

2.3.2 Concerns and trust about data accuracy

One of the most persistent barriers to the adoption of wearables in clinical practice is healthcare professionals' level of trust in the data produced by these devices, and more precisely, concerns regarding their accuracy, consistency, and overall clinical reliability. Especially when managing a complex, data-intensive condition like T2D, trust in the accuracy of key metrics, like blood glucose, heart rate variability, physical activity, and sleep quality, is crucial for informed and effective clinical decision-making *(Piwek et al., 2016).*

2.3.2.1 Consumer-grade VS clinical-grade wearables

A major issue highlighted in the literature is the distinction between consumer-grade and clinical-grade wearables. Although devices like the Fitbit, Apple watch, and other mainstream fitness trackers are commonly used by patients, they often do not meet strict validation standards or regulatory approvals that healthcare professionals consider essential for clinical reliability, which creates a credibility gap (*Lu et al., 2020*). Healthcare professionals may see these devices as useful for promoting general wellness, yet not very reliable for critical clinical tasks like adjusting insulin doses or assessing patient risk levels.
Studies indicate that even minor inaccuracies in measurements, particularly in glucose readings or step tracking, can significantly affect clinicians' confidence, leading to reduced clinical use of wearables, even when patients are actively engaged *(Poncette et al., 2*021).

2.3.2.2 Data validity

Besides concerns about accuracy, healthcare professionals often question the validity and interpretability of data generated by wearables. Even when wearables provide precise data, doubts persist about how useful that data is on its own. For example, while a wearable might track metrics like step count or sleep duration, the lack of standard reference values can make it difficult for healthcare providers to interpret this data effectively for managing or making treatment decisions for type 2 diabetes (Bent et al., 2020).

2.3.2.3 Concerns about accountability and liability

Another critical aspect of trust involves legal and ethical responsibility. Healthcare professionals may be reluctant to rely on data from wearable devices if there's concern that inaccuracies or device failures could lead to clinical errors, potentially exposing them to legal liability or ethical scrutiny (*Pavlovic et al., 2021*).

Moreover, when patients self-report wearable data, either through manual entry or selective syncing, the credibility of that information becomes more uncertain. Clinicians must then navigate a complex ethical dilemma: weighing their trust in the patient's active participation against the need for caution with potentially unverified or incomplete data (*Bent et al., 2020*).

2.3.3 Workflow integration

Incorporating data from various wearable devices into existing clinical workflows presents technical and logistical difficulties. For instance, merging information from CGMs, smart watches, and fitness trackers into a unified system typically depends on third-party platforms, making it more complicated and challenging for healthcare practitioners *(Alotaibi, Wilson, and Traynor, 2025).*

Although continuous data from wearables can offer advantages like early identification of hyperglycemic episodes and real-time monitoring of physical activity, many healthcare professionals identify workflow disruption as one of the main obstacles for wearable adoption *(Mansour, Saeed Darweesh, and Soltan, 2024).*

The lack of interoperability between wearable devices and electronic health records (EHRs) is the biggest perceived workflow disruption. Most wearables, particularly consumer-grade ones like Fitbit or Apple Watch, are designed for individual use and typically do not follow standardized health data exchange protocols such as HL7 or FHIR (Fast Healthcare Interoperability Resources), making data integration difficult *(Dinh-Le et al., 2019).*

A study by *Perlman* revealed that healthcare professionals showed more trust and willingness to use wearable data when it was automatically incorporated into EHR systems, formatted in a clinically relevant manner, and supplemented with alerts or trends. In contrast, when wearable data was presented as raw, unstructured, clinicians often had to resort to manual review, which increases their workload and reduces time available for direct patient care *(Perlman, 2021).*

Time is a vital resource in clinical settings, particularly in primary care, where the majority of T2D management occurs. While the continuous data from wearables can provide valuable insights, the volume and complexity of that data can also be overwhelming. Many clinicians often express concern about the additional time needed to analyse and interpret this data within the tight timeframes of standard consults (*Pavlovic et al., 2021).* Without proper summarisation tools or decision-support systems, raw data may become overwhelming and difficult to manage, often leading to it being overlooked or underutilized.

Effective workflow integration heavily depends on well-defined responsibilities for data management. In many practices, there is a lack of clarity around who is responsible for reviewing wearable data, whether it is the physician, nurses, or IT staff. This role ambiguity often leads to delays or inconsistencies in data handling *(Greenhalgh et al., 2017).*

The broader institutional environment and policy framework also influence workflow integration. In healthcare systems that actively promote digital health through investments in IT infrastructure, leadership engagement, and performance incentives, wearable technologies are adopted more effectively. Conversely, in low-resource institutions with limited digital policy development, integration often fails

due to insufficient training, inadequate technical support, and a general lack of institutional motivation *(Dinh-Le et al., 2019).* Without institutional backing, clinicians are less likely to trust or effectively utilise wearable data, and the technology may remain underused despite its potential benefits.

2.3.4 Ethical and legal considerations

As wearable devices increasingly become part of chronic disease management, including type 2 diabetes, they bring along a range of significant ethical and legal considerations that need to be addressed. Concerns regarding data privacy, informed consent, patient autonomy, professional liability, and compliance with existing frameworks require careful evaluation**.**

Wearable devices continuously collect sensitive health data, like glucose levels, physical activity metrics, heart rate, and sleep patterns. When this data is transmitted or stored through cloud platforms or third-party apps, it faces an increased risk of security breaches or unauthorized access, raising privacy concerns. In many cases, patients lack a clear understanding of how their health data from devices is utilized or have access to it. This uncertainty raises important ethical concerns regarding informed consent and the potential secondary use of data without the patient's full knowledge or agreement *(Morley et al., 2020).*

An essential ethical principle in healthcare is respecting patient autonomy, emphasizing the importance of patients to make informed decisions and know how their data is used. With wearables, this principle is challenged when patients accept terms of service without fully understanding how their data will be shared, analysed, or used. This can lead to a form of "digital paternalism", where technology influences decision-making without full transparency and patient involvement *(Sharon, 2018).*

Healthcare professionals are responsible for helping patients make informed decisions about treatment plans and the technologies used to monitor those treatments. This includes explaining how data from wearable devices will be used, who will access it, and any risks or limitations associated with the technology.

Another significant legal concern involves professional liability. When healthcare professionals rely on data from wearable devices to make clinical decisions, like adjusting insulin doses or prescribing treatments, there's a risk of legal complications if the data is incorrect or misleading. Unlike conventional medical tools, many wearables are not consistently certified or regulated as medical devices, making it challenging to ensure data reliability *(Theodos and Sittig, 2020).*

Moreover, the line between medical advice and device-generated recommendations is becoming less clear, particularly as wearables now deliver real-time alerts and AI-driven recommendations directly to patients. This raises questions about medical oversight, legal disclaims, and the extent to which clinicians are responsible for interpreting or ignoring such alerts.

Ethical implementation of wearable technologies must also prioritise health equity. In low-income countries and rural areas, many patients lack access to advanced digital devices or may face challenges due to low digital literacy. This creates a risk that wearable-based healthcare solutions could deepen existing inequalities by favouring patients with higher socioeconomic status or technological familiarity *(World Health Organization, 2021).*

Ethical practice demands proactive inclusion strategies. This involves providing subsidized devices for low-income patients, designing simplified interfaces, and offering culturally tailored training, which will help ensure wearable technologies benefit diverse patient populations.

Today's advanced wearables often include AI-powered features that predict health risks or recommended behavioural changes. While these capabilities can improve preventive care, they also raise ethical concerns, especially around algorithmic bias, lack of transparency, and limited explainability. Clinicians may not fully understand how AI reaches conclusions, which can affect trust in outputs and complicate accountability when outcomes are negative *(Jobin, Ienca, and Vayena, 2019).*

The ethical and legal framework for wearable devices in type 2 Diabetes management (T2D) remains in development. For healthcare professionals, concerns about data privacy, professional liability, and a lack of clear regulatory guidance can affect integration into clinical workflows.

2.4 Readiness and willingness to integrate wearables

Technology has opened doors for infinite opportunities and benefits; nonetheless, like with every new invention, it presents challenges and a period of adaptability.

The constant advancement and integration of digital solutions have become a crucial aspect of healthcare practitioners' routine workflow, requiring them to adapt to emerging digital tools. These present challenges, as healthcare professionals must have the necessary digital proficiency and training to effectively use and incorporate wearable and digital tools into their clinical practice. *(Rodrigues et al., 2024).*

Alotaibi, in their 2025 study, observed a growing readiness among healthcare professionals to incorporate wearable technologies in practice, driven by evidence of positive outcomes and patient satisfaction. However, it was also noticeable that there was a clear correlation between the readiness and positive perception of interviewed practitioners and their digital literacy, as well as prior exposure to technology during training, which was more commonly found among the youngest practitioners. Experienced professionals demonstrated a more cautious approach, highlighting potential workflow interruptions and the need for specialized training and reskilling as key concerns *(Alotaibi, Wilson, and Traynor, 2025).*

The integration of wearables in healthcare practice, requires both readiness and willingness of healthcare professionals, and while closely linked, these two elements represent distinct yet complementary facets of adoption: readiness refers to the structural, institutional, and cognitive capacity to implement new technologies, while willingness relates to individual motivation, openness, and personal acceptance of using those technologies in clinical practice.

2.4.1 Organizational readiness

A fundamental aspect of organizational readiness involves ensuring sufficient technological infrastructure. Successful integration of wearable devices in routine T2D care depends on:

- Reliable internet access to enable consistent real-time data sharing.
- Robust data storage and interoperability, including secure servers and platforms that can interface with Electronic Health Records

(EHRs).

- Effective device management systems that allow clinicians to monitor, analyze, and respond to data across multiple wearable technologies *(Rodrigues et al., 2024).*

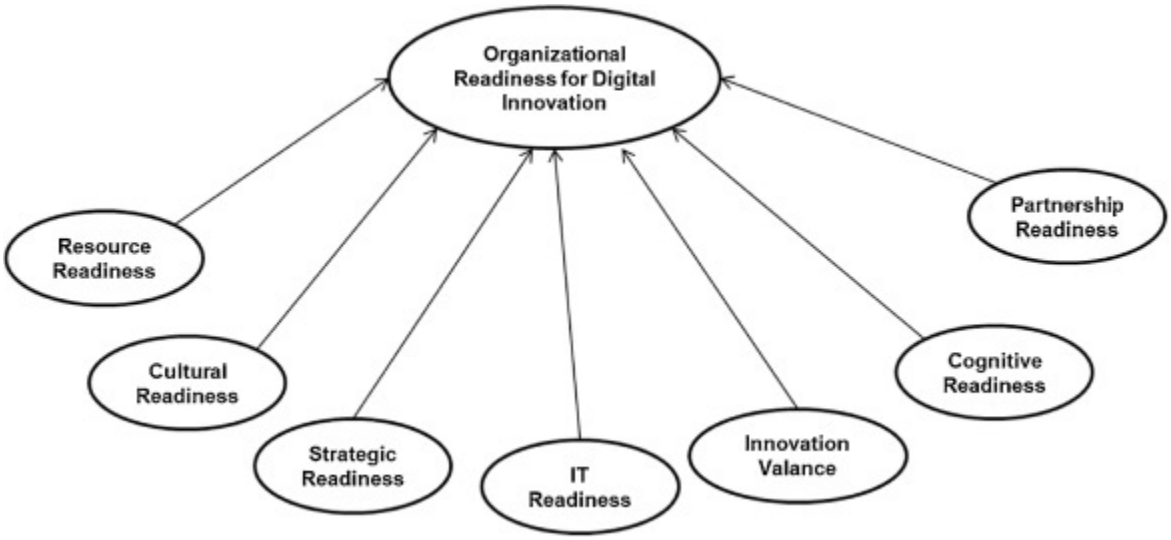

Figure 7. Factors driving organizational readiness for digital innovation (Lokuge et al., 2019).

On the other hand, human interaction plays a crucial role in organisational wearable integration. Leadership is a key factor in an organization's readiness to adopt wearables; supportive leadership that embraces digital transformation can secure funding for device purchases, IT upgrades, and staff training. Assign clinical change agents to lead adoption at the team level, set strategic goals and timelines, ensure implementation is both prioritized and tracked, and promote a shared vision by communicating how wearables improve care and align with broader organizational objectives (Ginsburg, Picard, and Friend, 2024).

Weiner emphasizes that perceived organizational commitment to change significantly influences predictors of successful implementation. When healthcare professionals view wearable integration as a top-down initiative without clinical involvement or alignment with patient care goals, they are most likely to resist change (*Weiner, 2020*). Organizational readiness must also account for the knowledge and confidence levels of both clinical and administrative staff in handling wearable technology. Adequate training programs should be designed to build these competencies, focusing on Device operation and problem-solving, ensuring users can effectively deploy and maintain wearables in real-world settings.

Data interpretation and clinical relevance to help clinicians understand the meaning of wearable data in the diagnostic or treatment context.

Communicating strategies, equipping staff to educate patients, and encouraging sustained device use through meaningful engagement.

Clarifying privacy laws, informed consent, and professional responsibilities related to wearable data *(Alotaibi, Wilson, and Traynor, 2025).*

A cross-sectional study by Gözde Tetik found that targeted training significantly increased readiness among healthcare professionals to adopt e-health technologies. This indicates that even in well-equipped institutions, the lack of structured educational initiatives can hinder the successful integration of wearable technologies and restrict their potential in clinical care *(Gözde Tetik et al. 2024).*
An often-overlooked aspect of readiness is the organization's culture toward innovation, which is why an institution that fosters open communication, collaborative problem-solving, continuous improvement, and risk tolerance for trial-and-error innovation is more likely to succeed in digital health transformations. Cultural resistance, especially in traditionally hierarchical systems, can hinder implementation efforts even when all technical conditions are met *(Greenhalgh et al., 2017).*
Organizational readiness for integrating wearable technologies into T2D care goes beyond infrastructure. It includes strong leadership support, strategic planning, established policies, targeted training for staff, and most importantly, an organizational culture that encourages innovation and adaptability to technological change.

2.4.2 Professional readiness

2.4.2.1 Digital health technology literacy

A fundamental aspect of professional readiness is digital literacy, which equips healthcare professionals with the skills needed to navigate, assess, and apply digital tools in clinical practice. For wearables, this includes a basic understanding of how they function and the types of health data they monitor, such as glucose levels, physical activity, and sleep patterns. It involves evaluating the accuracy, reliability, and clinical relevance of patient-generated data while learning how to integrate wearable data into existing treatment protocols.
Studies indicate that healthcare professionals' digital literacy levels vary significantly based on geographic location, the type of healthcare system, and job function. For example, clinicians in high-resource settings may be more familiar with digital health tools than those in rural or underfunded facilities *(Kuek and Hakkennes, 2020).*

2.4.2.2 Attitudes toward technology in clinical practice.

Healthcare professionals' acceptance of wearable technology is strongly influenced by how useful and user-friendly they perceive it to be. When clinicians see clear benefits and find the tools easy to use, they are more likely to adopt them willingly. Conversely, negative past experiences, fear about being replaced by technology, or concern about the dehumanization of care can create resistance and lower readiness for integration *(Seidl et al., 2025*).
Indeed, while wearables promise improved data and personalization, some clinicians fear that over-reliance on digital tools could depersonalize care or burden them with additional administrative tasks. Greenhalgh et al. highlighted that successful technology adoption in healthcare occurs only when psychological readiness, such as trust and perceived value, is developed alongside technical infrastructure *(Greenhalgh et al., 2017).*

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2.4.2.3 Training and professional development

Ongoing education and structured training programs are essential in improving professional readiness to incorporate wearable technologies into T2D care. When healthcare professionals learn to interpret trends from continuous glucose monitors (CGMs), identify patterns in physical activity, and understand how smart insulin devices work, they are more likely to confidently use these insights in their clinical decisions. Additionally, evidence indicates that formal training decreases perceived complexity, builds confidence, and boosts the willingness to adopt digital innovations (ÇİĞDEM and ŞAHİN, 2022).

2.4.2.4 Role differences and hierarchies

Professional readiness varies across roles or experience levels. Junior clinicians and newly trained professionals often demonstrate greater enthusiasm for wearables due to their digital fluency and familiarity with tech-enhanced tools. In contrast, senior healthcare professionals, despite their clinical acumen, may exhibit hesitation due to limited training in digital health, skepticism about efficacy, or perceived disruptions to established workflows. Senior professionals often set the tone for clinical norms and decision-making priorities; if they are disengaged or skeptical, initiatives might stall. Therefore, leadership engagement and cross-generational mentorship are essential components of successful integration strategies *(Yang Meier et al., 2020). Tanenbaum,* in their 2017 study, observed that young health professionals are more prompted to prescribe and use diabetes technologies and devices with their patients and have an overall better opinion regarding these technologies compared with older practitioners due to recent training and greater digital literacy, while older practitioners may prefer traditional methods *(Tanenbaum et al., 2017).*

2.4.2.5 Confidence in patient engagement

Professionals' confidence in both interpreting and communicating wearable-derived data is a backbone for effective use. If they lack the skills or time to translate continuous data into actionable, understandable insights for patients, the technology's potential is diminished. In T2D care, this becomes even more critical given the central role of patient education and self-management (*Seidl et al., 2025).*

2.4.3 Willingness: professional motivation and perception

Willingness adds a vital human layer to the equation, even with robust infrastructure and formal training; adoption can stall if healthcare professionals are not personally motivated or see little value in change. Willingness is shaped by factors like perceived clinical relevance, trust in the technology, alignment with professional identity, and prior positive or negative experiences**.**

Self-determination theory (SDT) provides value for framing how different types of motivation influence healthcare professionals' adoption of wearables. By distinguishing between intrinsic (e.g., commitment to better care) and extrinsic (e.g., compliance with institutional incentives) motivations, SDT helps explain why some clinicians adopt wearables enthusiastically, while others do so reluctantly or not at all *(Legault, 2017).*

A study by *Nascimento et al* highlighted that clinicians who were both intrinsically and extrinsically motivated were more open to adopting digital tools in clinical care

settings. Motivation is particularly relevant in T2D care, where clinicians experience firsthand the long-term effects of poorly controlled disease and may be eager to trial interventions that enhance monitoring and patient engagement *(Nascimento et al., 2023).*

Clinicians' willingness is strongly influenced by whether they believe wearable devices offer actionable, meaningful, and patient-specific insights. Wearables that collect data without offering clinical value may be perceived as irrelevant or even misleading. When wearable technologies are seen as not to be useful to healthcare professionals, especially those with limited time or who are skeptical, they are less likely to implement them into practice (*Kuek and Hakkennes, 2020*).

Some healthcare professionals perceive digital innovations as valuable tools that enhance personalized care and enable real-time monitoring of patient behaviors. However, others express concerns about the loss of autonomy, deskilling, or even professional redundancy. Such concerns are heightened when technologies are implemented without adequate consultation or when their functions closely mirror those traditionally performed by clinicians *(Greenhalgh et al., 2017).*

For instance, endocrinologists may readily adopt continuous glucose monitoring (CGM) applications for their precision and data richness, whereas general practitioners may feel less comfortable engaging with complex data analytics that fall outside their typical practice.

Moreover, younger professionals, who are often more digitally fluent, may embrace the evolving professional identity that includes using data-driven decision support systems. In contrast, more experienced clinicians may value institutional and interpersonal care over technological innovations, leading to reluctance *(Kuek and Hakkennes, 2020).*

2.5 Challengers and enablers in wearable devices integration in Mexico

Digital health tools provide numerous benefits compared to conventional methods for diabetes management. However, the successful integration and use of digital wearables depend largely on the country's healthcare system structure and resources. While the potential for wearable technologies for diabetes management is recognized, adoption remains limited within the Mexican healthcare system *(Mexico Business, 2021).* Different factors present challenges in clinical practice adoption and together open a door for improvement opportunities. Understanding these is critical for designing effective adoption strategies and policy frameworks that support the implementation of digital health innovations.

2.5.1 Key *Challenges*

2.5.1.1 High device cost and lack of accessibility

Lack of health insurance limits low-income people's access to health services. Advanced wearable devices remain financially inaccessible for a vast percentage of patients and healthcare institutions in Mexico, particularly in low-income areas *(Insights 10, 2022).*

Most advanced wearables technologies for diabetes management, like CGMs, smart watches with health tracking features, and smart insulin pens, are produced by international manufacturers. In Mexico, these devices are typically imported and

priced in foreign currencies, which makes them costly and often inaccessible for both public health institutions and patients (*Bianchi, Tuzovic, and Kuppelwieser, 2022).* Prices for Continuous glucose monitor systems can go from $1,200-$7,000 annually without insurance, with an average of $1,200-$3,600 per year. This provokes patients to device abandonment due to expense or overall unattainability, particularly for those living in rural and marginalized zones *(Watson, 2022).*

Currently, Mexico's healthcare institutions (IMSS, ISSSTE, INSABI) provide minimal to no financial coverage for wearable devices used in outpatient chronic care. These technologies are generally not listed in official formularies or included in benefit packages. As a result, even when healthcare professionals are willing to prescribe them, the cost burden falls entirely on patients. This situation creates a dual-access healthcare system: patients with private insurance or financial means can access and benefit from wearable technology, while the majority of the population, especially those dependent on public services, remain excluded. The absence of formal health technology assessments and clear policies regarding device evaluation and reimbursement continues to hinder institutional integration *(OECD, 2025).*

Financial barriers are made worse by supply and distribution problems, especially in less developed areas. Many clinics in these regions lack the equipment or systems to store or manage wearable devices. Additionally, local pharmacies and medical suppliers often do not stock these technologies or may not even be aware of them, which reduces their availability. As a result, even when patients are informed and financially capable, access can still vary depending on where they live. This creates gaps in diabetes care, particularly in a country like Mexico, where 1 in 7 adults has diabetes, and access to healthcare services often depends on the level of regional development *(Mexico Business, 2024).*

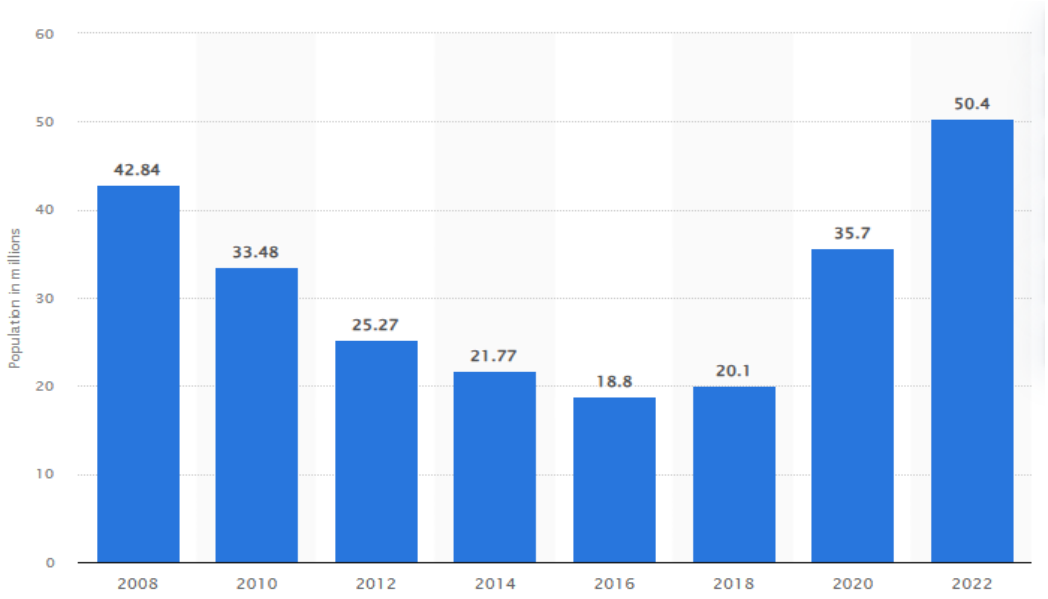

Figure 8. Number of population considered vulnerable due to lack of access to health services in Mexico between 2008 and 2022 (in millions) *(Statista, 2024*).

From healthcare professionals' perspective, financial issues also affect their willingness to recommend wearable devices. If insurance or public health programs do not cover the cost, professionals may hesitate to suggest them to patients, fearing that patients might not afford them. Additionally, health institutions might avoid investing in necessary technology, such as software, training, or data systems, if the return on investment is unclear or not immediate. This creates a cycle where low adoption results in limited investment, and limited investment continues to hinder adoption.

2.5.1.2 Technological and infrastructure gaps

Literature agrees that one of the most significant barriers to the widespread integration of wearable devices in Mexico's healthcare system is the inadequacy of technological infrastructure. This limitation encompasses multiple factors, ranging from national-level digital connectivity to the availability of compatible clinical information systems within healthcare institutions.

Although Mexico has made improvements in digital health infrastructure, a pronounced digital divide remains, particularly between urban and rural areas. Data from the Instituto Nacional De Estadística y Geografía (INEGI) reveal that internet access surpasses 75% in urban areas but falls below 45% in rural and marginalized communities (*INEGI, 2023*). Given that many wearable technologies, especially those enabling real-time glucose monitoring or activity tracking, depend on stable internet or Bluetooth connections, their effectiveness is significantly reduced in connectivity-limited areas, creating inequitable access to digital care innovations.

Integrating wearable devices into healthcare systems effectively depends on having an IT infrastructure that allows different devices, electronic health records, and decision support systems to work together. However, in Mexico, this process is complicated by the fragmentation of the public health system across institutions like IMSS, ISSSTE, which each use different, and often outdated, EHR systems. Additionally, in many clinics, patients' information is still recorded on paper or incompatible digital systems, complicating the inclusion of wearable devices' data into routine care *(Chambers.com, 2024).*

Even in settings where wearable device data is available, significant obstacles remain in converting that data into actionable insights. Many public and/or smaller healthcare facilities do not have access to trained technical staff, appropriate training programs, or advanced data analytics systems required to interpret ongoing patient data streams. As a result, despite the abundance of raw data, its clinical application is often minimal, a situation commonly referred to as being "data rich but information poor" or DRIP *(OECD, 2025).*

Beyond software infrastructure, access to physical devices is a significant limitation. Most advanced wearables used in diabetes management, such as continuous glucose monitors (CGMs), are generally imported and quite costly. Due to limited domestic manufacturing and an inefficient procurement system within public health institutions, these devices often face shortages or delays in delivery. These issues are even more severe in low-resource settings, where healthcare budgets mainly prioritize essential medications over digital innovations (Bianchi, Tuzovic, and Kuppelwieser, 2022).

2.5.1.3 Workforce and cultural influences

Doubt among senior healthcare providers regarding data reliability and potential workflow interruptions remains, further intensified by generational differences in digital proficiency.

Many Mexican healthcare professionals have been trained within traditional care models that prioritize clinical judgment, face-to-face interactions, and manual documentation. For some, wearable devices are seen as a disruption to established routines, particularly when there is limited experience with digital tools and uncertainty about how to incorporate wearable data into traditional care models. This perspective contributes to skepticism about the usefulness of wearable data, especially when the devices are perceived more as consumer electronics than clinical tools *(Chambers.com, 2024).*

In Mexico, where many public health institutions continue to operate with limited or outdated digital infrastructure, this resistance is further reinforced by the practical challenges of working with systems that are often incompatible with modern technologies like wearables *(Mexico Business, 2021).*

Additionally, the organizational structure of many healthcare institutions, particularly within the public sector, tends to be highly hierarchical and bureaucratic, making it more challenging for staff at lower levels including junior doctors and nurses who may have limited authority to initiate or experiment with the use of new technologies due to decision-making typically being centralised (*Daniela Chueke, 2023*).

This hierarchical culture often prioritizes adherence to standardized procedures over adaptive innovation. As a result, even when wearable technologies have the potential to improve patient care, they may be disregarded. Consequently, opportunities for pilot testing, clinical experimentation, or collaborative learning are often overlooked, particularly in busy and resource-limited clinical settings. Moreover, rigid organizations frequently lack formal channels for bottom-up feedback, limiting the inclusion of frontline perspectives of patient usability, clinical integration, or workflow compatibility into institutional decisions about new technologies *(Brommeyer, Whittaker, and Liang, 2024*).

A persistent barrier to the adoption of wearable technologies is the absence of structured digital health education within healthcare training programs. In Mexico, most medical and nursing education does not include formal training on wearable health devices, telemedicine platforms, or mobile health applications *(Mexico Business, 2021).* Studies indicate that lack of training is closely linked to reduced confidence and a lower likelihood of adopting health technologies *(Rouidi, Elouadi, and Hamdoune, 2022)*. This challenge also affects nurses and all healthcare professionals, who often provide hands-on patient education but may not be equipped with the necessary skills or support to effectively incorporate wearables into care routines.

Healthcare professionals' willingness to recommend wearable technologies is also closely linked to their perception of patient readiness. In regions where patients have limited access to smartphones, low digital literacy, or lack trust in technology, professionals may hesitate to recommend these tools, assuming poor adoption or incorrect use *(Zaghloul et al., 2024*). This dynamic can result in a self-perpetuating cycle where low adoption among patients leads to minimal exposure among professionals, reinforcing professionals' reluctance to engage with wearable

integration. This issue is particularly relevant in rural and low-income zones, where both patients and health professionals often have reduced access to digital infrastructure.

2.5.1.4 Data privacy concerns

Patients and practitioners have expressed concern regarding the security of data collected by wearables, especially with limited regulatory frameworks. Wearable devices collect a range of personal health data, including blood glucose levels, heart rate, and physical activity, that must be handled in strict accordance with legal and ethical standards *(Canali, Schiaffonati, and Aliverti, 2022).* In Mexico, however, the lack of clear frameworks, limited institutional protocols, and gaps in digital health governance create difficulties in fully integrating wearables into routine care.

These devices produce patient-generated health data (PGHD), which differs in both origin and characteristics from data traditionally collected in clinics. PGHD is typically collected continuously and remotely, often outside formal healthcare settings. The data is normally stored on third-party cloud platforms and potentially accessed or transmitted through multiple digital interfaces. These attributes raise important ethical, legal, and operational questions, including:

- Who holds ownership of the data (patients, healthcare providers, or the device manufacturer)
- Where and how should the data be stored
- Under what conditions can this data be used in clinical decision-making *(Kostkova et al., 2016*).

In Mexico, these questions frequently remain unanswered in policy and clinical practice, leading to uncertainty among healthcare professionals and administrators.

Mexico's primary data protection legislation, the Federal Law on the Protection of Personal Data Held by Private Parties (FDPL), and the General Law on the Protection of Personal Data held by Government Agencies establish a general legal framework for the handling of personal information. However, it does not explicitly address the specific complexities of digital health or wearable technologies. As a result, key issues regarding continuous data collection, third-party storage, cross-border data flows, and real-time clinical use remain largely unregulated, leaving gaps that complicate both compliance and clinical adoption *(ICLG, 2024).*

In many healthcare settings across Mexico, particularly within the public sector, internal institutional policies concerning data security, device approval, and data-sharing protocols are either outdated or absent. This regulatory and procedural vacuum often leaves clinicians to navigate ethical, legal, and practical responsibilities without clear guidance. For instance, healthcare providers may be uncertain about whether wearable-generated data can be legitimately used when making treatment decisions, or whether they could be held liable for adverse outcomes if the data proves inaccurate. Furthermore, oversight bodies like COFEPRIS (The Federal Commission for the Protection against Sanitary Risks), which regulates health technologies and medical devices in Mexico, have been slow to implement comprehensive standards for the certification, approval, and post-market surveillance of wearable devices *(Chambers.com, 2024).* This regulatory gap

introduces further ambiguity for healthcare institutions and professionals, making them more hesitant to adopt wearable technologies within routine care due to concerns of legal liabilities.
Another significant challenge concerns informed consent and patient awareness. Patients often agree to the terms of service for wearable apps without fully understanding how their data will be used or shared. This raises ethical concerns around data transparency, third-party access, and secondary uses of data (marketing, algorithm training). For clinicians, this creates a dilemma regarding how to ethically engage with data that may not have been collected under conditions that meet clinical consent standards *(Mexico Business, 2021*).

2.5.1.5 Accuracy and reliability

While wearable technologies present valuable opportunities for ongoing monitoring and patient involvement, their effectiveness in clinical practice depends largely on the accuracy and reliability of the data they produce. If the quality of this data is uncertain, professionals may hesitate to rely on it for making diagnoses, planning treatments, and disease management.
The performance of wearable devices designed for general consumer use can differ considerably depending on the quality of their sensors, calibration protocols, and underlying software algorithms. For instance, smart watches that measure heart rate often produce inconsistent results, not only between different manufacturers but often even across models from the same brand. This can seriously undermine confidence in data for clinical reliability. This challenge gets amplified by the need for many wearables of constantly calibration. this is more pronounced in countries like Mexico, where technical support is limited and user training is minimal, which further reduces trust in the reliability of the data *(Canali, Schiaffonati, and Aliverti, 2022).*
The weak or complete lack of rigorous clinical validation for wearable devices in Mexico undermines credibility and reliability, while some of these devices are imported from international markets, where they may meet regulatory standards (e.g. FDA or CE regulations), they still may not align with specific regional regulatory bodies like COFEPRIS, clinical needs, or operational conditions of the Mexican healthcare system *(Gob.mx. 2023).*
The lack of standardized benchmarks for clinical accuracy presents an additional challenge to incorporating wearable devices into everyday healthcare practice. Glucose monitoring devices intended to inform clinical decisions are expected to comply with international standards, such as ISO 15197:2013. However, many commercial continuous glucose monitors do not meet these criteria, especially when used without medical supervision (*Krouwer, 2025).*
Even when devices demonstrate technical accuracy under monitored conditions, their data quality can be affected by multiple external factors; fluctuations in temperature, sweat, and even user movement can influence parameters. In Mexico, where the geographic, climatic, and socioeconomic factors can be very diverse and, in many cases, extreme, this can cause significant variance in device performance, leading to inconsistent results that may reduce the reliability of professionals in their readings *(Fuller et al., 2020).*
Lastly, for wearable technologies to be effectively adopted in practice, healthcare

professionals need to have confidence in the data and know how to interpret it appropriately. However, in Mexico, the limited formal training in the use of medical devices means that many healthcare providers may struggle to distinguish and make sense of irregular, incomplete, and/or unfamiliar data patterns. Without clear clinical guidance, wearable data is often viewed as supplementary at best or discarded at worst. This issue is exacerbated when wearable data lacks integration with electronic health records (EHRs), requiring additional effort for interpretation and integration, something that is often impractical within the constraints of busy or under-resourced healthcare settings *(Greenhalgh et al., 2017*).

2.5.2 Key ***Opportunities:***

2.5.2.1 Growing burden of Diabetes and the need for innovation

Type 2 diabetes (T2D) is one of the most critical public health challenges that Mexico currently faces, with severe implications for both population health and the country's socioeconomic stability. According to the International Diabetes Federation (IDF), Mexico ranks among the top ten countries globally in terms of the number of adults living with diabetes. Estimates suggest that approximately 16% of the adult population is affected, with the incidence rate increasing among younger age groups. The chronic nature of T2D, combined with its associated complications, places a significant burden on the healthcare system, workforce productivity, and household finances, highlighting the urgent need for scalable, technology-enhanced management strategies *(Diabetes Atlas, 2025).* Every year, the health sector allocates billions of pesos to cover direct medical costs, including medications, outpatient care, hospitalizations, and the management of diabetes-related complications. In addition, indirect costs like reduced workforce productivity, absenteeism, and caregiver burden further strain Mexico's economic resilience. These challenges are particularly magnified in low-income and rural regions, where access to specialized care is limited and the cost of complications tends to escalate *(Salinas, 2021).*

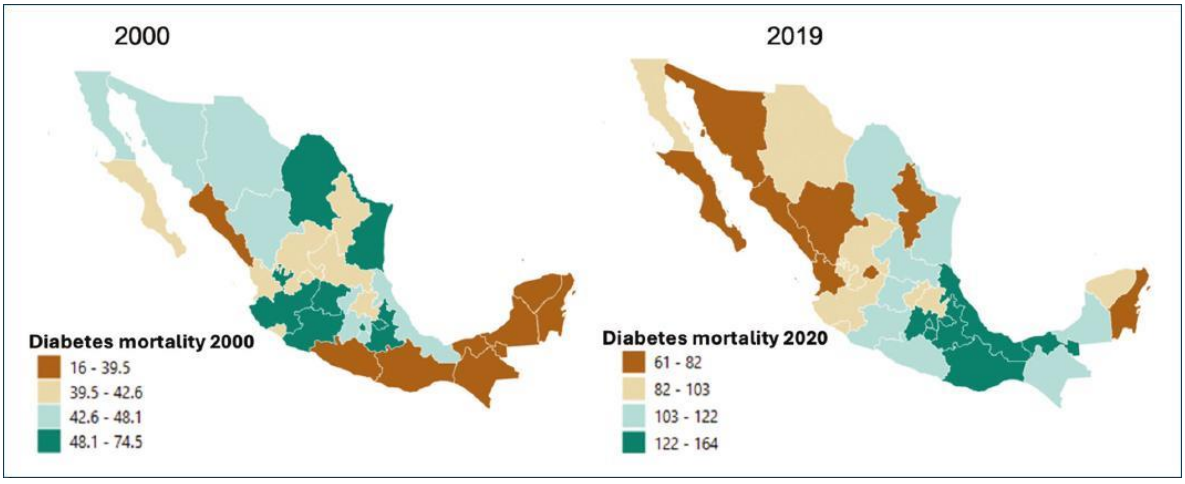

Figure 9. Diabetes mellitus mortality rate per 100,000 inhabitants in percentage divided by counties, 2000-2019 (Soto-Estrada et al., 2025).

Traditional patient care models based on scheduled in-person visits and paper-

based monitoring have shown limitations in meeting the continuous and real-time management needs of patients with Type 2 Diabetes. Issues like poor glycemic control are prevalent, often due to delayed clinical feedback, inconsistent follow-up, and low patient involvement in self-care. These gaps have led to growing interest in digital health solutions, such as mobile apps, telehealth services, and especially wearable devices, which offer the potential for more proactive, data-driven, and patient-centered care models *(Rodriguez-Leon et al., 2020).*
Wearable technologies such as continuous glucose monitoring, smart insulin pens, and smart watches make it possible to track important health indicators like glucose levels, physical activity, and heart rate in real time. When used regularly as part of diabetes care, these devices can help support quicker clinical decisions, improve how patients manage their conditions, and allow healthcare professionals to monitor progress remotely. Research for several countries has shown that wearables can lead to better treatment adherence, fewer hypoglycemic episodes, and healthier daily habits in people living with diabetes *(Alaslawi et al., 2022).*

Given the scale and complexity of the diabetes crisis in Mexico, adopting innovative care strategies is no longer optional but essential. While wearables are not a standalone solution, they serve as a valuable supplement to traditional care models, especially in low-resource settings where access to physicians and ongoing monitoring is limited. These tools have the potential to transform diabetes care by shifting the approach from reactive to proactive, from episodic to continuous, and from provider-led to more patient-centered. This transition aligns with national and global objectives focused on healthcare modernization and chronic disease prevention *(Salinas, 2021).*

2.5.2.2 Government-driven digital healthcare programs

Mexico's Ministry of Health promotes telemedicine and electronic health records, creating an opportunity for wearables integration. Over the past decade, Mexico has seen a growing effort to modernize its healthcare system through the integration of digital health technologies. Both public and private sectors have introduced initiatives to improve access, quality, and efficiency of care, creating opportunities for more extensive adoption of innovations like wearable devices. One of the most prominent national efforts is the gradual digitization of Electronic Health Records (EHRs) across various institutions. Although implementation has been slow, particularly in remote and rural regions, public health agencies, such as La Secretaria de Salud, and social security institutions (IMSS, ISSSTE) have begun implementing interconnected systems designed to support patient data tracking across care levels *(Insights10, 2022).* These EHR platforms serve as a necessary backbone for integrating real-time data from wearable devices, making it easier for healthcare professionals to access, interpret, and act on continuous patient-generated data.
COVID-19 accelerated the use of telehealth, normalizing remote monitoring and creating demand for wearable devices in chronic disease management. Several pilot projects, including state-level mobile health (mHealth) platforms and remote specialist consultations, showed that remote healthcare delivery is a practical alternative in situations where in-person visits are restricted by infrastructure, travel

costs, or geographic barriers *(Chambers.com, 2024).* These efforts have helped to increase acceptance of digital health tools among healthcare institutions and the general public, paving the way for more permanent integration of connected health technologies, including wearables.

Parallel to government efforts, Mexican universities, research institutes, and tech startups have begun developing and testing locally produced wearable devices, including low-cost glucose sensors and smart bands tailored for the Latin American market. These initiatives seek to minimize dependence on costly imported technologies while encouraging the development of tools that are better suited to the cultural and healthcare realities of the local population. In addition, promoting domestic innovation creates space for collaboration between universities and the private sector, enabling the design of scalable solutions for chronic disease management across the country (*Tentori et al., 2020).*

These combined advancements indicate that Mexico's digital health ecosystem is gradually shifting from fragmented pilot programs to a more coherent platform capable of supporting wearable technology integration. However, the long-term success of these initiatives will depend on sustained investment, clear regulatory frameworks, and better alignment between national health priorities and the design of technological solutions.

2.5.2.3 Growing market and technological adoption

Mexico is seeing a rapid growth in the digital health and consumer technology industries, creating better opportunities for the adoption of wearable devices. Multiple factors have contributed to the increasing interest in the wearable technology market, including the growing use of smart phones, broader internet access, and an increasing demand for remote and personalized healthcare services. Mexico's wearable tech market is projected to grow at a 17.6% CAGR from 2025 to 2031, fueled by increasing health awareness and the increasing use of smart phones *(6Wresearch, 2024).*

Recent statistics *collected by* The National Institute of Statistics and Geography (INEGI) show that approximately 81% of the Mexican population has internet access, with smart phones being the most commonly used, surpassing 90% among young adults *(Ift.org.mx, 2023*). The increased use of smart phones allows wearable devices to function as an extension of everyday digital habits, making integration into daily routine more viable for both patients and healthcare professionals.

Additionally, several surveys have shown increases in consumer interest in using digital tools for health monitoring. The Cleveland Clinic, in its 2024 study, found that out of 2,000 adults in Mexico, 51% use at least one type of technology to monitor their health *(Clinic, 2024).* This growing acceptance highlights a shift towards a more proactive health management and self-tracking, especially among young adults and those living in urban areas.

Mexico's digital sector has also experienced notable growth in investment and entrepreneurial activity in recent years. From 2020 to 2023, venture capital funding for health tech startups in Latin America surged by more than 150%, with Mexico emerging as one of the region's leading destinations for this capital *(LAVCA, 2024).* Local startups have begun to develop wearable-compatible platforms for chronic disease monitoring, remote diagnostics, and patient engagement. Companies like

PROSPERIA, Diabesmart, and Melli have introduced solutions that integrate wearable data with telemedicine AI-driven analytics, increasing confidence in the commercial expenditure of such tools *(F6S, 2025).*
In addition, major healthcare institutions like the Mexican Social Security Institute (IMSS), have initiated pilot programs involving digital health technologies in primary care settings, supporting a gradual cultural shift toward a more technology-oriented healthcare practice *(Mexicohistorico.com, 2023).*
Devices, including fitness trackers, glucose monitors, and smart watches, are now more widely accessible in Mexico through popular retail outlets. Companies like Xiaomi, Huawei, Apple, and Abbott have expanded their distribution in several markets. With growing visibility, public awareness of wearable health technology has also improved.

2.5.2.4 International and national collaboration

Recent collaborations between tech companies and the healthcare national system are improving access to wearable technology for diabetes management as wearables and other medical devices become part of digital health strategies worldwide. Transactional and local partnerships have proven to be critical support for clinical research, regulatory compliance, technology transfer, and local capacity building *(Levine, 2017).*
The Dulce Wireless Tijuana Project may stand as one of the most successful examples of international collaboration in the digital health sector. This initiative united key partners from the United States and Mexico, including Qualcomm, the Mexican Social Security Institute (IMSS), the Scripps Whittier Diabetes Institute, and the Autonomous University of Baja California, to use mobile and wearable technologies for diabetes management in low-resource communities. The project demonstrated how cross-border collaboration, linking technical innovation and public healthcare infrastructure, helped in facilitating remote monitoring and early intervention for individuals with chronic diseases, reducing dependence on in-person consultations. Also provides a replicable framework for implementing digital health solutions in other low-resource regions of Mexico and Latin America, enhancing the importance of international collaboration in advancing health system innovation *(Anzaldo-Campos et al., 2016).*
Recent market analyses show that Mexico's wearable technology sector is growing rapidly, with projections estimating an annual growth rate of 13.6% to 18.2% through 2033. This increase can be linked to several interconnected factors, starting with the entry of internationally developed devices (Huawei's Watch GT Cyber and Abbott's glucose monitors) into the Mexican market through global partnerships *(Imarcgroup.com, 2025).* Additionally, the integration of wearable technologies with Internet of Things (IoT) systems and cloud-based platforms has benefited from international standards, enhancing interoperability and data security. Continuous innovation and knowledge exchange from multinational manufacturers and research institutions have also played a vital role, helping to adapt these technologies to local healthcare settings and making them more accessible to healthcare providers and patients *(Mobility Foresights, 2025).*
Collaborative projects have also played a key role in strengthening the digital health ecosystem in Mexico by supporting local institutions in several strategic regions.

These initiatives have contributed to the development of regulatory frameworks and clinical guidelines modelled after international best practices, helping to ensure the safety, efficacy, and ethical use of wearable health devices. In parallel, international workshops, technical exchange projects, and joint training programs have helped to build the capacity of Mexican healthcare professionals by addressing gaps in digital literacy and encouraging readiness to adopt and integrate new technologies into clinical practice *(Levine, 2017)*. Strengthening these tools will be essential in building a sustainable, scalable digital health ecosystem capable of improving chronic disease management nationwide.

2.6 Perceptions of junior and senior healthcare professionals

The rapid development and integration of digital tools into the healthcare system has become key in healthcare practice. These technologies offer the capacity for type 2 diabetes management, with the potential to empower patients in self-management, provide real-time data to clinicians, facilitate early intervention, and potentially improve glycemic control. Recent studies indicate that many clinicians now consider CGM as one of the most impactful interventions for T2D management *(Dexcom.com, 2025).* Regardless, despite the potential, the actual integration of these technologies into clinical practice is influenced by multiple factors, including the perceptions, attitudes, and readiness of healthcare professionals, not to mention the constant need for professionals to update their knowledge and acquire new skills and training in digital technologies, and the apparent difference in technology literacy among different generations of healthcare providers *(Alzghaibi, 2025*). *Lee and Lee* found that one of the most notable distinctions between younger and senior healthcare professionals is the clear difference in technological exposure during their education and training *(Lee and Lee, 2020).*

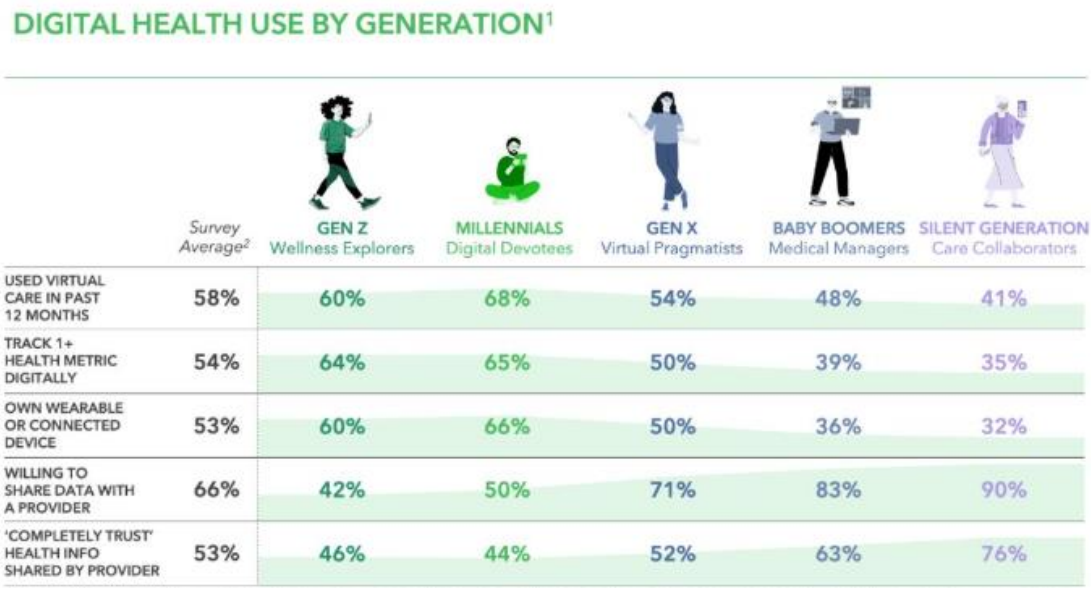

Figure 10. Comparative chart of Digital Health use by different generations (Sharma, 2025).

Some of the key perceptions that strongly influence healthcare providers are the perceived benefits, risks, and limitations of wearable devices.
HCPs frequently mention the advantage of wearables for real-time monitoring of vital signs and activities, leading to more informed clinical decision-making, earlier detection, and more efficient patient management *(Gagnon et al., 2024).* The ability to access continuous patient data can enhance personalized care treatments and potentially reduce the need for in-person visits, improving accessibility, especially in remote zones. On the other hand, even with documented benefits, significant concerns persist, normally associated with data accuracy and reliability of commercial devices, privacy and security of sensitive patient information, and the potential for clinicians to feel overwhelmed by too much data. Usability challenges, technical glitches, and the need for interoperability with existing Electronic Health Records (EHRs) are also frequently cited barriers *(Brückner et al., 2025).*
A main focus of this study is to explore the potential generational difference in perception and readiness between healthcare professionals.
Younger practitioners, often referred to as “digital natives”, have grown up in an era vastly influenced by the use of digital technology. Their academic education and initial professional practice are increasingly integrated with digital tools, telehealth platforms, and digital patient records, which commonly provide a sense of familiarity and comfort with the use of technology, and a lower perceived effort in adopting new digital health solutions like wearables *(Gu et al., 2021).* Younger professionals may also be more inclined to embrace new approaches and technologies, driven by a desire for efficiency and a less rigid adherence to traditional workflows. They may also perceive digital tools as a means to reduce administrative burden and improve a work-life balance *(American Medical Association, 2022).*
Modern medical programs increasingly emphasise digital health literacy and the application of technology in clinical practice. This fundamental training equips junior professionals with the necessary skills to navigate and utilize digital health tools effectively. In contrast, senior practitioners may require more individualised training and support to overcome potential knowledge gaps or initial resistance regarding new digital implementations *(Pascale, 2025).*
And while the majority of literature suggests that junior practitioners are generally more receptive to adapting wearables and to the overall use of digital tools. In contrast, senior practitioners tend to be more cautious about incorporating technology, valuing clinical experience and established workflows more. However, a study by *Coffetti* found that perceived ease of use plays a key role in senior professionals’ willingness to integrate digital tools and wearables into practice *(Coffetti et al. 2022).* Still, challenges for senior practitioners are pronounced. Potential resistance to changing established clinical routines, and a perceived lack of immediate necessity or value if their current methods are considered adequate, present a barrier to adopting these new tools. Concerns about data privacy, reliability, and the impact on patient-clinician relationships may also be more pronounced (*Brückner et al., 2025*). However, it is important to consider that individual factors like personal tech literacy and organizational support can significantly influence adoption regardless of age.

As previously mentioned, the Mexican healthcare system is undergoing a digital

transformation, with significant progress in adopting Electronic Health Records (EHRs) and an increasing focus on digital health initiatives. The digital health market in Mexico is projected to grow substantially, indicating a supportive environment for technology integration *(Group, 2025).* Despite the growing opportunities, several challenges remain, including fragmentation across public and private sectors, inconsistent infrastructure investment, particularly in rural regions, and the lack of a unified national digital health strategy *(MarketWatch, 2025)*. These systematic barriers can influence and impact healthcare professionals' ability and willingness to integrate wearable devices, regardless of their technological readiness.

While efforts are underway to align regulatory frameworks with international best practices for digital health, clarity on data privacy, security, and the legal implications of using wearable device data for clinical decisions is still evolving, concerns over data privacy are a constant barrier for patients, and by extension, for healthcare professionals who are responsible for managing patient data these regulatory uncertainties can cause apprehension across all professionals *(Alzghaibi, 2025).*

Socioeconomic differences in Mexico significantly affect who can access and effectively use wearable devices, which in turn influences professionals' perceptions of their utility in practice. The digital divide, marked by inequalities in internet access and digital literacy, means that a considerable portion of the Mexican population, particularly older adults and those in rural regions, may lack the means or skills to engage with wearable devices *(De la Peña-López and Acosta-Gonzaga, 2025)*. For healthcare professionals, regarding their professional experience, the reality of patient access is a critical consideration. If a significant percentage of their patient population cannot afford to effectively use wearable devices, the perceived benefit of integrating these tools into their general practice might decrease. Furthermore, while patient demand for convenient and personalised care is growing, and telemedicine has seen an increase in acceptance, factors like cultural attitudes towards health technology and data sharing can vastly vary *(Mexico Business, 2025).*

The existing literature consistently highlights how healthcare professionals' perceptions of wearable device integration are influenced by personal attributes, professional training, and the broader healthcare system. Specifically, when it comes to wearable devices for managing type 2 diabetes, a clear difference often exists between younger and more experienced practitioners. Younger practitioners, usually "digital natives" with recent exposure to digital health during their education, tend to have higher digital literacy and are more open to adopting innovative tools for patient care. Conversely, while more seasoned practitioners acknowledge the clinical benefits of advanced monitoring, their views can be affected by concerns about workflow disruptions, data accuracy from commercial devices, and a preference for established, traditional methods.

Despite general insight into technology adoption in healthcare, several critical gaps that need to be addressed still remain, particularly regarding the integration of wearables into the Mexican healthcare system.

2.7 Gaps in the Research

While the literature shows a growing agreement on the benefits of wearable devices in managing Type 2, especially for continuous glucose monitoring, patient

empowerment, and proactive care, several important gaps still exist, particularly within the Mexican healthcare system.

First, there is a clear lack of empirical data focused on the perceptions of healthcare professionals in Mexico. Much of the existing research either focuses on patient-centred outcomes or is based in high-income countries, overlooking the infrastructural, cultural, and economic challenges specific to low and middle-income countries. This limits the ability to tailor implementation strategies to the unique needs of Mexican healthcare professionals.

Furthermore, the impact of generational differences on the readiness and adoption of digital health tools has been understudied, especially regarding wearable devices. While some research addresses digital literacy gaps, few studies quantitatively compare junior and senior practitioners' perceptions, particularly within public healthcare institutions where traditional workflows are prevalent.

Lastly, limited attention has been given to Mexico's fragmented healthcare system and how this affects potential wearable integration. The interoperability challenges, outdated EHRs, and lack of standardized device protocols create structural barriers that have not yet been fully examined regarding their impact on professionals' willingness or institutional readiness.

2.8 Conclusion

The literature established the increase in wearable devices in the health industry and the proven benefits of these in enhancing real-time monitoring, improving patient engagement, and fostering personalized care in diabetes management. Healthcare professionals generally acknowledge this potential, yet their readiness and willingness to integrate these technologies into practice are influenced by a mix of perceived benefits, risks, and limitations.

Across the literature, key topics consistently emerge: trust in data accuracy, institutional readiness and support, professional training, and ethical and legal considerations. Studies underline the persistent gap between commercial wearables and clinical standards, particularly regarding data reliability and regulatory policies.

The Mexican healthcare context presents more complexities and several critical factors that influence potential integration. The country's evolving digital health infrastructure, characterized by advancements in EHR adoption and persistent challenges in interoperability and internet connectivity, directly impacts the possibility of national wearable integration. In addition, the evolving rules around digital health and data use, along with differences in income, access to technology, and patients' attitudes, strongly affect how healthcare professionals experience and perceive the usefulness of these tools in practice.

In summary, while wearable devices are not a universal solution, research shows they can be highly valuable when correctly implemented and supported by the right systems, policies, and training. To fully benefit from what wearables can offer for diabetes management, particularly for countries like Mexico, it is essential to overcome existing challenges with inclusive and evidence-based strategies to deliver a more effective and accessible diabetes care.

CHAPTER 3 METHODOLOGY

3.1 Overview

This study employed a positivism philosophy research design with a descriptive and comparative approach that focused on exploring and comparing the perceptions and readiness of junior and senior healthcare professionals in Mexico regarding the adoption of wearable devices for Type 2 Diabetes management. The study primarily adopted a deductive approach, emphasizing a mixed-methods quantitative strategy aimed at testing the hypothesis that junior professionals will exhibit a more favourable perception and readiness compared to their senior peers.

3.2 Research philosophy

Positivism is a philosophical approach to research that prioritizes knowledge gained through direct observation and scientific methods. Emerging in the early 20th century, it is grounded in the belief that an objective reality exists independently of individuals and can be systematically investigated. Within this framework, researchers concentrate on aspects of the world that can be measured and quantified, employing structured methods, statistical tools, and hypothesis testing to produce findings that can be broadly applied.

The goal of positivist research is to remain impartial and minimize personal bias by adhering to standardized procedures for data collection and interpretation. Because of its focus on factual, numerical data and its emphasis on replicable results, positivism is closely linked with quantitative research, particularly in studies aimed at identifying patterns, testing relationships, and making predictions based on empirical evidence *(Prime, 2024)*.

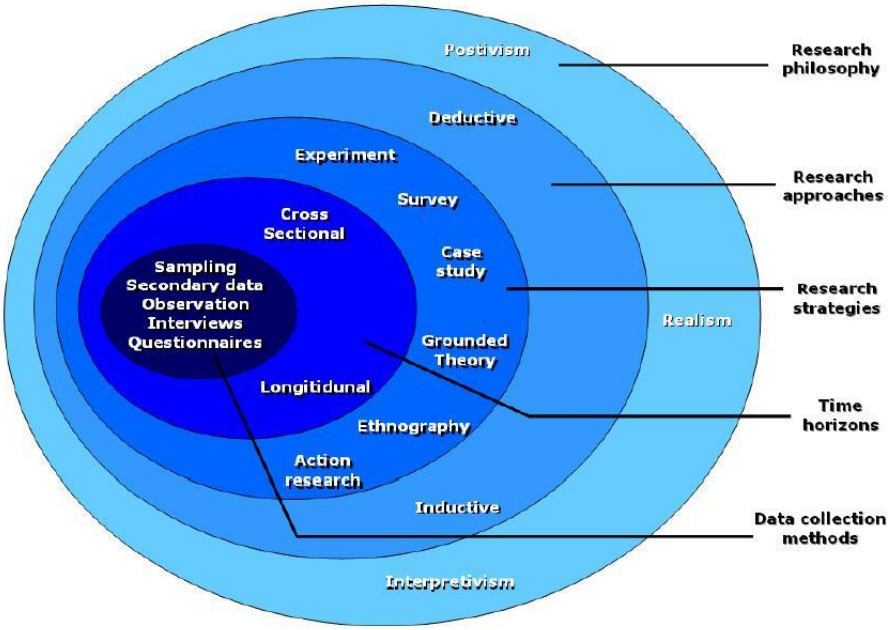

Fig 11. The research onion (Essaycompany, 2017).

A positivist research philosophy was designed for this study, which aligns with its objective, deductive approach, and reliance on measurable, empirical data. Positivism assumes that reality is objective and can be observed and quantified through scientific methods. Within this study, the perceptions and readiness of healthcare professionals to adopt wearable devices are approached as observable phenomena that can be captured numerically, analysed statistically, and generalized (within limitations) to a broader population of healthcare professionals.

By adopting this philosophy, the study focused on collecting quantitative data through a structured survey, avoiding subjective interpretation and minimizing possible bias. The positivist focus supported the formulation and testing of an established hypothesis: "Junior healthcare professionals will exhibit more favourable attitudes and higher readiness for wearable device integration compared to their senior peers. This approach allowed for the identification of patterns, trends, and correlations between defined variables (career stage, perception, etc,), and evidence-based conclusions**.**

Positivism was particularly chosen given the study's aim to explore and compare perceptions that can inform institutional strategies and digital health policies in Mexico**.**

3.3 Research design

This study employed a descriptive and comparative quantitative research design aligned with its aims and objectives. The descriptive section offered a detailed examination of current perceptions, knowledge, readiness levels, and the main challenges and opportunities faced by Mexican healthcare professionals. It assessed factors such as awareness of wearable technologies, perceived benefits of their use in managing T2D, and common barriers to their adoption within Mexico's healthcare system. Through this analysis, the study aimed to provide a data-driven overview of prevailing attitudes and understanding among healthcare professionals in Mexico *(Unimrkt Research, 2023).*

The comparative aspect of the research design was essential for addressing the study's goal and testing the hypothesis. Dividing participants into two predefined groups, "Junior" and "Senior" healthcare professionals (based on years of clinical experience), enabled the identification of key differences or similarities in their perception, understanding, and readiness regarding wearable technology adoption *(Iranifard and Roudsari, 2022).*

Furthermore, the research's deductive approach began with a specific hypothesis: "Junior healthcare professionals in Mexico will show a more favourable perception and readiness for the adoption of wearable devices for Type 2 Diabetes management than Senior healthcare professionals". This top-down approach involved collecting empirical data through a structured survey to test this pre-formulated hypothesis. The quantitative data served as evidence for the support of this proposition. This design was robust for quantifying attitudes, identifying relationships between variables, and drawing generalizable conclusions about the targeted population of Mexican healthcare professionals *(Dudovskiy, 2025).*

3.4 Research strategy

The study adopted a quantitative research strategy designed to collect empirical, measurable data to be statistically analysed to test the central hypothesis.

The strategy was centred on a structured online survey, distributed among a sample of healthcare professionals working with Type 2 diabetes patients in Mexico. This method allowed for a more efficient gathering of standardized data from a relatively large sample. The format also supported respondent anonymity, which was important for obtaining honest and unbiased answers, particularly on topics that may relate to workplace resources, digital competencies, or institutional barriers.

The survey was designed to capture dimensions relevant to the study's objectives. It aimed to assess participants' levels of familiarity with wearable devices, their confidence in using and interpreting such technology. In addition, it explored healthcare professionals' perceived benefits and risks, as well as the key barriers they associate with the integration of wearables into Type 2 Diabetes care.

Finally, the survey structure allowed for the identification of variations in responses based on career stage, professional role, and institutional context, enabling meaningful comparative analysis across groups.

The quantitative research was employed due to its objectivity and replicability, which enhances the credibility and generalizability of the findings within similar healthcare contexts.

By collecting numeric data across multiple variables, the study was positioned to conduct descriptive and comparative analyses, enabling the identification of trends and statistically significant group differences that could inform future training programs or implementation strategies related to wearable health technologies in Mexico.

3.5 Research participants

The target population for this study consisted of a diverse range of healthcare professionals currently practicing in Mexico and engaged in the clinical management of patients with Type 2 Diabetes. This included general practitioners, endocrinologists, registered nurses, nurse practitioners, nutritionists, and other allied health professionals who play a direct role in the care and treatment of individuals living with T2D.

Given the professional nature of the target population and the challenges associated with accessing a national registry, a non-probability sampling strategy was employed. Initial participants were recruited through professional networks. These initial contacts were then encouraged to share the survey invitation with other eligible colleagues within their professional circles. While this method did not ensure full representativeness of the broader Mexican healthcare professional population, it provided a practical and effective approach for reaching a specialized and often difficult-to-access group. A categorization based on their years of professional experience was performed among the participants to ensure an effective comparison between career stages.

3.6 Data collection

Primary quantitative data were systematically collected using a self-administered online survey instrument. The instrument was designed to capture data aligned with

each study's objective. The analysis results were structured into different sections aimed at addressing the research aim and objectives:

3.6.1 Section 1: Demographic information

This section gathered essential background data crucial for categorisation and contextual analysis. It included questions regarding participants' profession, years of professional experience, and the approximate number of T2D patients seen monthly.

3.6.2 Section 2: Perception and understanding of wearable devices

This section explored healthcare professionals' awareness, knowledge, and general attitudes towards wearable technologies for T2D management. Questions employed multi-point Likert scales ("Strongly Disagree" to "Strongly Agree") to measure agreement with statements regarding perceived benefits, risks, and limitations.

3.6.3 Section 3: Readiness and willingness to integrate

This part assesses the practical inclination of healthcare professionals to adopt these devices. It included questions about the likelihood of recommending wearables to patients, beliefs about the future trajectory of wearable device use in diabetes management, and perceived personal preparedness to integrate them into daily practice.

3.6.4 Section 4: Challenges and opportunities

The last section employed multiple-choice questions to identify the most significant challenges hindering adoption in Mexico, and open-ended questions to capture other unlisted factors that could facilitate the integration of wearables.

The survey design primarily featured closed-ended questions, with a strong emphasis on Likert-scale items to ensure consistency and facilitate efficient quantitative analysis. To enrich the dataset and capture distinct insights, a limited number of open-ended questions were also included, which allowed participants to elaborate on unique challenges or opportunities that may not have been fully addressed by the closed-response items, and helped in providing a degree of qualitative depth to complement the quantitative findings.

The data collection process was carefully organized to ensure it was efficient, accurate, and followed the appropriate ethical considerations. The survey was shared using Google Forms, a trusted online platform that supports data security and provides easy access for participants. This approach provided several benefits: it allowed the survey to reach professionals in different locations, made participation more convenient for those with busy schedules, and helped reduce manual errors by automatically collecting and organizing responses. This also allowed the process of moving into data analysis to be much faster and reliable.

3.6.5 Participant recruitment

The recruitment process followed a structured approach to ensure ethical standards and broad outreach.

An official online link invitation to participate in the study was shared, clearly explaining the purpose of the research, guaranteeing anonymity, and voluntary participation. This link was facilitated through professional networks that were willing to disseminate the link among colleagues, and the use of professional social media platforms like LinkedIn and Facebook was also employed to broaden the

participation rate.
To ensure the highest level of anonymity, no personally identifiable information (names, addresses, etc.) was collected within the survey. All collected data was treated with strict confidentiality, accessible only to authorized personnel.
Raw survey data was securely stored on password-protected servers, accessible only to authorized people, in compliance with data protection regulations.
A realistic timeframe for data collection of three weeks was established, and constant reminders and updates were sent periodically to maximize the response rate.

3.7 Sample Size

To determine the appropriate sample size for this study, Cochran's formula was applied due to its widespread use in survey-based research involving large or unknown populations. Based on a 95% confidence level, a conservative estimated population proportion of 0.5, and a fixed margin of error of 6%, the initial calculated sample size was 196 participants *(Glen, 2021*). As the precise total population of healthcare professionals in Mexico involved in T2D management is unknown, but according to data from the Mexican government, the number of general practitioners and specialists during the third quarter of 2024 was 352,000 people *(Data México, 2024).*

$$n_0 = \frac{Z^2 \cdot p(1-p)}{e^2}$$

Figure 12. Cochran's Formula (Johnson, 2025).

Where:
n0= is the sample size
z = is the selected critical value of the desired confidence level
p =is the standard deviation
e = is the margin of error

Although the original target sample size of 196 was calculated using Cochran's formula to achieve a 6% margin of error at a 95% confidence level, the study ultimately gathered 103 valid responses. This shortfall was primarily attributed to two constraints: the limited timeframe available for data collection and the professional commitments of the target population. These individuals often face time pressures and demanding clinical schedules, making them a traditionally hard-to-reach population in survey-based research.
Despite not reaching the full target, the final count of 103 responses remains methodologically acceptable, particularly for exploratory, non-probability studies where the aim is to identify trends and group differences rather than make statistical generalisations to an entire population. Existing literature in the social and health sciences supports the use of sample sizes between 80 and 120 for cross-sectional and comparative research *(Ishtiaq, 2019).*

3.8 Approach to data analysis

The data collected from the online survey were analysed using quantitative methods aligned with the study's positivist and deductive framework. The primary objective of the data analysis was to evaluate healthcare professionals' perceptions and readiness to adopt wearable technologies in the clinical management of Type 2 Diabetes, and identify whether statistically significant differences existed between generations. Once data collection was completed via Google Forms, all responses were exported into Microsoft Excel for preliminary processing. The dataset underwent a thorough cleaning process to ensure data quality. Following data cleaning, the dataset was imported into JASP, an open-source statistical software, for formal statistical analysis. The use of JASP enabled efficient management of variables and the application of both descriptive and inferential statistical tests.

Descriptive statistics were calculated to summarize demographic information and survey responses. These included frequencies and percentages for categorical variables, as well as means for continuous data. This initial stage of analysis provided an overview of participants' awareness of wearable technologies, perceived benefits and challenges to adoption, confidence in use, and willingness to integrate these tools into their practice. Descriptive results were used to establish a baseline understanding of the sample population and to identify general patterns and attitudes toward wearable health technology. To examine the study's central hypothesis, comparative statistical analysis was employed through the use of chi-square test parameters.

To enhance interpretability and communicate findings effectively, the results were visually represented through bar charts, pie charts, and other representative graphics, created using Microsoft Excel and Tableau. These visualisations helped to support the narrative by illustrating key differences and trends across professional groups, allowing for clearer comparison and more impactful presentation of the data. This analytical approach was designed to ensure rigour, transparency, and alignment with the research's objectives.

3.9 Ethical considerations

The ethical integrity of this research is paramount and was rigorously upheld throughout all phases of the study, strictly adhering to principles outlined in the Griffith College Ethics Application and Declaration Forms. All ethical considerations were addressed to ensure participant protection, data integrity, and regulatory compliance. Before accessing the survey, participants received clear information about the study's purpose, procedures, and their rights, including the voluntary nature of participation and the right to withdraw at any time without penalty. Informed consent was obtained electronically through a digital form that participants had to affirmatively accept. The survey was designed to guarantee anonymity by avoiding the collection of any personally identifiable information, such as names, contact details, or IP addresses, ensuring that individual responses could not be traced back to specific participants. Collected data were stored securely on encrypted, password-protected servers, accessible only to authorised personnel. These practices complied with relevant data protection laws, including GDPR principles. Data will be retained for two years following qualification reward, for data management and

retention, after which it will be permanently and securely destroyed. Given the nature of the study (an anonymous, non-invasive survey focused on professional perceptions), the risk to participants was minimal, and every effort was made to ensure the content was respectful and appropriate. Participants were also informed about how findings would be disseminated, including inclusion in a postgraduate dissertation and potential academic publications. As stated in the Griffith College Ethics Application and Declaration Form, no data collection began until formal ethical approval was granted, and all research activities were conducted in strict accordance with that approved protocol.

3.10 Conceptual Framework

The conceptual framework guiding this study has been developed to support a structured, quantitative investigation into the perceptions and readiness of healthcare professionals in Mexico. It integrates Technology Acceptance Theory, Digital Health Readiness, and principles of institutional adoption to explore how career stage, professional experience, digital literacy, and perceived benefits influence attitudes toward wearable integration.

The framework supports a positivist, deductive, and survey-based quantitative approach, enabling a comparison of measurable perceptions across groups. It accounts for individual and contextual factors influencing technology adoption in clinical practice. This structured approach ensures that the clinical and systematic aspects of wearable health technology implementation in Mexico are addressed by the research.

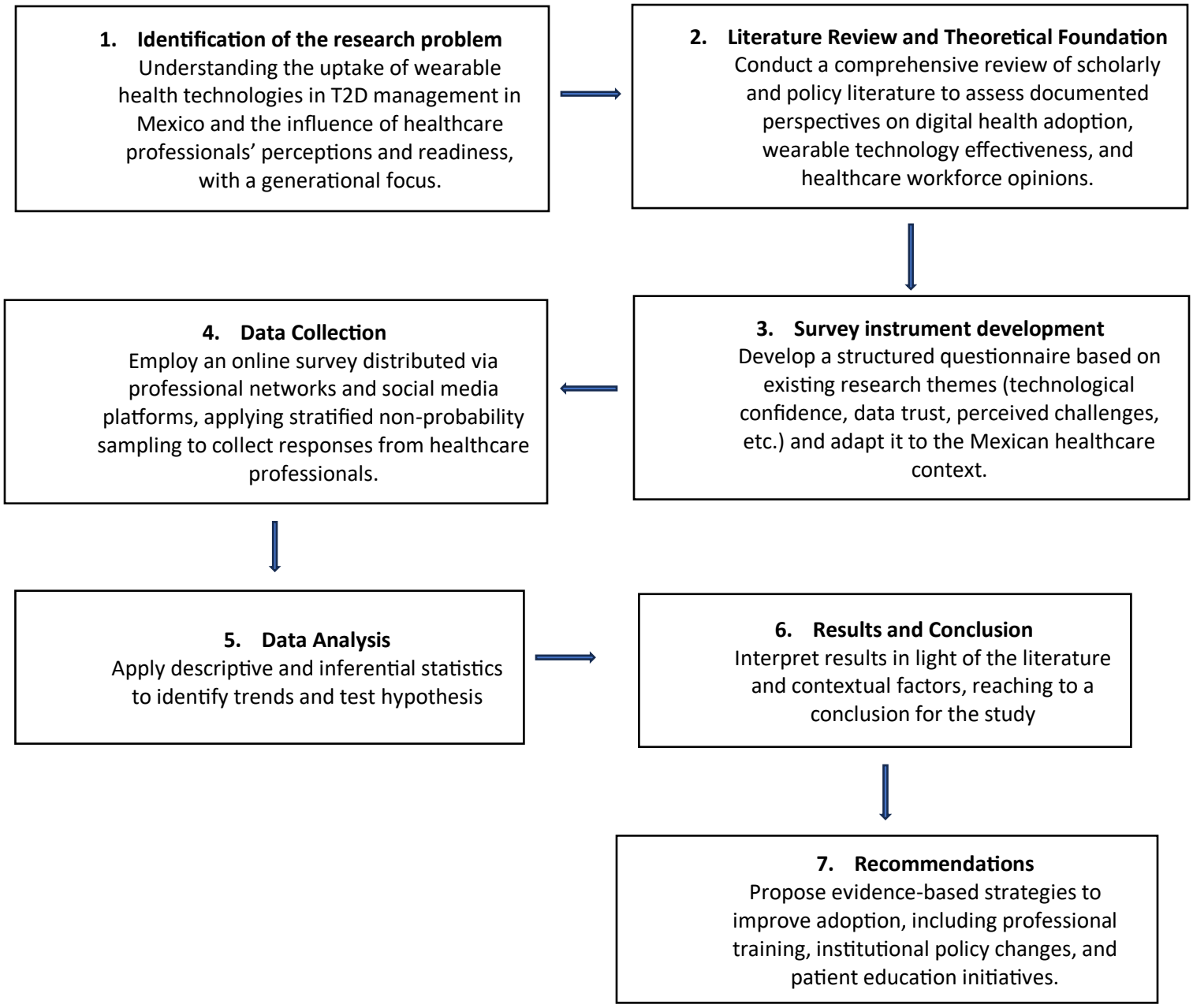

Figure 13. Conceptual Framework

3.11 Conclusions

This chapter has outlined the systematic approach employed to investigate healthcare professionals' perceptions and readiness. Framed within a positivist, research philosophy, the study utilised a deductive, non-interventional survey design to collect primary data. A structured, self-administered questionnaire was distributed online via convenience and snowball sampling to achieve a balanced sample of participants. Data cleaning and preparation ensured the integrity of responses, which were then subjected to descriptive statistics to profile familiarity, confidence, and institutional factors, followed by inferential analysis to compare between groups and quantify effect sizes. Visualisation tools supported the clear presentation of key findings. Throughout, ethical considerations, including informed digital consent, anonymity, and secure data storage in compliance with GDPR, have been rigorously maintained.

Chapter 4: Data analysis and findings

4.1 Overview

Chapter 4 summarizes the findings from the quantitative data gathered through a structured online survey distributed among healthcare professionals in Mexico who are actively involved in the management of type 2 Diabetes. A total of 103 responses were collected and analysed to explore perceptions, level of readiness, and key factors influencing the adoption of wearable health technologies, with a particular focus on comparing responses across career stages (Junio vs. Senior professionals) The analysis is structured into two main components.

The descriptive statistics presented summarise the demographic profile of participants and provide an overview of their familiarity with wearable technologies, perceived benefits and barriers, and attitudes toward integration into clinical practice. Inferential statistics methods, including chi-square tests, are used to explore statistically significant differences between junior and senior healthcare professionals.

Visual representations support findings to enhance clarity and interpretability. This chapter ultimately aims to answer the central research question by identifying whether and how professional experience level influences the perception and readiness to adopt wearable technologies for T2D management in Mexico.

4.2 Participants' Demographics and Background

4.2.1 Age distribution

A total of 103 healthcare professionals participated in the survey. The age distribution indicates that the majority of respondents were between 30 and 39 years old, accounting for 42.7% of the sample, with 44 respondents. This was followed by the 40-49 age group, with 24 respondents representing 23.3% of participants. Both the under-30 and 60+ categories made up an equal share of the sample, each contributing 15.5% with 16 respondents each. The smallest age group was 50-59 years, comprising only a small fraction of the sample, with 3 respondents representing the 2.9%. This age profile shows a relatively young to mid-career population. The balanced presence of older participants (especially the 60+ group) allows for meaningful comparisons across generational lines.

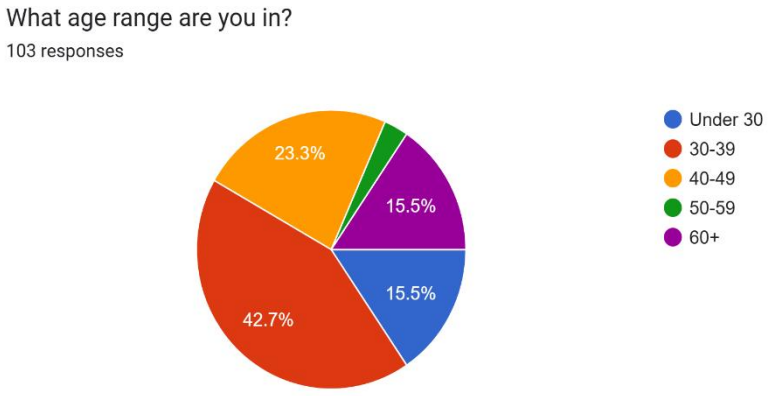

Figure 14. Age distribution of respondents

Age	Respondents	Distribution %
Under 30	16	15.5
30-39	44	42.7
40-49	24	23.3
50-59	3	2.9
60+	16	15.5

Table 1. Demographics of respondents (Age distribution)

4.2.2 Professional role distribution

The table below shows the distribution of professional roles among the 103 participants; the majority identified as General Practitioners, comprising 34% of the sample. This was followed by Specialists (22.3%) and Residents/Interns (19.4%). Other professional categories included Nurses, Nutritionists, Professors, and additional roles such as allied health providers. Each of these groups accounted for smaller proportions of the total responses, indicating a wider but less frequent presence of interdisciplinary roles.

Role	Respondents	Distribution %
General Practitioner	35	34
Specialist	23	22.3
Resident/Intern	20	19.4
Nutritionist	8	7.8
Nurse	6	5.8
Med teacher	2	4
Registered Dietitian	2	4
Registered Dietitian Nutritionist	1	2.7

Table 2. Demographics of respondents (Professional role distribution)

4.2.3 Years of Professional Experience

The next section was crucial to support the comparative focus of this study, helping to profile the participants into “Junior” and “Senior” professionals. The professionals with less than 11 years of professional experience were labelled as “Junior”, and all the professionals with more than 11 years as “Senior”.

Out of the 103 responses, Junior Professionals accounted for a combined 54.4% of the sample. Distributed as follows:

- 15.8% with less than 5 years of experience, with 16 responses.
- 38.6% with 5-10 years of experience, with 39 responses.

Senior professionals made up the remaining 45.6%, including:

- 21.8% with 11-15 years, with 23 participants.
- 9 responses made the 16-20 years category with 7.9%.
- 15.8% with more than 20 years of experience, with the remaining 16 participants.

This distribution provided a well-balanced sample, allowing for meaningful, strong comparative analysis.

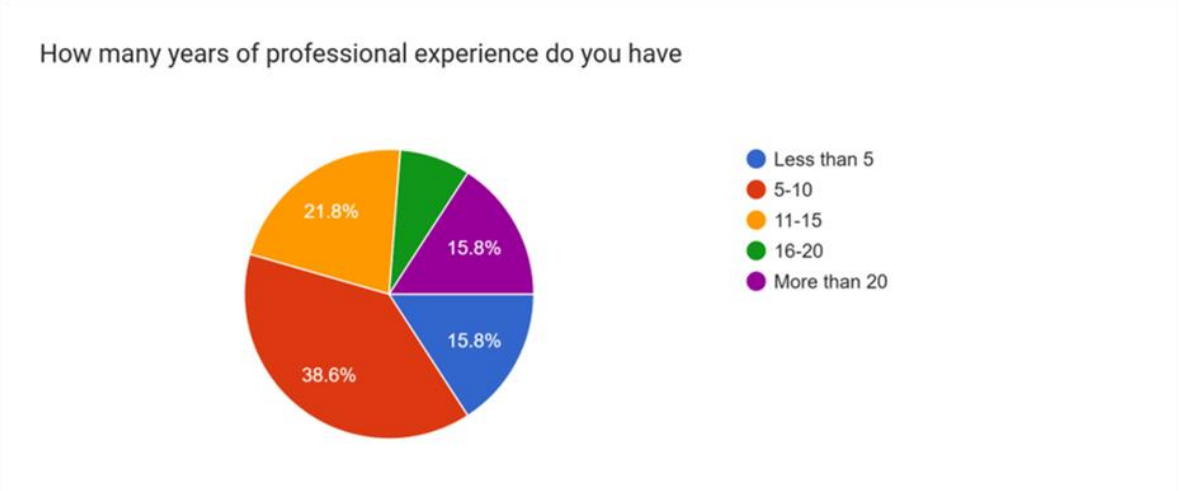

Figure 15. Years of Professional Experience distribution

Career stage	Category	Respondents	Distribution %
Junior	Less than 5 years	16	15.8
Junior	5-10 years	39	38.6
Total Junior		**55**	**54.4**
Senior	11-15 years	23	21.8
Senior	16-20 years	9	7.9
Senior	More than 20 Years	16	15.8
Total Senior		**48**	**45.6**

Table 3. Distribution of Participants by Career Stage

4.3 Use and understanding of wearable devices

Addressing one of the main objectives of the study, which focuses on assessing the perception and understanding of wearable devices for type 2 diabetes management, the participants were asked to answer a series of questions.

4.3.1 Familiarity and use of wearables (comparative between Junior and Senior Professionals).

To introduce the main theme, participants were first questioned about their awareness of wearable devices used for Diabetes management. Responses were categorized in “Not at all familiar”, “Slightly Familiar”, “Familiar”, “Very Familiar”,

and “Extremely Familiar”, and subsequently divided into Junior and Senior for generational comparative. The chart below shows that among Junior Professionals, the highest response was for “Familiar” (n=26), followed by “Very Familiar” (n=15), “Slightly Familiar” (n=12), and “Not at all familiar” (n=3). Showing that a majority of junior participants reported at least a moderate level of familiarity. On the other hand, in the Senior group, the most frequent response was “Slightly Familiar” (n=21), followed by “Familiar” (n=17), “Not at all familiar” (n=5), and “Very familiar” (n=5). Compared to the “Junior” group, fewer “Senior” participants reported being “Very Familiar” with wearable devices, and a greater number reported being “Not at all familiar” or only “Slightly familiar”. The lack of “Extremely familiar” responses from both groups indicates a reserved familiarity with wearables among the participants. Overall, the data showed that higher familiarity levels were more common among junior professionals, while lower familiarity levels were more prevalent among senior respondents.

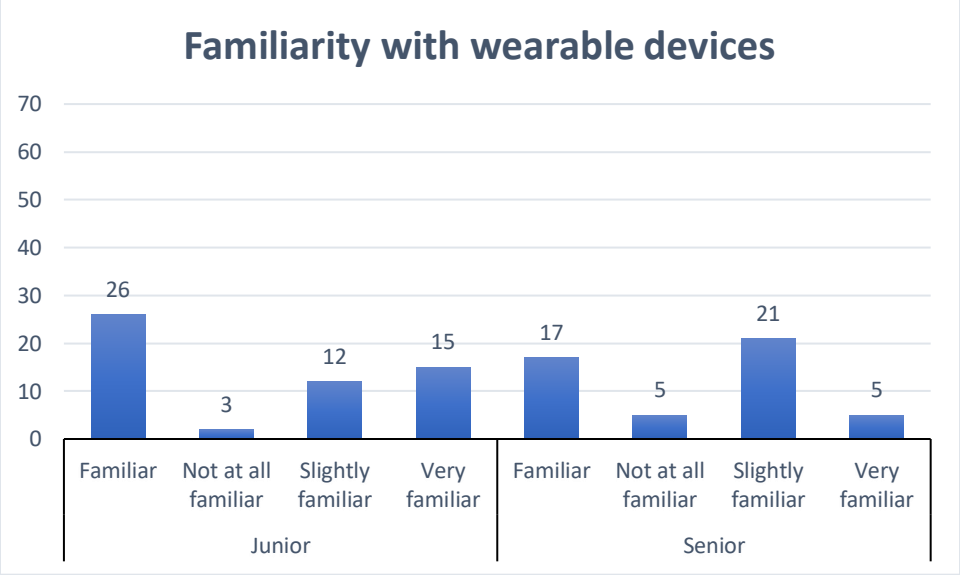

Figure 16. Comparison of the familiarity with the existence of wearable devices between junior and senior healthcare professionals.

To assess the hypothesis and determine if there is a statistically significant correlation between career stage (“Junior” vs. “Senior”) and level of familiarity with wearable devices used for diabetes management among healthcare professionals, a chi-square test was performed using JASP. A contingency table was created to summarize the observed counts of responses from the two groups (Junior and Senior healthcare professionals). To avoid zero-frequency issues, the categories “Very familiar” and “Extremely familiar” were combined. Categories were labelled as follows for analysis:

- 2 = Extremely familiar and Very familiar
- 3 = Familiar

- 4 = Slightly familiar
- 5 = Not at all familiar

The analysis yielded a chi-square statistic of 10.080 with 3 degrees of freedom and a p-value of 0.018, which is statistically significant at the 0.05 level. Based on this, the null hypothesis is rejected, suggesting a significant association between career stage and familiarity with wearable devices. Junior professionals were more likely to report higher levels of familiarity, while senior professionals were more represented in the lower familiarity categories. These findings provide statistical support for the central hypothesis, indicating that junior healthcare professionals may indeed be more willing and positively inclined toward adopting wearable technology in managing T2D.

Contingency Tables ▼

	CareerStage		
3ityWearables	Junior	Senior	Total
2	15	5	20
3	26	17	43
4	11	21	32
5	3	5	8
Total	55	48	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	10.080	3	0.018
N	103		

Table 4. Chi-square test in JASP for familiarity with wearable devices.

4.3.2 Recommendation of wearable devices to patients with Type 2 Diabetes

Participants were asked whether they had previously recommended the use of wearable devices for T2D management to patients. Out of the 103 participants, 59 responded "Yes," representing the majority at 56.3%. The remaining 44 respondents, representing 43.7%, answered "No."

Following the initial statistical analyses, the data were further examined to explore differences in behaviour between Junior and Senior professionals. This comparative analysis aimed to determine whether there were significant differences between the two groups regarding the recommendation of wearable devices to patients.

The following bar chart visualises this variable across the distinct years of professional experience, and categorised into Junior (Less than 11 years of

experience), and Senior (11 or more years of experience) to enable structured comparisons.
The data showed that participants with 5-10 years of experience represented the group with the highest rate of recommendation, with 33 “Yes” responses and only 7 “No”. similarly, those with less than 5 years of experience also leaned positively, with 11 “Yes” versus 4 “No” responses.
In contrast, among Senior professionals, the group with 11-15 showed an almost equal split between “Yes” (11 responses) and “No” (12 responses), suggesting a more balanced or cautious stance. As experience increased further, the recommendation rate decreased: only 2 out of 8 professionals in the 16-20 years category responded “Yes”, and among those with more than 20 years of experience, just 2 of 17 participants reported recommending wearables.

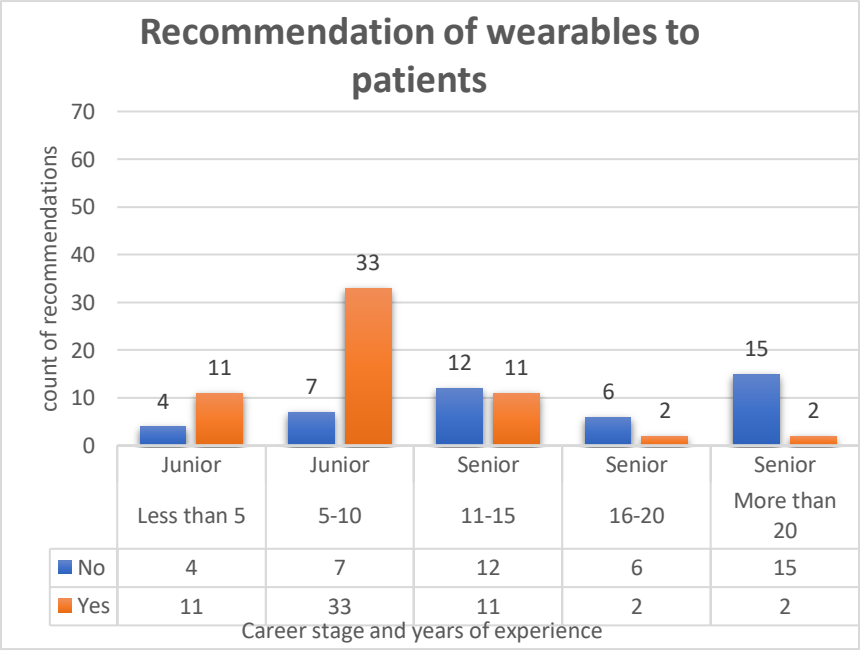

Figure 17. Distribution of responses between Junior and Senior healthcare professionals in recommending wearable devices to patients.

To examine whether career stage (Junior vs Senior) is significantly associated with the likelihood of recommending wearable devices to patients, a chi-square test of independence was conducted. This test assessed whether the observed distribution of responses (“Yes” or “No” to recommending wearables) differed significantly between the two professional groups.
As shown in the contingency table, 44 out of 55 Junior professionals (80%) reported recommending wearable devices to patients, compared to only 15 out of 48 Senior professionals (31%). This notable contrast justified further statistical evaluation.
The chi-square test yielded a x^2 value of 24.893, with 1 degree of freedom, and a p-value of <0.001. Since the p-value is well below the conventional alpha level of 0.05, the result is statistically significant. This indicates a strong association between

career stage and the likelihood of recommending wearable devices, allowing us to reject the null hypothesis of no association.

Contingency Tables ▼

	CareerStage		
CurrentRecommendation	Junior	Senior	Total
No	11	33	44
Yes	44	15	59
Total	55	48	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	24.893	1	< .001
N	103		

Table 5. Chi-square test in JASP for recommending wearables to patients with T2D

4.3.3. Previous and current use of wearable devices in clinical practice

The last question in the perception and understanding section asked about previous or current use of wearable devices in clinical practice, using a Yes/No scale. Out of 103 respondents, 54 answered “Yes”, indicating that the majority, 52.4%, have used or are using wearables in their clinical work. The remaining 47.6% with 49 answers responded “No” to current or previous use of wearables.

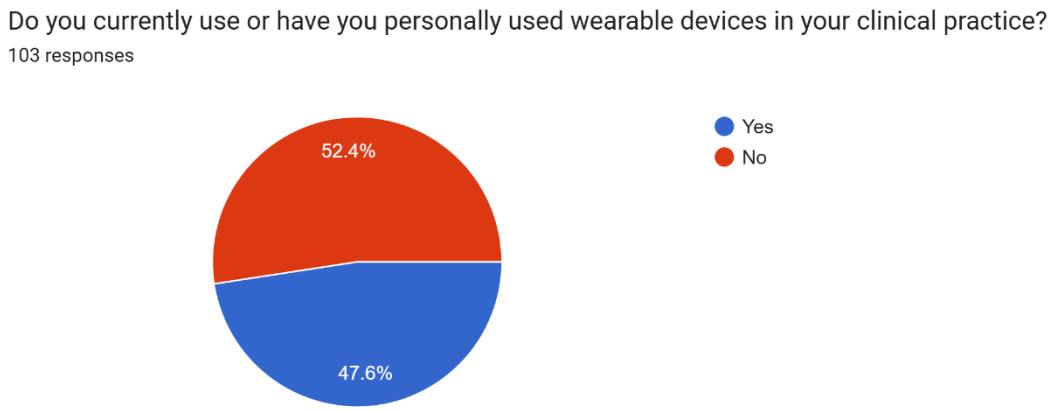

Figure 18. Previous and current use of wearables in clinical practice using Yes/No scale.

To further analyse and explore the comparison between groups, the data was segmented by responses based on career stage and years of experience.
The analysis showed that Junior professionals with 5-10 years of experience reported the highest level of wearable use, with 30 out of 40 respondents (75%) indicating current or past use. In contrast, senior professionals with more than 16 years of experience had the lowest reported use, with only 2 “Yes” responses for each category (16-20, More than 20), indicating any prior or current integration of wearables.
Among Junior respondents with less than 5 years of experience, the responses were nearly balanced (7 Yes, 8 No). Meanwhile, Senior professionals with 11-15 years showed a similar split (8 Yes, 15 No). This trend suggests a decline in wearable technology use with increasing experience.

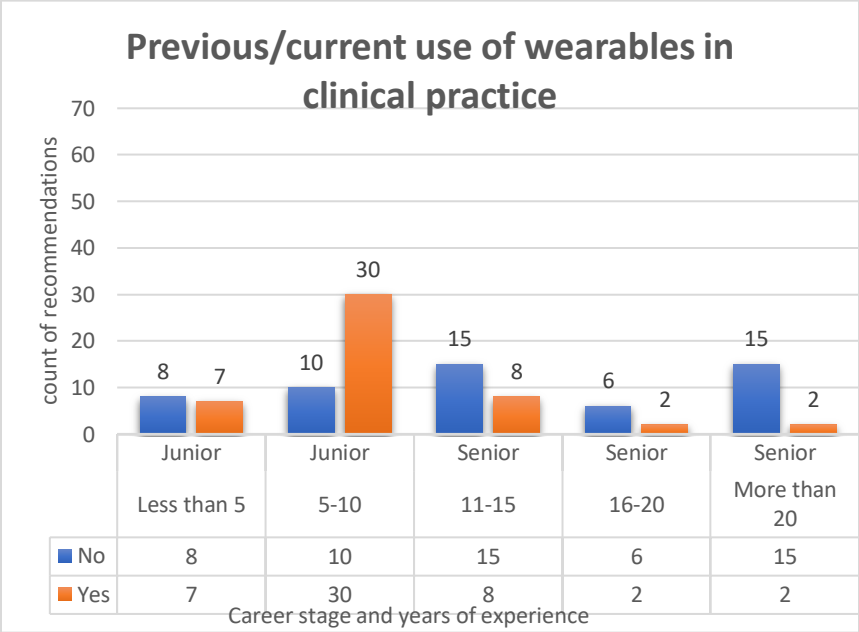

Figure 19. Distribution of responses divided by career stage and years of experience

A chi-square test was conducted to examine the relationship between years of experience and the reported use of wearable devices in clinical practice. This analysis aimed to assess whether experience level was associated with the likelihood of having previously or currently used wearable technology.
The contingency table supported the previous findings, showing that the observed data indicate that professionals with 5-10 years of experience reported the highest frequency of wearable use, whereas those with more than 20 years reported the lowest. Suggesting a possible association between years of experience and wearable adoption.
The chi-square test yielded a statistically significant result, with a x^2 of 23.952 with 4 degrees of freedom, and a p-value of <0.001, indicating that the distribution of wearable device usage is not independent of years of professional experience. In

other words, healthcare professionals' likelihood of using wearable devices in clinical settings significantly differs depending on their years of experience.

Contingency Tables ▼

	YearsExperience					
UseWearables	11-15	16-20	5-10	Less than 5	More than 20	Total
No	15	6	10	8	15	54
Yes	8	2	30	7	2	49
Total	23	8	40	15	17	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	23.952	4	< .001
N	103		

Table 6. Chi-square test of wearable usage in clinical practice between Junior and Senior healthcare professionals.

4.4 Perception of wearables and willingness for clinical integration

Moving on to the third section, which examines personal opinions about the use of wearable devices in clinical practice and professionals' willingness for potential future implementation.

4.4.1 Understanding the functionality of Wearable devices

The first question aimed to evaluate respondents' understanding of how wearable devices function in Type 2 Diabetes management. A five-point scale was used, ranging from Strongly Disagree to Strongly Agree. Before dividing the data into Junior and Senior groups, initial analysis showed that 55.33% of participants (57) answered "Agree" regarding their familiarity with how wearable devices operate for T2D management, followed by "Neutral" with 37 responses, representing 35.92%. "Disagree" was in third place with 7 responses (6.8%), and "Strongly Agree" received only 2 responses. Very noticeable, "Strongly Disagree" did not receive any responses.

The next chart presents the responses divided by career stage into Junior and Senior groups. The horizontal axis lists the levels of agreement, from "Strongly Agree" to "Disagree", while the vertical axis shows the number of respondents selecting each option.

Examining the results, junior professionals express more familiarity with the function of wearables. The vast majority of junior respondents (45) selected

“Agree”, only a small number of juniors reported neutrality (6), disagreement (3), or strong agreement (1), suggesting that the familiarity within this group is not only high but also relatively consistent.
In contrast, the pattern for senior professionals is notably different. While 12 seniors selected “Agree”, the largest cluster by far is in the “Neutral” category (31 seniors), showing hesitancy or uncertainty about their familiarity with how wearable devices work. Very few seniors choose “Disagree” (4), or “Strongly Agree” (1), indicating low levels of both strong familiarity and outright rejection.
This distribution suggests a generational divide in how the function of wearables is perceived and understood. Juniors overwhelmingly reported confidence and familiarity; meanwhile, senior professionals are more likely to remain neutral.

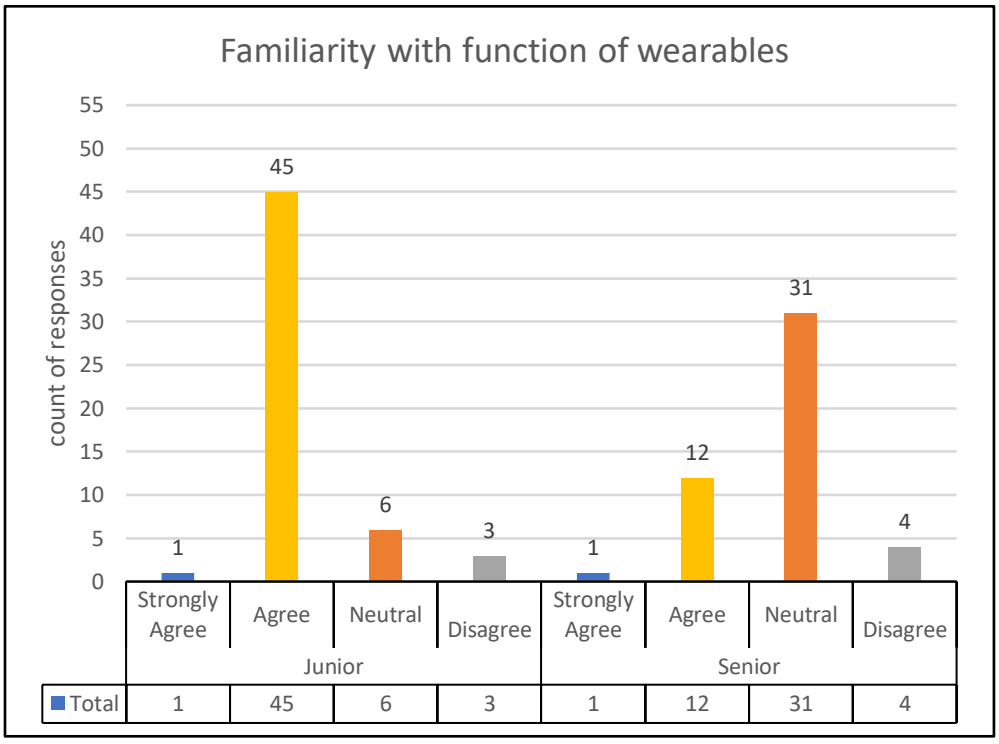

Figure 20. Familiarity with the functionality of wearable devices for T2D management in a five-point scale.

To determine whether there is a significant statistical difference in association between career stage and familiarity with wearables functionality, a chi-square test was performed. For software support, the categories were modified. “Strongly Agree” was labelled as 1, “Agree” was labelled as 2, “Neutral” as 3, and “Disagree” as 4.
The statistical analysis from the chi-square test confirmed that this difference between Juniors and Seniors is highly significant ($x^2 = 35.830$, df 3, p-value <0.001). According to data, this could suggest that a professional’s career stage is associated with how familiar they perceive themselves to be with how wearables work in T2D management. the data imply that junior professionals are not only

more likely to be familiar with the function of devices, but also more confident in their familiarity. In contrast, senior professionals tend to be less certain or more reserved in their responses.

Contingency Tables

	3ityFunction				
CareerStage	1	2	3	4	Total
Junior	1	45	6	3	55
Senior	1	12	31	4	48
Total	2	57	37	7	103

Note. Each cell displays the observed counts

Chi-Squared Tests ▼

	Value	df	p
X^2	35.830	3	< .001
N	103		

Table 7. Chi-square test for familiarity with wearable functionality divided by career stages. Category 1 corresponds to "Strongly Agree", 2 = "Agree", 3=" Neutral", and 4=" Disagree".

4.4.2 Perceived value in real-time data generated from wearable devices

Assessing perceptions of the potential value of data generated by these wearables. Healthcare professionals were asked: Wearable devices provide valuable real-time data for Type 2 Diabetes management? Initial descriptive statistics showed that the vast majority of respondents selected "Agree." With an overwhelming 48%, followed by "Neutral" with 41%, "Strongly Agree" and "Disagree" were closely matched, at 6% and 5%, respectively.

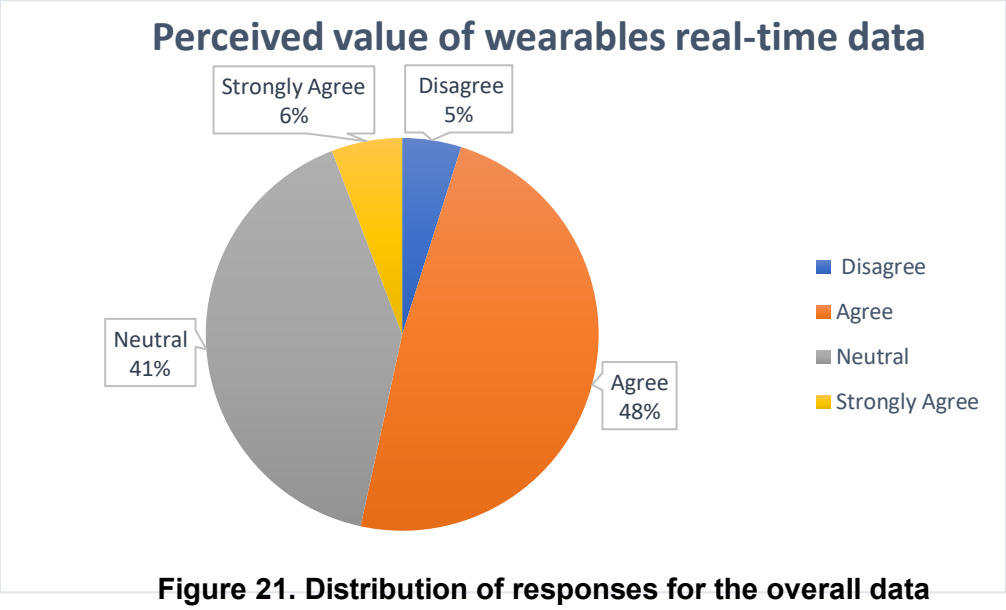

Figure 21. Distribution of responses for the overall data

To determine whether Junior and Senior healthcare professionals differ significantly in their perception, a group comparison analysis was performed. The data was divided into the groups of interest (Junior vs Senior). The chart showed a high agreement among junior professionals; 67.3% of junior professionals (37 out of 55) agreed and strongly agreed that wearable devices provide valuable real-time data. In contrast, only 39.6% of senior professionals (19 out of 48) expressed a form of agreement. This provided a marked difference in perception, with juniors more favourable overall. For Neutral responses, a significant proportion of senior professionals selected this category (24 respondents, 50%), compared to 32.7% of juniors (18 respondents). This could reflect uncertainty or less familiarity among senior professionals. As for the disagreement category, it was only observed among senior participants with 5 responses (10.4%). Non-junior selected "Disagree", further highlighting divergence in perception.

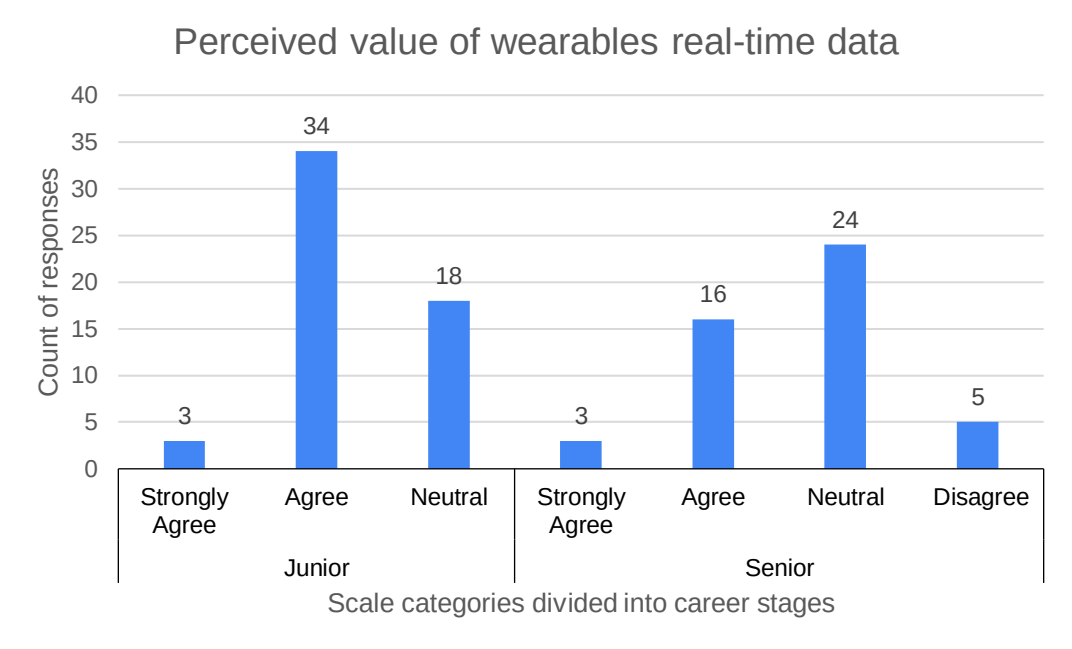

Figure 22. Perceived value of wearables generated data responses by career stages.

A chi-square test was conducted to examine the relationship between career stage (Junior vs. Senior) and perceptions of the benefit of wearable device data for T2D management. The test shows a $x^2 = 11.916$ with 3 degrees of freedom, and a P-value of 0.008. Since the P-value is less than 0.05, we reject the null hypothesis. This indicates a statistically significant difference in perception between Junior and Senior respondents regarding the benefit of real-time data from wearable devices.

RESPONSE	OBSERVED (JUNIOR)	EXPECTED (JUNIOR)	OBSERVED (SENIOR)	EXPECTED (SENIOR)
STRONGLY AGREE	3	3.2	3	2.8
AGREE	34	26.7	16	23.3
NEUTRAL	18	22.4	24	19.6
DISAGREE	0	2.7	5	2.3

Table 8. Observed vs. Expected values for usefulness of wearable data

Contingency Tables

	PerceivedBenefitData				
CareerStage	1	2	3	4	Total
Junior	3	34	18	0	55
Senior	3	16	24	5	48
Total	6	50	42	5	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	11.916	3	0.008
N	103		

Table 9. Chi-square test for the perceived benefit of wearables-generated data

Junior professionals were more likely than expected to “Agree” with the benefits and less likely to “Disagree”. On the other hand, Senior professionals showed more neutrality or disagreement than expected, suggesting comparatively lower enthusiasm or confidence. This analysis supports the central hypothesis that Junior professionals demonstrate a more favourable perception of wearable devices in managing type 2 diabetes (T2D).

4.4.3 Confidence in interpreting wearables-generated data

Following up with assessing the familiarity and confidence of healthcare professionals with the use of wearable devices. Participants were asked if they felt confident in their ability to interpret data generated by wearable health devices. Preliminary insights of the overall data shown that out of the 4 options (Strongly Agree, Agree, Neutral, Disagree), “Agree” was the most voted option with 50 responses and the 49%, “Neutral” came in second with 30 responses (29%), the rating considerably decrease with “Disagree” and “Strongly Agree” with 16 (15%) and 7 (7%) responses respectively. Similarly, as in the previous question, “Strongly Disagree” was not selected by any of the participants.

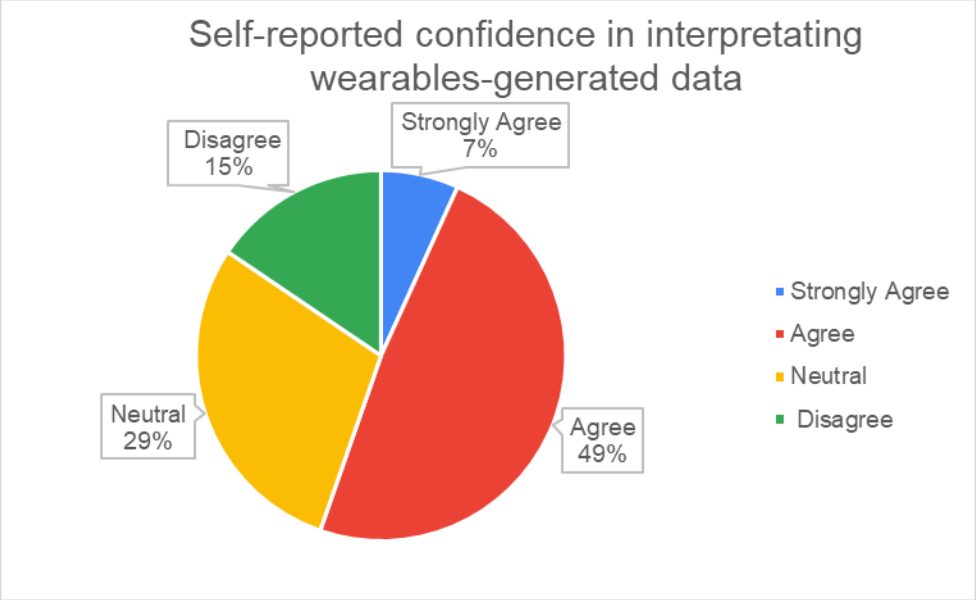

Figure 23. Percentage of responses to the overall dataset

To explore whether findings would differ when observing the data split by career stage, a comparative view of responses from Junior and Senior healthcare professionals was performed. The chart showed that among junior professionals, there is a clear trend toward higher self-reported confidence. The majority selected “Agree” (39), with an additional 4 selecting “Strongly Agree”, indicating that a significant proportion of this group feels capable of interpreting wearable-generated data. Only one respondent in the junior category expressed disagreement, and eleven remained neutral, suggesting that while not all are highly confident, most juniors lean positively toward self-reported competence in this area.
In contrast, responses from senior professionals reveal a more cautious attitude. While some indicated confidence, 3 selecting “Strongly Agree” and 11 selecting “Agree”, the largest share of senior respondents (19) reported a neutral stance. Moreover, a substantial portion (15) disagreed with the statement, signalling a notable degree of uncertainty or lack of confidence in interpreting wearable data among the senior professionals group.

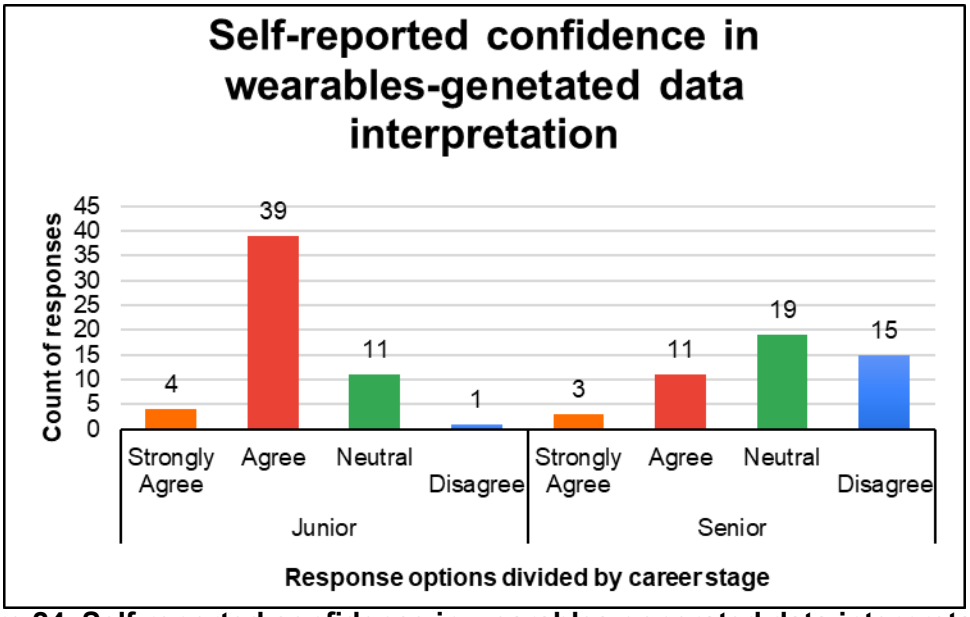

Figure 24. Self-reported confidence in wearables-generated data interpretation, divided by career stage.

A chi-square test was performed to determine whether there is a statistically significant association between healthcare professionals' career stage and their self-reported confidence in interpreting data generated by wearable devices. The results show a chi-square statistic of $x^2 = 29.868$ with 3 degrees of freedom and a p-value of <0.001. This p-value is well below the standard level of significance of 0.05, indicating that the observed differences in confidence levels between junior and senior healthcare professionals are statistically significant.
The statistically significant result supports the rejection of the null hypothesis and reinforces the central hypothesis that there is an association between career stage and confidence in interpreting wearable-generated data.

Contingency Tables

	ConfidenceInData				
CareerStage	1	2	3	4	Total
Junior	4	39	11	1	55
Senior	3	11	19	15	48
Total	7	50	30	16	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	29.868	3	< .001
N	103		

Table 10. Chi-square test for self-reported confidence in interpreting wearable-generated data.

RESPONSE	OBSERVED (JUNIOR)	EXPECTED (JUNIOR)	OBSERVED (SENIOR)	EXPECTED (SENIOR)
STRONGLY AGREE	4	3.74	3	3.26
AGREE	39	26.70	11	23.30
NEUTRAL	11	16.02	19	13.98
DISAGREE	1	8.54	15	7.46

Table 11. Observed vs. Expected values for self-reported confidence in interpreting wearables-generated data.

This comparison reveals that junior professionals reported higher-than-expected agreement (especially “Agree”), while senior professionals reported higher-than-expected disagreement and neutrality, helping explain the significant result from the chi-square test

4.4.4 Concerns over privacy and security of wearables-generated data

Following the previous analysis on the willingness to adopt wearable devices, the study further explored participants' perceptions regarding a critical aspect of digital health integration: concerns over the privacy and security of patient data generated by wearable devices.

The initial general analysis indicated that a substantial proportion of the healthcare professionals perceive this as a valid concern.

45% (46) of respondents agreed, and 23% (24) strongly agreed, meaning that a combined 68% of participants acknowledge significant concerns about data privacy and security related to wearable devices. Meanwhile, 26% (27) remained neutral,

suggesting a degree of uncertainty on the topic. Only a small minority of 6% in total (2% strongly disagree and 4% disagree) did not perceive privacy and security as significant concerns.

The data was again divided by career stage to assess whether junior and senior healthcare professionals differed in the extent of their perception regarding whether wearables present concerns over privacy and security of patients' data.
The distribution of responses shows that agreement with the statement was the most common response across both groups. Among junior professionals, 21 selected "Agree" and 13 chose "Strongly Agree", highlighting that a majority expressed concern about privacy and data protection. Similarly, among senior professionals, 25 responded with "Agree" and 11 with "Strongly Agree", confirming that concerns are also widely shared in this group. Neutral responses were also present, with 17 from juniors and 10 from seniors, indicating that a portion of participants remain uncertain or undecided on the issue. Disagreement was minimal, with only a small number in both groups selecting "Disagree" or "Strongly Disagree". The findings suggest that, irrespective of career stage, there is a broadly shared apprehension regarding the security and confidentiality of patient data when using wearable devices.

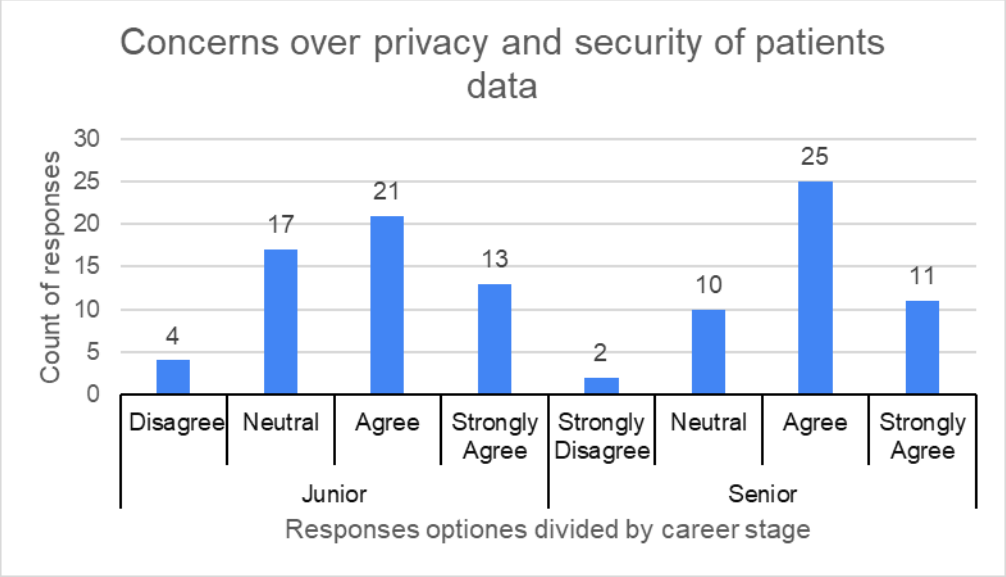

Figure 25. Privacy Concerns about Wearable Devices by Career Stage.

To statistically assess whether the observed differences were meaningful, a chi-square test of independence was performed. The test yielded a chi-square value of $x^2 = 7.890$, with 4 degrees of freedom, and a p-value of 0.096. Since the p-value exceeds the conventional level of significance of 0.05, the result is not statistically significant. These findings support the descriptive data that concern over patient data protection is a broadly shared issue among healthcare professionals, regardless of career stage.

Overall, while there were some small differences between observed and expected frequencies, particularly in the “Agree” and “Disagree” categories, these deviations did not reflect a statistically significant divergence between the junior and senior groups.

Contingency Tables ▼

	PerceivedConcernsInSecurity					
CareerStage	1	2	3	4	5	Total
Junior	13	21	17	4	0	55
Senior	11	25	10	0	2	48
Total	24	46	27	4	2	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	7.890	4	0.096
N	103		

Table 12. Chi-square test for concerns over privacy and security of patients’ data

RESPONSE	OBSERVED (JUNIOR)	EXPECTED (JUNIOR)	OBSERVED (SENIOR)	EXPECTED (SENIOR)
STRONGLY AGREE	13	12.81	11	11.18
AGREE	21	24.56	25	21.43
NEUTRAL	17	14.41	10	12.58
DISAGREE	4	2.13	0	1.86
STRONGLY DISAGREE	0	1.06	2	1.86

Table 13. Observed vs. Expected values for privacy concerns over patients’ data

4.4.5 Perception over Younger Healthcare Professionals

To finalise the section regarding perceptions and willingness to integrate wearable devices. The respondents were asked for their personal opinion on whether they agreed with the statement: “Younger healthcare professionals are generally more comfortable using new digital tools”. The purpose of this question was to capture shared perceptions regarding generational differences in digital literacy and readiness and to assess a directly relevant theme to the study’s hypothesis, comparing junior and senior practitioners.

Out of the 103 respondents, the majority expressed agreement with the statement, with 59 participants (57%) selecting “Agree”, 23 participants (22%) chose “Strongly Agree”, and 21 respondents (21%) remained “Neutral”. Notably, no respondents disagreed with the statement.
Following initial descriptive analysis, the data was disaggregated by Junior and Senior, to assess whether perceptions varied between groups and to examine the consistency of responses in relation to the central hypothesis.
Among the junior professionals, the majority selected “Agree” (33 respondents), while 8 selected “Strongly Agree” and 14 selected “Neutral”. This may suggest that most junior participants acknowledge a generational comfort gap, even when it reflects on their own peer group, suggesting self-awareness in their professional environment.
Among senior participants, responses similarly indicated strong agreement with the statement, but with a slightly different distribution: 15 respondents selected “Strongly Agree”, 26 selected “Agree, and only 7 selected “Neutral”. Compared to juniors, a higher proportion of seniors expressed strong agreement, indicating a more definitive perception of younger colleagues being more digitally inclined.

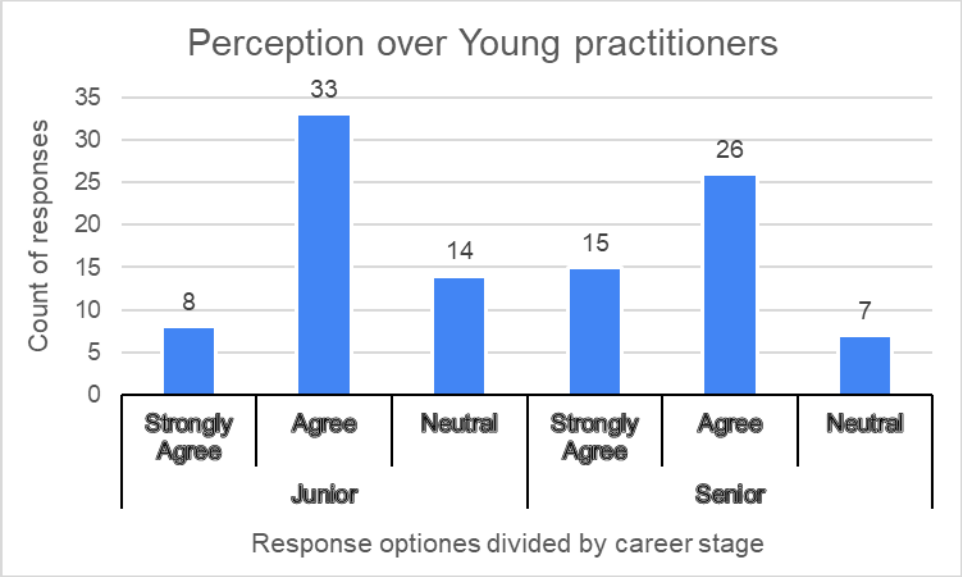

Figure 26. Perceptions over Younger Healthcare Professionals by Career Stage

A chi-square test was conducted to assess whether there was a statistically significant association between career stage and perception over the statement: “Younger healthcare professionals are generally more comfortable using new digital health tools.”
The observed results indicated slightly different distributions between junior and senior professionals. For instance, a greater proportion of junior participants selected “Agree”, while seniors had a higher portion in the “Strongly Agree” category.

However, with an x^2 value of 4.841 with 2 degrees of freedom and a p-value of 0.089, which is greater than the conventional significance threshold of 0.05, the result is not statistically significant. This means we fail to reject the null hypothesis and conclude that the difference in perception between junior and senior professionals is not strong enough to be considered statistically relevant for this statement.
Overall, both groups largely agree that younger practitioners are more comfortable with digital tools. The fact that senior respondents were more likely to "Strongly Agree" reinforces the notion that this perception is not only shared across career stages but is particularly more recognized by more experienced professionals.

Contingency Tables

	PerceptionYoung			
CareerStage	1	2	3	Total
Junior	8	33	14	55
Senior	15	26	7	48
Total	23	59	21	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	4.841	2	0.089
N	103		

Table 14. Chi-square test for Perceptions over Younger Practitioners

RESPONSE	OBSERVED (JUNIOR)	EXPECTED (JUNIOR)	OBSERVED (SENIOR)	EXPECTED (SENIOR)
STRONGLY AGREE	8	12.28	15	10.72
AGREE	33	31.50	26	27.50
NEUTRAL	14	11.21	7	9.79

Table 15. Observed vs. Expected Values for Perceptions over Younger Practitioners

4.4.6 Perceptions over Older Healthcare professionals

Continuing on the previous analysis, the study also explored the complementary perspective on older professionals. The participants were asked the statement: "Older healthcare professionals tend to rely more on traditional methods than on digital technologies". This question aimed to provide a broader understanding of generational dynamics in the adoption of clinical technology and how these perceptions may influence overall attitudes toward digital integration. Based on the

overall data from 103 respondents, the results show a modest consensus leaning toward agreement with this perception.
The majority of participants, 48 respondents (46%), agreed with the statement, while 44 respondents (43%) remained neutral, indicating a significant portion of the sample was either uncertain or chose not to take a definitive stance. A smaller proportion, 6 respondents (6%), strongly agreed, suggesting a minority held stronger views on the topic. On the other end of the scale, only 4 participants (4%) disagreed, and just 1 respondent (1%) strongly disagreed.
Following the analysis pattern, the responses were separated by career stage to explore how junior and senior healthcare professionals perceive the reliance of older practitioners on traditional versus digital methods, and to observe any potential difference between groups.
Among junior respondents, the majority agreed with the statement that older practitioners tend to rely more on traditional methods, with 27 selecting “Agree” and 23 responding “Neutral”. Only 3 strongly agreed, and very few disagreed, just one each for “Disagree” and “Strongly Disagree”. This suggests a moderate to strong perception among juniors that older practitioners are less inclined toward digital adoption.
Senior professionals showed a slightly different distribution, with responses more evenly split between “Agree” (21) and “Neutral” (21), suggesting a more balanced or cautious view. Only 3 selected “Strongly Agree”, and 3 “Disagree”. This symmetry is that senior professionals may acknowledge the reliance on traditional methods among older peers but are perhaps more reserved in their judgments.

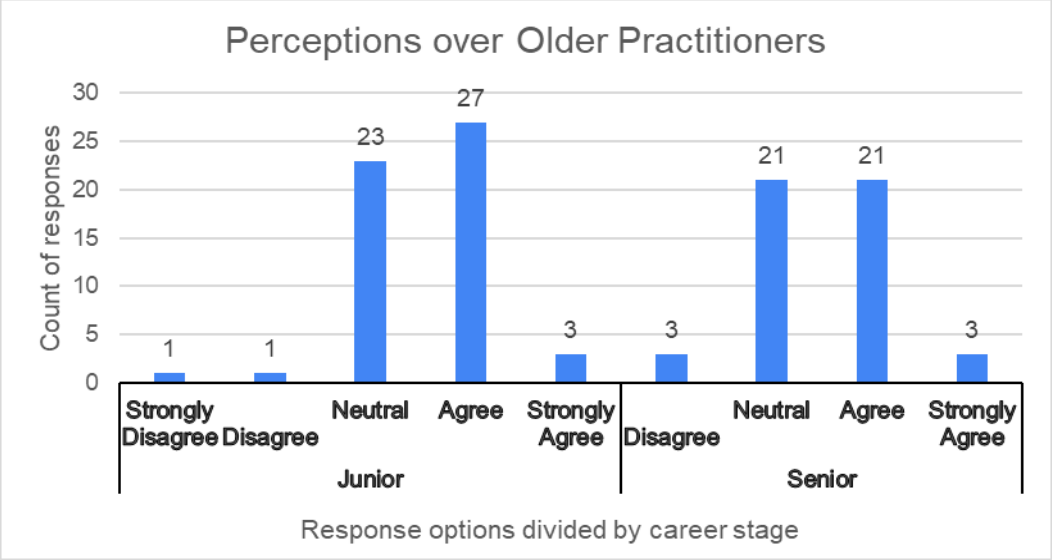

Figure 27. Perceptions over Older Healthcare Professionals by Career Stage

To examine whether there is a statistically significant association between career stage (junior vs. senior) and perceptions about older practitioners’ reliance on traditional methods, a chi-square test of independence was performed.
With an x^2 value of 2.376, 4 degrees of freedom, and a p-value of 0.667, since the p-value is well above the conventional significance level of 0.05, the null

hypothesis is rejected. This means there is no statistically significant association between career stage and perception about older professionals relying more on traditional methods than on digital technologies. Observing very similar patterns between the two groups.
The expected frequencies were close to the observed ones across all response categories, which further supports that any variation is likely due to random chance rather than a true difference between the groups.

Contingency Tables

	PerceptionOlder					
CareerStage	1	2	3	4	5	Total
Junior	3	27	23	1	1	55
Senior	3	21	21	3	0	48
Total	6	48	44	4	1	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	2.376	4	0.667
N	103		

Table 16. Chi-square test for Perceptions over Older Practitioners

RESPONSE	OBSERVED (JUNIOR)	EXPECTED (JUNIOR)	OBSERVED (SENIOR)	EXPECTED (SENIOR)
STRONGLY AGREE	3	3.07	3	2.93
AGREE	27	24.87	21	23.13
NEUTRAL	23	22.11	21	21.89
DISAGREE	1	2.90	3	1.10
STRONGLY DISAGREE	1	1.07	0	0.93

Table 17. Observed vs. Expected values for Perceptions over Older Practitioners

4.5 Readiness in wearable devices adoption

To address one of the key objectives in the study regarding professionals' readiness to integrate wearable health technology into their practice.

4.5.1 Primordial factors to integrate wearable technology into clinical practice.

For the first question in this section. participants were requested to rank several factors in order of importance that would increase their willingness to incorporate these tools into their professional practice, on a scale from “Most Important” to “Least Important”. This ranking aimed to highlight priority areas that would enhance the integration of wearables technologies into professional workflows. For analysis purposes, the data was divided into two charts for better visualisation.

The initial descriptive analytics for the overall data indicated that “Demonstrated clinical effectiveness of wearables” emerged as the most highly valued factor, with 37 respondents ranking it as “Most Important” and an additional 20 as “Important”. This was followed closely by “Affordability and insurance coverage for patients”, which received 36 votes for “Most Important” and 37 for “Significant”.

“More training and education about wearables” also received considerable emphasis, though responses were more varied. While 15 respondents selected it as “Most Important” and 22 as “Important”, a significant portion (32) rated it as “Neutral”.

“Institutional support and Infrastructure” were predominantly marked as “Important” (27 responses) and “Significant” (25 responses), though fewer participants identified it as the highest priority (6 for “Most Important).

“Better data privacy and security” yielded a more mixed response pattern. Although 18 respondents rated it as “Neutral”, a notable portion considered it less influential, with 34 selecting “No so Important” and 20 choosing “Least Important”. Only 3 respondents viewed it as “Most Important”.

In contrast, “Availability of technical support” was consistently ranked lower. It received the highest count (68 responses) for “Least Important”, with minimal selection in the top categories (6 for “Most Important” and 1 for “Important”).

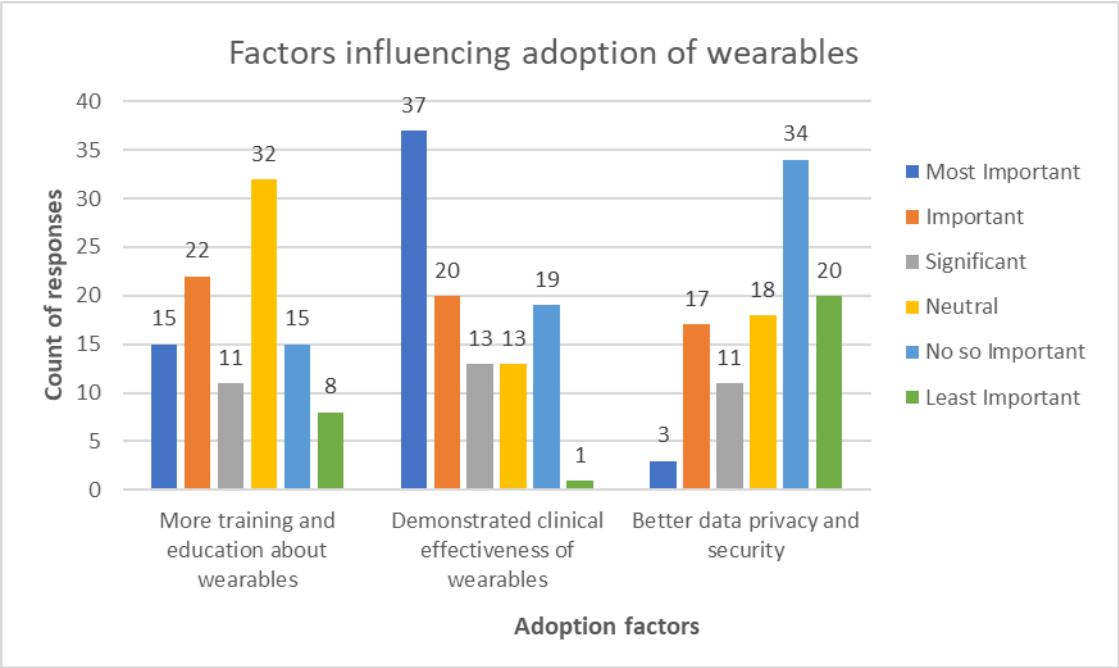

Figure 28. Ranked importance of factors influencing adoption of wearable devices in clinical practice (Chart 1).

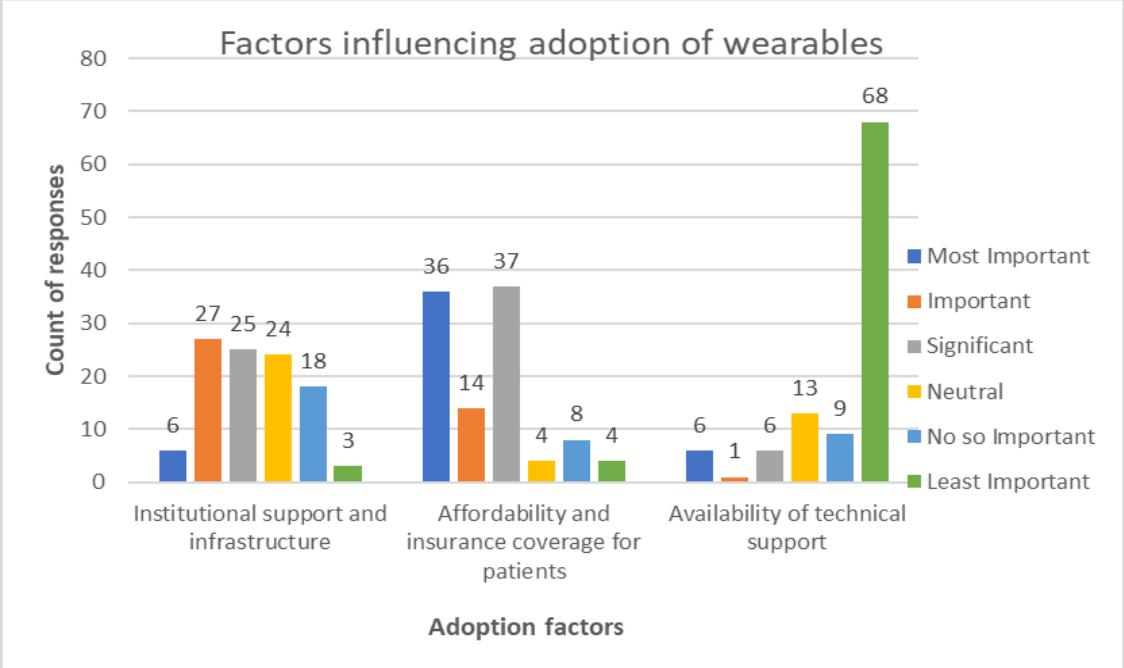

Figure 29. Ranked importance of factors influencing adoption of wearable devices in clinical practice (Chart 2).

The data were disaggregated to continue with the exploration of both groups (Junior vs. Senior), which allowed for a more nuanced understanding of the specific factors each group considers most influential in their willingness to adopt such tools in clinical practice.

Among junior participants, “Demonstrated clinical effectiveness of wearables” emerged as the most highly valued factor. It received 19 responses as “Most Important” and 13 as “Important”, indicating that clear, evidence-based outcomes are a key driver of acceptance among early-career professionals. A similar pattern was observed for “Affordability and insurance coverage for patients”, which garnered 20 “Most Important” and 22 “Significant” responses. This highlights a strong emphasis on patient accessibility and the economic viability of integrating these tools into routine care. “Institutional support and infrastructure” also featured prominently, though with a slightly more moderate distribution. While only 3 respondents rated it as “Most Important”, 22 selected “Important”, and 10 marked “Significant”, indicating that structural and organizational support is recognised as a vital enabler, even if not the foremost concern. The importance of “Training and education” was relatively balanced across the scale. 10 participants considered as “Most Important”, with another 11 selecting “Important” and a further 14 choosing “Neutral”. In contrast, “Better data privacy and security” was ranked lower in perceived importance. Only 1 participant identified it as “Most Important”, whereas 25 chose “No so Important” and 14 selected “Least Important”.

Lastly, “Availability of technical support” appears to be the least prioritised consideration overall. While a few respondents recognised it as “Important“ or “Significant”, a notable 33 participants selected “Least Important”, indicating that juniors may assume a basic level of digital fluency or feel confident navigating technical issues without professional support.

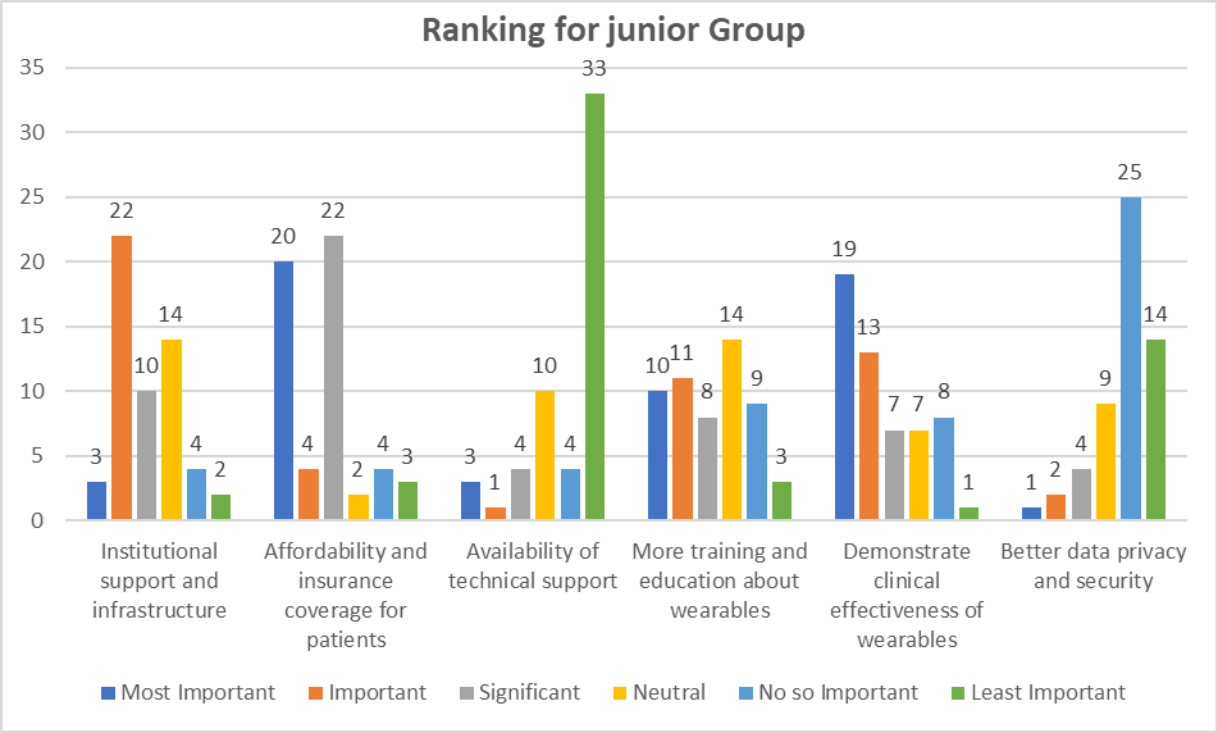

Figure 30. Ranked importance of factors influencing adoption of wearable devices in clinical practice for Junior participants

The findings for the Senior cohort showed that among this group, “Demonstrate clinical effectiveness of wearables” was the most dominant factor, with 18 participants ranking it as “Most Important” and 7 as “Important”. These findings align with the expectations that more experienced professionals rely heavily on robust clinical evidence before integrating new tools into practice.
“Affordability and insurance coverage for patients” also ranked highly, with 16 “Most Important” and 10 “Important” responses; Similarly mirroring findings seen in the Junior group.
In contrast, “Institutional support and infrastructure” drew a wider distribution of opinions. Although 3 participants ranked it as “Most Important”, a notable 15 selected “Significant” and 10 chose “Neutral”, reflecting mixed views on whether organisational readiness is a primary enabler or simply a secondary consideration.
Responses around “More training and education about wearables” were more varied. Only 5 respondents rated it as “Most Important”, but 11 marked it as “Important” and 18 as “Neutral”. While there is awareness of the role of training in successful adoption, Senior professionals may not view it as critically as Juniors.
When examining “Better data privacy and security,” senior professionals appeared more cautious compared to their junior counterparts. A combined 17 participants marked it as either “Most Important” or “Important”, and only 6 chose “Least Important”. Lastly, “Availability of technical support” was ranked very low in importance, with 35 participants selecting it as “Least Important”.
These findings suggest a more cautious and evidence-based stance, particularly in terms of data protection, while placing relatively less importance on training and technical infrastructure compared to junior professionals.

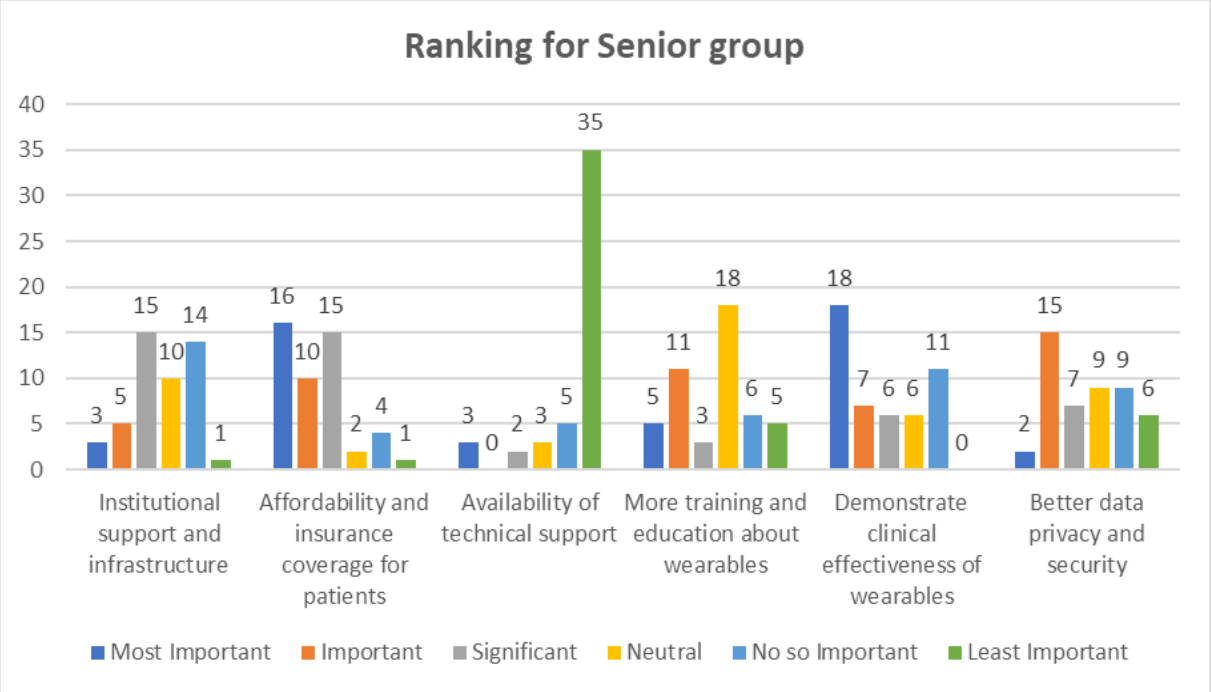

Figure 31. Ranked importance of factors influencing adoption of wearable devices in clinical practice for Senior participants

To assess whether the prioritisation of adoption factors differed significantly between junior and senior healthcare professionals, a chi-square test of independence was conducted for each of the six factors.
For analysis purposes, the responses were ranked on a six-point scale, where 6= Most Important, 5= Important, 4= Significant, 3= Neutral, 2= No so Important, and 1= Least Important.
For “More training and education about wearables”, the chi-square test produced the following results: x^2 value of 5.087 with 5 degrees of freedom and a p-value of 0.405.
Since the p-value exceeds the conventional significance level of 0.05, the null hypothesis is not rejected, meaning that career stage does not have a statistically significant effect on how participants ranked the importance of training and education for wearable adoption. Both junior and senior healthcare professionals showed broadly similar perceptions: they recognise training as relevant, but not universally as the top priority compared to other factors.

Contingency Tables ▼

	[More training and education about wearables]						
CareerStage	5	4	6	3	2	1	Total
Junior	11	8	10	14	9	3	55
Senior	11	3	5	18	6	5	48
Total	22	11	15	32	15	8	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	5.087	5	.405
N	103		

Table 18. Chi-square test for “More training and education about wearables”

The next factor examined was “Demonstrated clinical effectiveness of wearables”; the analysis showed a x^2 of 2.993 with 5 degrees of freedom and a p-value of 0.701. Given the high p-value, we reject the null hypothesis, meaning that, as with training and education, there is not a statistically significant difference between the groups for this category. As previous charts suggest, both junior and senior participants consistently view clinical evidence as a primary enabler for integrating wearables into Type 2 Diabetes care.

Contingency Tables

	[Demonstrated clinical effectiveness of wearabl						
CareerStage	4	5	3	2	6	1	Total
Junior	7	13	7	8	19	1	55
Senior	6	7	6	11	18	0	48
Total	13	20	13	19	37	1	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	2.993	5	.701
N	103		

Table 19. Chi-square test for “More training and education about wearables”

The findings for the category “Better data privacy and security” showed a difference compared to the previous categories. With an x^2 of 21.45 with 5 degrees of freedom and a p-value of < 0.001, and given the p-value is below the conventional significance level of 0.05, the test reveals a statistically significant difference in how junior and senior respondents perceive the importance of data privacy and security. Senior professionals consistently rated privacy as a more critical enabler or barrier than their junior counterparts.

	[Better data privacy and security]						
CareerStage	3	2	1	6	5	4	Total
Junior	9	25	14	1	2	4	55
Senior	9	9	6	2	15	7	48
Total	18	34	20	3	17	11	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	21.45	5	< .001
N	103		

Table 20. Chi-square test for “Better data privacy and security”

Similarly, the factor of “Institutional support and infrastructure” revealed clear divergence between groups. Junior professionals concentrated responses in the “Important” category, senior professionals, however, distributed responses more evenly across “Significant”, “Neutral”, and “No so Important”, with fewer rating it as outright “Important”.
The chi-square test indicated a statistically significant difference, with an x^2 of 17.87, 5 degrees of freedom, and a p-value of 0.003. This suggests that career stage plays a role in shaping perceptions of institutional support: juniors tend to prioritise it as a key requirement, whereas seniors consider it relevant but weigh it less heavily compared to other factors.

	[Institutional support and infrastructure]						
CareerStage	2	6	4	5	1	3	Total
Junior	4	3	10	22	2	14	55
Senior	14	3	15	5	1	10	48
Total	18	6	25	27	3	24	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	17.87	5	.003
N	103		

Table 21. Chi-square test for “Institutional support and infrastructure”

“Affordability and insurance coverage for patients,” as observed in the charts, showed a more even distribution between groups, both predominantly choosing between the “Most Important”, “Important”, and “Significant” categories. This was further highlighted with the results for the chi-square test: $x^2 = 4.887$, 5 degrees of freedom, and p-value 0.430. This indicated a non-statistically significant difference between junior and senior respondents. Suggesting that both groups broadly recognise affordability and insurance coverage as a central enabler of wearable adoption, reflecting a strong consensus on the importance of economic accessibility for patients.

	[Affordability and insurance coverage for patie						
CareerStage	6	1	5	2	3	4	Total
Junior	20	3	4	4	2	22	55
Senior	16	1	10	4	2	15	48
Total	36	4	14	8	4	37	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	4.887	5	.430
N	103		

Table 22. Chi-square test for "Affordability and insurance coverage for patients"

And lastly, the findings for "Availability of technical support" showed that both groups consistently ranked this factor as a lower priority. Juniors mostly responded with "Least Important," and seniors displayed a similar pattern, with "Least Important" being dominant. The chi-square test indicated no significant difference between the groups (x^2=5.154, 5 df, p-value=0.430). These findings suggest that, regardless of career stage, healthcare professionals generally do not see technical support as a key factor compared to affordability or clinical evidence.

	[Availability of technical support]						
CareerStage	1	3	6	5	4	2	Total
Junior	33	10	3	1	4	4	55
Senior	35	3	3	0	2	5	48
Total	68	13	6	1	6	9	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	5.154	5	.397
N	103		

Table 23. Chi-square test for "Availability of technical support"

Overall, these findings suggest that while there are shared priorities across career stages, such as the importance of clinical evidence and affordability, differences in emphasis, particularly regarding institutional reliance and data security, should be considered in tailoring adoption strategies.

4.5.2 Readiness to receive training

To evaluate healthcare professionals' readiness to further develop their knowledge, participants were asked whether they were willing to receive training on wearable devices for diabetes management. This question provides insight into the willingness and readiness of the workforce to engage with technological tools through upskilling efforts.

The results indicated a strong overall inclination toward training, with 41% of respondents selecting "Agree" and 19% selecting "Strongly Agree". Additionally, 38% of participants responded "Neutral", implying that while they are not opposed, they may require more information about the nature or benefit of such training programs. Only 2% expressed disagreement, selecting "Disagree", showing minimal resistance to the idea of training. None of the participants selected the "Strongly Disagree" option.

Following the overall analysis of training willingness, the data were further disaggregated by career stage to explore whether differences exist between junior and senior professionals in their openness to receiving training on wearable devices for diabetes management.

Among junior respondents, a clear majority expressed positive attitudes toward training, with 24 selecting "Agree" and 14 selecting "Strongly Agree", totalling 38 out of 55 respondents (69%) in favour. An additional 16 respondents selected "Neutral", while only 1 expressed disagreement. This distribution reflects a strong willingness among the junior healthcare participants to enhance their skills in wearable health technology through formal instruction.

On the other hand, senior professionals demonstrated slightly more varied responses. While 18 respondents selected "Agree" and 6 selected "Strongly Agree", totalling 50% with a positive orientation, a relatively large portion (23 respondents) chose "Neutral". Similarly, with the junior cohort, only 1 senior respondent selected "Disagree". This comparison reveals that although both groups show a willingness to receive training, junior participants exhibit a more decisive stance, whereas seniors' respondents showed more hesitation, with nearly half undecided.

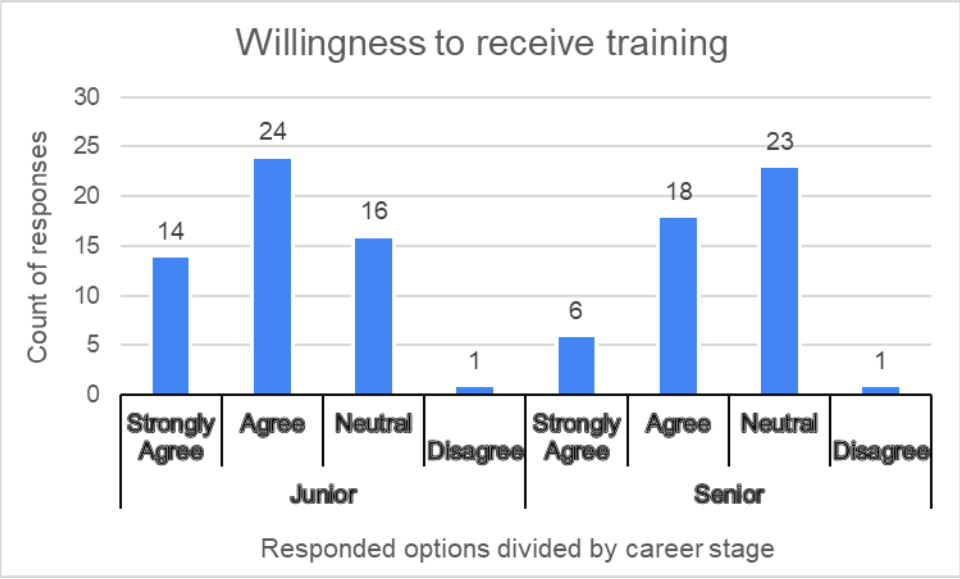

Figure 32. Willingness to receive training in Wearable Devices by Career Stage

To explore whether there were significant differences between the junior and senior respondents, a chi-square test of independence was performed. This analysis aimed to determine whether the variation in responses across the two groups was statistically significant.
The chi-square test yielded a x^2 value of 4.860 with 3 degrees of freedom and a p-value of 0.182. Since the p-value is greater than the standard significance level of 0.05, the null hypothesis is not rejected. This suggests that the differences in willingness to receive training between junior and senior professionals are not statistically significant.
The expected frequencies aligned closely with the observed data, indicating that the distribution of responses across groups does not differ more than what would be expected by chance. Therefore, both junior and senior professionals show comparable willingness to train on wearable devices.

Contingency Tables

	TrainingWillingness				
CareerStage	1	2	3	4	Total
Junior	14	24	16	1	55
Senior	6	18	23	1	48
Total	20	42	39	2	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	4.860	3	0.182
N	103		

Table 24. Chi-square test for willingness to receive training in wearables

RESPONSE	OBSERVED (JUNIOR)	EXPECTED (JUNIOR)	OBSERVED (SENIOR)	EXPECTED (SENIOR)
STRONGLY AGREE	14	10.67	6	9.32
AGREE	24	22.42	18	19.57
NEUTRAL	16	20.82	23	18.17
DISAGREE	1	1.06	1	0.93

Table 25. Observed vs. Expected values for willingness to training in wearables.

4.5.3 Readiness in adopting wearable devices into clinical practice

To explore and gain deeper insights into healthcare professionals' willingness to potentially integrate wearable devices into their clinical routine, the participants were asked how open they were to adopting wearable health technologies as part of their professional practice in the future. Employing a Likert-scale with 5 different options, going from Strongly Disagree to Strongly Agree. The overall responses to the statement reflected a predominantly positive attitude among the respondents. Out of the 103 participants, 51 (50%) indicated agreement ("Agree") and an additional 24% expressed strong agreement ("Strongly Agree"). Meanwhile, 26% of respondents chose a neutral position, indicating a certain percentage of caution and probable uncertainty. Notably, no participants expressed disagreement, either in the form of "Disagree" or "Strongly Disagree", which further reinforces the generally favourable perception of wearable device adoption.

For further analysis and to discover if there were notable differences between the groups (Junior vs. Senior), the dataset was divided according to career stage. As illustrated in the chart below, among junior professionals, the majority expressed strong openness, with 20 respondents selecting "Strongly Agree" and 27 selecting "Agree." Together, these account for 47 out of 55 junior participants, indicating a high level of willingness in this group. Only 8 junior respondents remained neutral, and none expressed disagreement.

In contrast, the "Senior" group displayed slightly more reserved attitudes. While a significant portion (24 out of 48) still selected "Agree", only 5 respondents chose "Strongly Agree". Notably, 19 senior professionals selected the "Neutral" option, suggesting a more cautious or undecided stance compared to their junior counterparts. Interestingly, as their junior peers, none selected either "Disagree" or "Strongly Disagree"

Overall, the distribution reflected a trend: Junior professionals demonstrate a greater enthusiasm and willingness to integrate wearable technology into their clinical practice, while senior professionals are more measured, with a notable proportion remaining neutral.

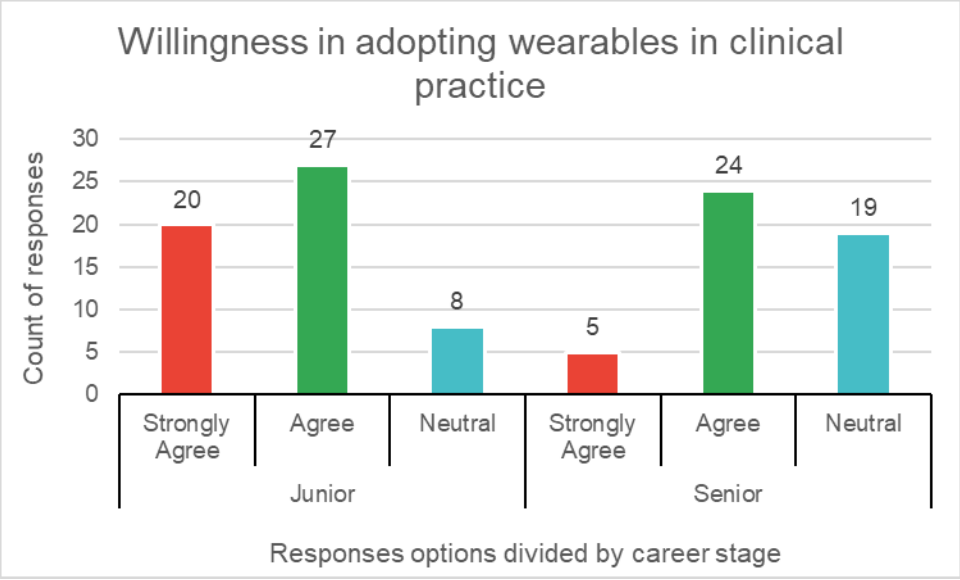

Figure 33. Willingness to adopt wearables technology divided by career stage

A chi-square test of independence was conducted to examine the relationship between career stage (junior vs. senior healthcare professionals) and willingness to adopt wearable devices in clinical practice. The results indicated a statistically significant association between the two variables, $\chi^2 = 13.24$, 2 degrees of freedom, and a p-value of 0.001.
This p-value is significantly lower than the conventional level of significance of 0.05, leading to the rejection of the null hypothesis. The findings suggest that career stage influences respondents' willingness to adopt wearable technologies. Concretely, junior healthcare participants appear more inclined toward adopting these devices compared to their senior counterparts, as reflected in higher proportions of "Strongly Agree" and "Agree" responses within this group. Notably, more junior professionals selected "Strongly Agree" than expected, suggesting. Conversely, senior professionals showed a higher-than-expected rate of "Neutral" responses. These deviations from expected values highlight meaningful differences in willingness between the two career stages.

Contingency Tables ▼

	PerceptionInAdoption			
CareerStage	1	2	3	Total
Junior	20	27	8	55
Senior	5	24	19	48
Total	25	51	27	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	13.243	2	0.001
N	103		

Table 26. Chi-square test for generational comparison of willingness to adopt wearables performed

RESPONSE	OBSERVED (JUNIOR)	EXPECTED (JUNIOR)	OBSERVED (SENIOR)	EXPECTED (SENIOR)
STRONGLY AGREE	20	13.35	5	11.65
AGREE	27	27.27	24	23.73
NEUTRAL	8	14.39	19	12.61

Table 27. Observed vs. Expected values for willingness to integrate wearables in clinical practice.

4.6 Key enablers and challenges in integrating wearable devices in Mexico

The last section of the survey focused on addressing the key enablers and challenges perceived by healthcare professionals regarding the integration of wearable devices within the Mexican healthcare system.

4.6.1 Cost of wearables influencing acquisition for patients

The first question aimed to explore healthcare professionals' agreement or disagreement regarding the cost of wearable devices and whether they consider this a major barrier for patients. Out of the 103 respondents, the vast majority indicated agreement with the statement. Specifically, 56% (58) selected "Strongly Agree", while an additional 33% (34) chose "Agree". A much smaller proportion expressed neutrality or disagreement. Only 7% (7) indicated a "Neutral" stance, while minimal disagreement was observed, with just 2% (2) selecting "Disagree" and another 2% (2) choosing "Strongly Disagree".

When the data were disaggregated by career stage, some notable differences in emphasis emerged. Among junior participants, responses were distributed between "Strongly Agree" (24) and "Agree" (24), with a small minority selecting "Neutral" (3). Only four participants disagreed with the statement, 2 selecting "Disagree" and the other 2 choosing "Strongly Disagree". This indicates that while most juniors perceive cost as a barrier, their responses show a slightly more balanced split between strong and moderate agreement.

In contrast, senior respondents expressed a stronger overall consensus. A majority of seniors selected "Strongly Agree" (34), with fewer choosing "Agree" (10) or "Neutral" (4). No senior respondents disagreed with the statement. This suggests that senior professionals perceive cost as an even more critical barrier, with a greater tendency to select the highest level of agreement.

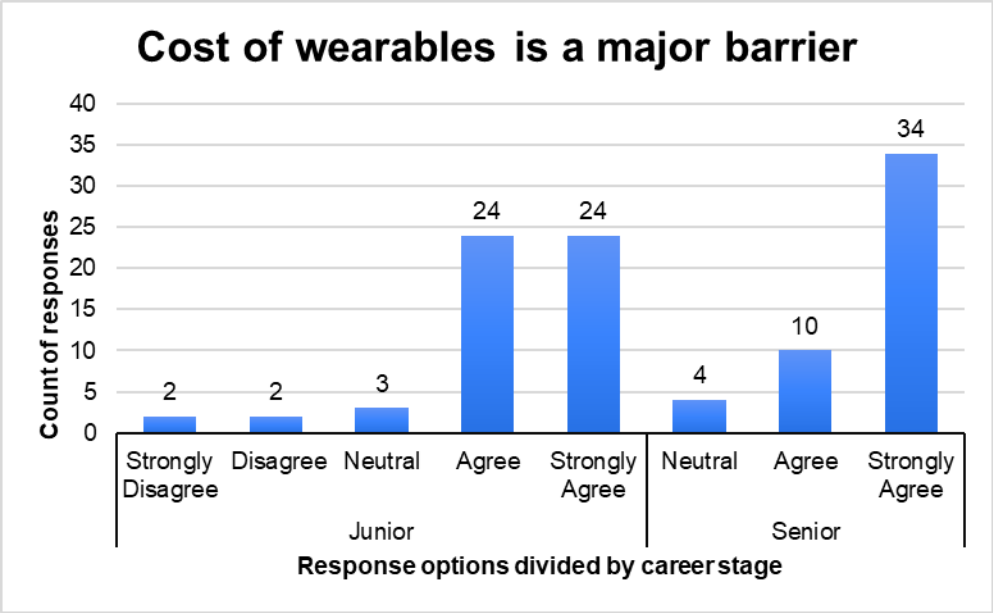

Figure 34. Cost as a Key Barrier to Patient Acquisition.

To test whether there was a significant association between career stage and perceptions of cost as a barrier to wearable adoption, a chi-square test of independence was performed.
The results showed:

- x^2= 11.21
- df= 4
- p-value= 0.024

because the p-value is below the conventional threshold of 0.05, the result indicates a statistically significant difference between junior and senior professionals in how they perceive cost as a barrier.
The distribution of responses showed that while both groups overwhelmingly agreed that cost was a barrier, the strength of agreement varied. Senior professionals were far more likely to select “Strongly Agree”, reflecting a stronger consensus that cost is a decisive barrier for patients. In contrast, junior professionals were more evenly split between “Agree” and “Strongly Agree,” besides the fact that they were the only group to show, though very small, disagreement with the statement. The test confirms that while cost is widely seen as a barrier by both groups, seniors view it with greater urgency and unanimity.

	PerceivedBarriersCost					
CareerStage	2	1	3	5	4	Total
Junior	24	24	3	2	2	55
Senior	10	34	4	0	0	48
Total	34	58	7	2	2	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	11.21	4	.024
N	103		

Table 28. Chi-square test for cost as a key barrier.

4.6.2 Biggest challenges for wearable integration in clinical settings

Following the theme for key challenges, for the next question, participants were asked to select out of six options (Device price, lack of training, doubts about accuracy, concerns about patients’ data privacy, changes in workflow, and not enough support from institutions) the perceived 3 main challenges to the adoption of wearables. Both junior and senior healthcare professionals consistently highlighted “Device price” as the most pressing barrier. Among juniors, 76.4% selected price, closely matched by 75% of seniors, underlining a broad consensus

that affordability remains the dominant challenge across career stages as seen in previous findings.
Beyond cost, differences between groups become more evident. Junior participants placed greater emphasis on lack of training (50.9%) and doubts about accuracy (63.6%), compared to 31.3% and 41.7% of seniors, respectively. This suggests that juniors are more concerned with their readiness and the clinical reliability of wearables. In contrast, seniors were more likely to emphasise not enough institutional support (50%), compared to 40% of juniors, reflecting the importance of organisational support for those with greater professional experience in clinical systems.
Other challenges, like concerns about patients' data privacy (32.7% for juniors; 29.2% for seniors) and changes in workflow (45.5% for juniors; 41.7% for seniors), showed relatively similar levels of concern across both groups, suggesting that these issues are broadly acknowledged regardless of career stage.

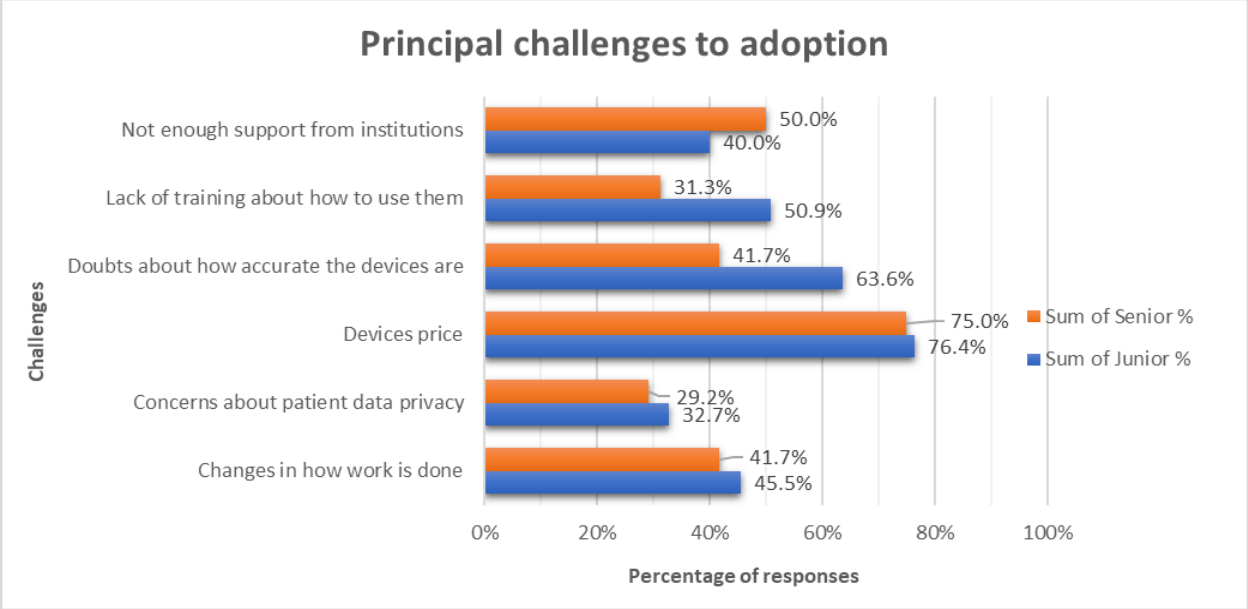

Figure 35. Principal challenges for wearables integration in clinical practice.

To further explore potential differences in perceived challenges to wearable devices adoption between the groups (Senior vs. Junior), a series of chi-square tests of independence were conducted for each of the six identified challenges.

The results indicated that only one challenge demonstrated a statistically significant difference between the two groups. This was "Doubts about how accurate the devices are." Juniors selected this option substantially more often than seniors (63.6% vs. 41.7%), $\chi^2 = 4.128$, df = 1, p-value = 0.042. This suggests that accuracy concerns are more prominent among junior healthcare professionals compared to their senior counterparts.

A second challenge, “Lack of training about how to use them”, approached statistical difference with a p-value of 0.069, with juniors again reporting this challenge more frequently (50.9% vs. 31.3%). While this does not meet the conventional level of significance (0.05), it may still indicate a meaningful trend worth exploring in potential future research.
For the remaining challenges (device price, Concerns about data privacy, Changes in how work is done, and not enough support from institutions), no statistically significant differences were observed between the junior and senior participants (all p-values were > 0.05). This may suggest that these issues are perceived similarly across career stages, indicating broad agreement among healthcare professionals on these barriers to wearable devices integration.

To summarise, the findings highlighted that while most challenges are shared between junior and senior professionals, accuracy concerns and training needs may be more predominant issues for junior practitioners.

Challenge	Observed counts Jr/ Sr	Expected counts Jr/ Sr	X^2	Df	P-value
Devices price	42/36	41.65/ 36.35	0.000	1	1.000
Lack of training about how to use them	28/15	22.96/ 20.04	3.305	1	0.0691
Doubts about how accurate the devices are	35/ 20	29.37/ 25.63	4.128	1	0.0422
Concerns about patient data privacy	18/ 14	17.09/ 14.91	0.031	1	0.8602
Changes in how work is done	25/ 20	24.03/ 20.97	0.035	1	0.8513
Not enough support from institutions	22/ 24	24.56/ 21.44	0.672	1	0.4124

Table 29. Chi-square tests challenges for wearable devices integration

4.6.3 Challenges in adopting wearable health technology in Mexico

Following the previous analysis of general challenges to wearable adoption, the survey also explored which issues healthcare professionals considered to be the main barriers for adoption of wearables within the Mexican system. Once again, Cost (Cost to patients) emerged as the most dominant concern, with almost identical proportions between career stages (76.4% of juniors and 77.1% of seniors), confirming that affordability is seen as a universal obstacle regardless of professional experience.

Other cost-related factors were also prominent. The cost to healthcare institutions was cited frequently by both groups, though slightly more often among seniors (64.6%) than juniors (56.4%). Access to health devices ranked highly as well, with juniors (60%) reporting it more often than seniors (47.9%).

Some barriers revealed sharp contrasts between career stages. Regulatory or policy barriers were reported by 27.3% of juniors compared to only 8.3% of seniors, and limited training opportunities for healthcare professionals were identified by 38.2% of juniors versus 18.8% of seniors. These differences may suggest that junior professionals in Mexico may feel more constrained by system-level regulations and gaps in professional development.

Other challenges like patient digital literacy (32.7% of juniors, 33.3% of seniors), concerns about data privacy and security (16.4% juniors, 20.8% seniors), and limited access to reliable internet or infrastructure (25.5% juniors, 18.8% seniors), were perceived at similar rates across both groups, indicating shared awareness of these factors within the Mexican healthcare environment.

Figure 36. Challenges for wearables adoption in Mexico

To assess whether perceptions of the main challenges differed between junior and senior healthcare professionals, chi-square tests of independence were conducted for each identified challenge.

The results indicated that Regulatory or policy barriers were the only challenge showing a statistically significant difference between groups, with a p-value of 0.0266. This barrier was cited more frequently by junior professionals (27.3%) compared to seniors (8.3%), suggesting that less experienced practitioners may perceive regulatory frameworks as a more prominent obstacle to adoption.

Limited training opportunities for healthcare professionals approached statistical significance with a p-value of 0.0514, with juniors again reporting this challenge more often (38.2%) than seniors (18.8%). Although this finding does not cross the conventional level of significance (0.05), it indicates a potential trend worth exploring in future studies.

For the remaining challenges —cost to patients, Access to health devices, Cost to healthcare institutions, Patient digital literacy, Limited access to reliable internet or infrastructure, and Concerns about data privacy and security —no statistically significant differences were found (all $P > 0.05$). These results suggest that, for most barriers, perceptions are broadly shared across career stages, with both junior and senior healthcare professionals acknowledging the same key constraints for the adoption of wearables in Mexico.

Overall, these findings indicate that while cost-related issues and infrastructure limitations are recognised equally by both groups, junior professionals place greater emphasis on policy-related and training barriers.

Challenge	Observed counts Jr/ Sr	Expected counts Jr/ Sr	X^2	Df	P-value
Cost to patients	42/37	42.18/ 36.82	0.000	1	1.000
Access to health devices	33/23	29.90/ 26.10	1.061	1	0.303
Cost to healthcare institutions	31/ 31	33.11/ 28.89	0.420	1	0.516
Patient digital literacy	18/ 16	18.16/ 15.84	0.00	1	1.000
Regulatory or policy barriers	15/ 4	10.15/ 8.85	4.917	1	0.0266
Limited access to reliable internet or infrastructure	14/ 9	12.28/ 10.72	0.334	1	0.563
Concerns about data privacy and security	9/10	10.15/8.85	0.108	1	0.742
Limited training opportunities for healthcare professionals	21/9	16.02/13.98	3.794	1	0.0514

Table 30. Chi-square tests challenges for wearable devices integration in Mexico.

4.6.4 Enablers to Wearable Devices Adoption

Following the analysis of the main perceived barriers to wearables adoption, the study further explored the factors that participants believed would most facilitate their implementation in clinical practice. To capture these insights, participants were asked: “If not using, what would most help you or your institution to adopt wearable devices?”.

“Lower costs or insurance coverage for devices” emerged as the most frequently cited enabler by both groups, selected by 32.14% of juniors and 28.08% of seniors. This aligns with earlier findings on the high perceived cost as a key barrier, indicating that financial accessibility remains the most significant driver for adoption.

“Devices that are simple to use and work well with other systems” ranked second for both career stages (26.19% juniors; 23.97% seniors), highlighting the importance of ease of integrating into existing workflows. This preference also reflects earlier results on usability and technical support, reinforcing that complexity in device operation could hinder adoption.

“Training programs about how to use wearables” held similar weight for both groups but was slightly more emphasised by seniors (26.02%) compared to juniors (23.8%). This may suggest that while all professionals value skill-building, senior practitioners may perceive a greater need for structured learning before adopting new digital tools.

“Better protection for patient data” was acknowledged by a modest share of both juniors (13.09%) and seniors (15.06%), consistent with prior findings on privacy concerns. While important, it's a lower ranking compared to other factors.

In contrast, “institutional support” (2.97% juniors; 4.10% seniors) and “support or advice from coworkers” (1.78% juniors; 2.73% seniors) were infrequently selected. This may indicate that while these factors can aid adoption, most participants feel that systemic and individual like cost, usability, and training, take precedence over interpersonal or organisational backing.

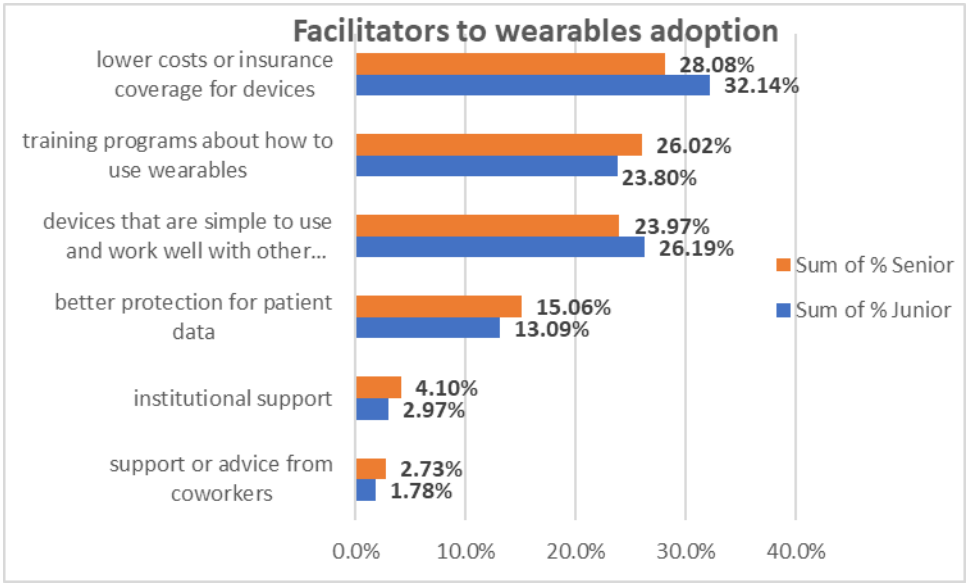

Figure 37. Principal facilitators for wearables integration in clinical practice.

Following inferential statistics, chi-square tests were performed to explore potential differences in opinion between junior and senior healthcare professionals regarding the perceived enablers that could facilitate the adoption of wearable devices in clinical practice.

The chi-square test revealed no statistically significant differences between the groups across any of the listed facilitators (all p-values were> 0.05). This indicates that perceptions of enabling factors are largely consistent across career stages. Both groups prioritised lower cost or insurance coverage for devices, devices that are simple to use and work well with other systems, and training programs about how to use wearables as the most important measures to support adoption. Less frequently chosen factors, like better protection for patient data, institutional support, and support or advice from coworkers, showed similarly low selection rates in both groups.

These results align with the earlier challenges analysis, where cost and usability emerged as the most prominent obstacles, followed by training and data protection concerns. The consistency between junior and senior professionals suggests a shared recognition of the core enablers needed to facilitate adoption in the Mexican system.

Facilitator	Observed counts Jr/ Sr	Expected counts Jr/ Sr	X^2	Df	P-value
Support or advice from coworkers	¾	3.75/ 3.25	0.203	1	0.6526
Institutional support	5/6	5.88/ 5.12	0.262	1	0.6086
Better protection for patient data	22/ 22	23.54/ 20.46	0.275	1	0.5999
Devices that are simple to use and work well with other systems	44/ 35	42.28/ 36.72	0.193	1	0.6605
Training programs about how to use wearables	40/ 38	41.72/ 36.28	0.196	1	0.6579
Lower cost or insurance coverage for devices	54/ 41	50.83/ 44.17	0.507	1	0.4765

Table 31. Chi-square tests for facilitators for wearable devices integration.

4.6.5 Additional insights regarding wearable devices in T2D management in Mexico.

To complement quantitative results, participants were given the option to provide additional comments regarding the use of wearable devices in T2D management in Mexico. This open-ended question allowed respondents to express concerns, expectations, and suggestions beyond the predefined survey items.

The thematic analysis of the qualitative responses produced seven key categories: *Cost and accessibility, Training and support, Technical and reliability issues, Patient acceptance and awareness, Data protection concerns, Preference for traditional methods, and Not enough Information and familiarity with wearables*.

Theme	Junior (count)	Senior (count)	Total	Junior %	Senior %
Not enough information and familiarity	23	20	43	53%	47%
Cost and accessibility	14	11	25	56%	44%
Patient acceptance and awareness	3	2	5	60%	40%
Training and support	3	1	4	75%	25%
Technical and reliability issues	1	1	2	50%	50%
Preference for traditional methods	1	1	2	50%	50%
Data protection concerns	0	1	1	0%	100%

Table 32. Theme frequency from comments by career stage.

The findings showed that Not enough information and familiarity with wearables was the single largest category (43 mentions), indicating a widespread perception that both healthcare professionals and patients have limited exposure to wearable devices. Mirroring earlier findings, showing moderate to low familiarity scores in the Likert-scale questions, suggesting that raising awareness and improving knowledge is a fundamental first step before large-scale integration is possible.

Cost and accessibility were the most frequently cited barriers after lack of information, with both groups pointing to affordability and the need for insurance coverage as crucial determinants for adoption. This directly reinforces the quantitative findings that cost was ranked as the leading challenge in the survey's structured questions. Training and support were raised more often by juniors (75% of mentions), indicating a strong perceived need for capacity-building initiatives in the early professional stage. Patient acceptance and awareness appeared in both groups, suggesting shared concerns about whether patients are ready to embrace wearable technology in diabetes care.
Technical and reliability issues and Preference for traditional methods were equally distributed between career stages, reflecting mutual concerns about device accuracy and potential disruptions to established care routines.
Data protection concerns were mentioned exclusively by seniors, again aligning with previous findings regarding seniors pointing to greater concerns surrounding privacy and security of patients' data.
The prominence of Not enough information and familiarity with wearables in the open-ended responses strongly complements the survey results showing relatively low familiarity levels with wearable devices. While cost, usability, and training emerged as primary drivers in the quantitative data, the qualitative feedback highlights that insufficient awareness may be an equally critical barrier.

The following participant quotes illustrate the most prominent themes identified in the qualitative analysis:
Not enough information and familiarity with wearables: *"Not enough information about wearable technology to implement in Mexican public clinics"* (Junior professional, 5-10 years of experience).

Cost and accessibility: ***"****The affordability of these devices is a must in this country"* (Senior professional, 11-15 years of experience).

Training and support: *"Public clinics and hospitals need to improve technical infrastructure to adopt technologies"* (Senior professional, 11-15 years of experience).

Patient acceptance and awareness: *"Patients don't always follow treatments"* (Junior professional, less than 5 years of experience).

4.7 Professional experience and future of wearables

To conclude the survey, participants were asked a series of questions to explore how healthcare professionals' direct clinical experience with Type 2 diabetes influences their perspective on the future role of wearable technologies.

4.7.1 Clinical experience: Number of T2D patients seen monthly

To assess the level of direct clinical exposure to T2D cases among participants, respondents were asked to indicate the number of patients with type 2 diabetes they typically see in a month.

The majority of respondents (51%) reported seeing 10-30 patients with diabetes per month, representing a moderate and consistent level of exposure. This was followed by 25% who indicated seeing fewer than 10 patients, suggesting a smaller subset of professionals with more limited experience in diabetes management.

Additionally, 20% of participants reported seeing 31-50 patients, while a smaller group (4%) reported managing more than 50 patients monthly.

To explore if there is a correlation between years of professional experience and the number of patients with T2D seen monthly, the data were disaggregated by career stage.

Among junior professionals, the largest group (23) reported seeing 10-30 patients monthly. This was followed by 16 respondents seeing fewer than 10, and 12 choosing the range 31-50. Notably, a small portion (4) reported managing more than 50 patients per month, suggesting a subset of junior practitioners with higher patient loads.

In contrast, Senior professionals more frequently reported seeing 10-30 patients, with 29 respondents selecting this range. 10 practitioners reported seeing fewer than 10 patients, and the other 9 reported seeing 31-50 patients. None of the senior participants selected "More than 50", indicating a potentially more balanced or supervisory role rather than direct high-volume patient care.

These findings suggest that both junior and senior professionals in Mexico are regularly exposed to patients with T2D, particularly within the 10-30 patient range. However, juniors appear slightly more represented in both the lower (<10) and higher (>50) exposure extremes, possibly reflecting more varied clinical assignments or practice settings early in their careers.

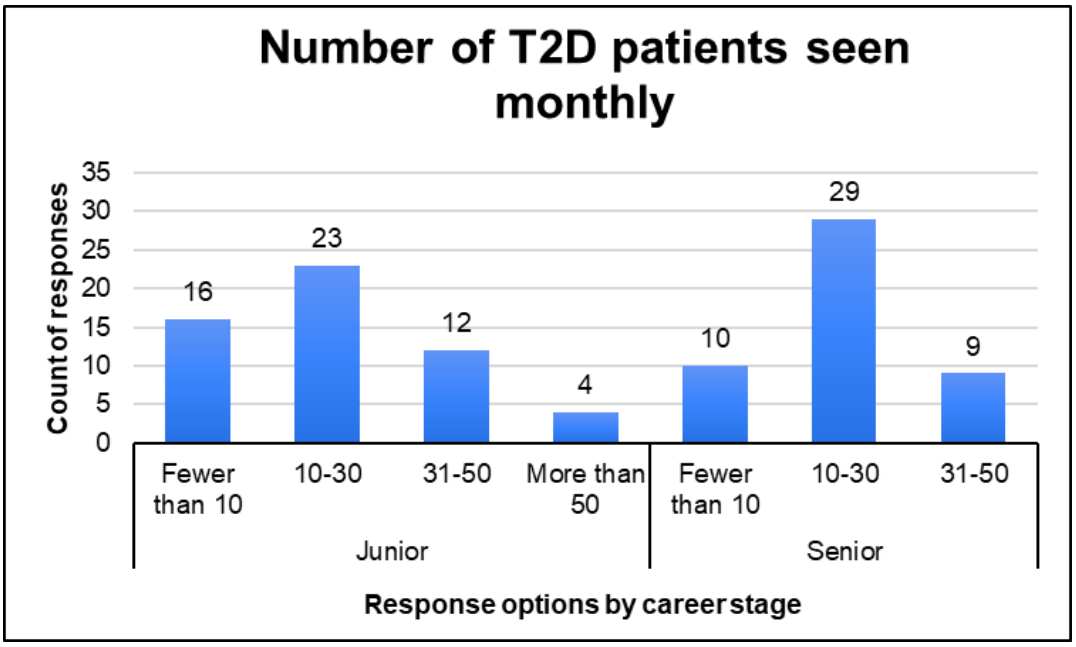

Figure 38. Monthly number of patients with T2D seen

To assess whether the observed distribution of patient load differs significantly between junior and senior professionals, a chi-square test of independence was performed. This one did not reveal a statistically significant association between career stage and the number of T2D patients seen monthly (p-value 0.109). while descriptive differences exist, such as juniors more often reporting either very few or many patients, and seniors clustering more around the 10-30 range, these differences are not strong enough to conclude a meaningful statistical relationship.

	CareerStage		
NumberPatients	Junior	Senior	Total
10-30	23	29	52
31-50	12	9	21
Fewer than 10	16	10	26
More than 50	4	0	4
Total	55	48	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	6.058	3	.109
N	103		

Table 33. Chi-square test for monthly patients seen divided by career stage.

4.7.2 Likelihood of wearables recommendation

To understand the outlook of healthcare professionals regarding the integration of wearable technologies into diabetes care, participants were asked: “How likely are you to recommend wearable devices to your patients in the near future?”. This question aimed to capture future intentions and attitudes that could influence the pace of adoption across clinical settings.

The responses reveal a landscape marked by cautious optimism. A combined 56% of participants reported that they were either “Likely” (39%) or “Very Likely” (17%) to recommend wearable devices. Showing a generally positive disposition toward technology integration and its potential to support diabetes management. However, a notable 42% of responses selected “Not sure”, signalling a substantial degree of uncertainty or hesitation within the clinical community. Only 2% expressed that they would be “Very unlikely” to recommend such tools.

Following initial analysis, the responses were disaggregated by career stage to explore potential differences between junior and senior professionals.

Among junior healthcare professionals, the most common response was “Not sure” with (28), reflecting a significant level of uncertainty about recommending wearable technologies. 21 juniors stated they were “Likely”, and only 5 were “Very Likely” to recommend them. 2 respondents said they were “Vey unlikely” to do so.

In comparison, senior professionals’ greater confidence, 13 out of 48 seniors indicated they were “Very likely” to recommend wearables, substantially higher than their junior counterparts. Another 19 seniors said they were “Likely”, while 15 remained “Not sure”. None of the senior respondents selected “Very unlikely”.

These results suggest that senior professionals showed a stronger inclination to recommend wearable devices, potentially reflecting greater confidence derived from clinical experience.

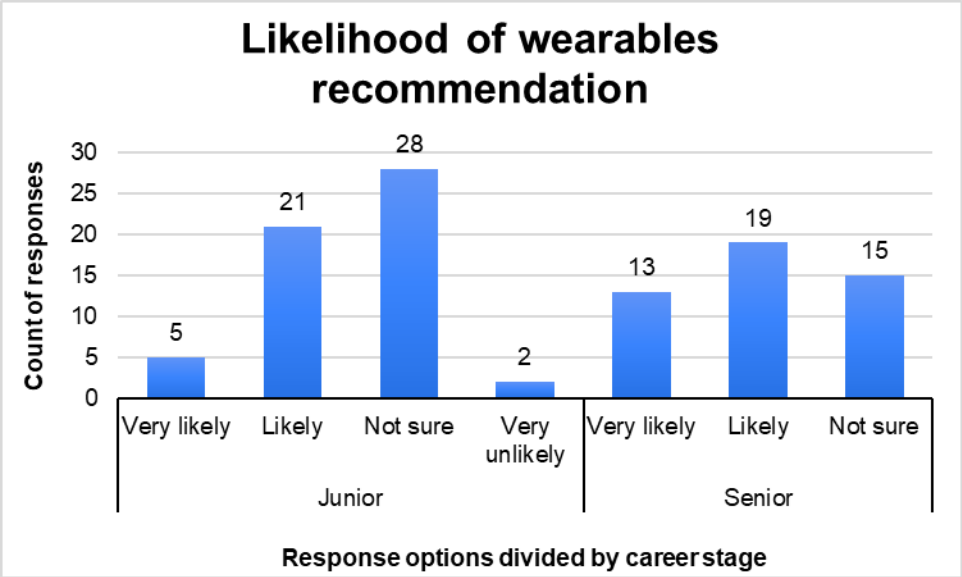

Figure 39. Likelihood of recommending wearable devices for T2D management

To examine whether the likelihood of recommending wearable devices differed significantly between junior and senior healthcare professionals, a chi-square test was performed. The results indicated a chi-square value of 8.867 with 3 degrees of freedom and a p-value of 0.031. Since this p-value is below the standard significance threshold of 0.05, the null hypothesis of no association was rejected.
This finding suggests that career stage and likelihood of recommending wearable devices are statistically associated, meaning that differences in responses between junior and senior groups are unlikely to be due to random variation. Specifically, senior professionals were more likely to indicate “Very likely” or “Likely”, while juniors showed a higher proportion of “Not sure” responses. This aligns with the observed frequencies and highlights a potential difference in readiness to promote wearable devices based on professional experience.

	CareerStage		
LikelynessUse	Junior	Senior	Total
Likely	21	19	40
Not sure	28	15	43
Very likely	5	13	18
Very unlikely	2	0	2
Total	56	47	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	8.867	3	.031
N	103		

Table 34. Chi-square test for the likelihood of wearable device recommendations

4.7.3 Future direction of wearable devices for T2D management

For the last question of the survey, participants were asked for their perspective regarding the future direction of wearable devices specialised in T2D management in Mexico, and whether they consider this will increase, decrease, or stay the same**.** The responses to the question indicated an overall strong expectation of growth in adoption. Among the 103 participants, 56% selected “Increase somewhat” and 25% selected “Increase a lot”, meaning that over four out of five respondents predict a positive trajectory in the use of wearable technologies in this field. In contrast, only 17% believe usage would “Stay about the same”, while just 2% expressed

uncertainty by selecting “Not sure”. Notably, no participants anticipated a decrease in the use of wearable devices**.**

The comparative analysis of expectations regarding the future use of wearable devices for diabetes management reveals a strong consensus among both junior and senior healthcare professionals toward growth in adoption, with some variation in intensity of outlook.

Among junior professionals, 16 participants indicated that usage would “Increase a lot” and 34 selected “Increase somewhat”, accounting for 91% of responses in this group favouring expansion. In contrast, 4 juniors believed usage would “Stay about the same”, and 1 was uncertain. No juniors anticipated a decrease.

Similarly, among senior professionals, 10 respondents predicted that use would “Increase a lot” and 24 selected “Increase somewhat”, representing 71% of responses in this group. However, a higher proportion of seniors (13 participants) selected “Stay about the same”, and one selected “Not sure”, indicating a comparatively more cautious perspective.

Overall, while both groups overwhelmingly foresee growth in wearable device adoption, juniors express a more decisive expectation of significant expansion, but they may not be ready to personally apply it to their practice based on the previous analysis. Whereas seniors demonstrate a greater inclination toward stability, with fewer predicting a substantial increase.

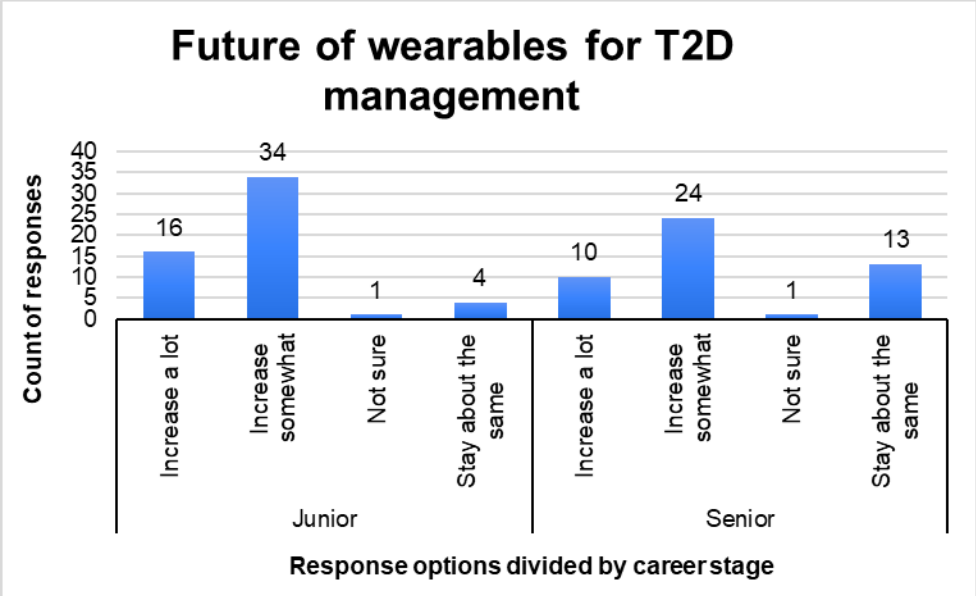

Figure 40. Perceived future direction of wearables for T2D management

To complement the descriptive analysis, a chi-square test of independence was conducted to assess whether the difference in future outlook between junior and senior healthcare professionals was statistically significant. The test produced a value of x^2= 7.432 with 3 degrees of freedom and a p-value of 0.059. Since this p-value is slightly above the conventional significance threshold of 0.05, the result is not statistically significant at the 5% level.
This means that, although juniors appear more optimistic (evidenced by 91% anticipating some level of increase compared to 71% of seniors), the difference in response distribution between the two groups cannot be confirmed as significant with strong statistical confidence. Nonetheless, the observed pattern suggests a trend where junior professionals are more likely to predict substantial growth, while seniors lean toward a more moderate or stable outlook.

	FutureUse				
CareerStage	Increase a lot	Increase somewhat	Not sure	Stay about the same	Total
Junior	16	34	1	4	55
Senior	10	24	1	13	48
Total	26	58	2	17	103

Note. Each cell displays the observed counts

Chi-Squared Tests

	Value	df	p
X^2	7.432	3	.059
N	103		

Table 35. Chi-square test for future of wearables for T2D management

4.8 Discussion

The findings of the analysis offered valuable insights into the current landscape of healthcare professionals' perceptions and readiness toward wearable devices for Type 2 Diabetes management in Mexico. The data analysed across multiple dimensions and career stages shed light on both shared and differing perspectives between junior and senior professionals.

In alignment with the central hypothesis, that junior healthcare professionals would show more favourable perceptions and readiness toward adopting wearables, the results consistently demonstrated a higher degree of familiarity, optimism, and willingness to engage with these technologies among the junior cohort. This was particularly evident in areas like perceived benefits, openness to training, and belief in the growing role of wearables in future clinical practice.

However, the analysis also revealed shared worries. Across both groups, the cost to patients emerged as the most significant barrier, with strong agreement on its limiting impact. Other recurring challenges included a lack of training and institutional support. Importantly, junior professionals were more likely to emphasise informational and technical barriers (doubts about device accuracy and lack of familiarity) while senior professionals more frequently cited structural and systemic issues like institutional support and policy compliance.

Chi-square tests supported several of these distinctions. Statistically significant differences were observed between groups in perceptions of benefit, likelihood of recommending wearables, and response to several adoption challenges. For instance, junior professionals were significantly more likely to express willingness to receive training, while senior professionals were more confident in recommending devices to patients.

When asked to identify potential facilitators, both groups prioritised cost reductions, insurance coverage, and user-friendly device design. Juniors additionally highlighted the importance of training programs, while seniors gave slightly greater weight to institutional support and data protection. These nuances suggest that implementation strategies should be multifaceted and responsive to the different informational, structural, and experiential needs of each group.

Finally, regarding the future outlook of wearables, most participants believed that the use of wearable devices will increase in diabetes care, reflecting a general optimism toward technological integration in healthcare. Although junior professionals were slightly more hesitant in recommending devices in the near term, they expressed strong belief in their long-term potential, further supporting the notion that readiness can be enhanced through education, support, and policy alignment.

Taken together, these findings offer a detailed picture of current attitudes toward wearable health technologies in Mexico, underlining both the opportunities and challenges in aligning professional readiness with the growing demands of digital healthcare. The results point toward the need for tailored interventions, including generational-specific training, institutional incentives, and clearer guidelines for integrating wearable devices into routine diabetes care.

Chapter 5: Conclusions and Recommendations

5.1 Conclusions

This study aimed to explore the perceptions, readiness, and potential challenges and facilitators related to the adoption of wearable devices for Type 2 Diabetes (T2D) management among junior and senior healthcare professionals in Mexico. Guided by four objectives and the central hypothesis that junior professionals would exhibit greater openness to adoption, the study incorporated both descriptive and comparative statistical analyses.

The literature review established that wearable devices have emerged as a promising innovation in chronic disease management, particularly for conditions that require ongoing monitoring, such as type 2 diabetes (T2D) *(Alzghaibi, 2025).* These devices enable continuous tracking of parameters such as glucose levels, physical activity, and heart rate, providing both patients and healthcare providers with actionable, real-time data *(Diabetes Resource Coalition of Long Island, 2024).* Globally, their integration into diabetes care has been associated with improved glycaemic control, enhanced patient engagement, and a potential reduction in complications *(Guk et al., 2019).* Studies from high-income countries have consistently demonstrated that healthcare professionals who are more familiar with digital technologies tend to report greater perceived usefulness and higher intention to adopt these tools *(Pavlovic et al., 2021).* The review also identified that factors like device cost, interoperability with existing systems, and data privacy concerns are persistent barriers across global contexts *(WHO, 2021; Alotaibi, Wilson, and Traynor, 2025).*

In line with these findings, the research confirms that perceived benefits of wearable devices are widely acknowledged among healthcare professionals in Mexico, with high levels of agreement that such technologies can improve T2D management. This mirrors results from studies conducted in high-income settings, where perceived clinical utility is a strong predictor of adoption. However, the current study provides insight by revealing that junior healthcare professionals in Mexico express a statistically higher level of agreement with these benefits than their senior counterparts.

Where this study differs somewhat from existing literature is in identifying differences based on career stage for training needs. While previous research by Lee and Lee suggests that training is a widely recognized facilitator (Lee and Lee, 2020), the study's data showed that junior professionals report a higher willingness to participate in training programs, whereas seniors, although also positive, are less likely to express this readiness. This may reflect differences in prior exposure to digital health tools, as suggested by work from Gu et al., and highlights the need for tailored training interventions (Gu et al., 2021).

Finally, consistent with the literature on facilitators to adoption, the study found strong support for the role of institutional support, technical interoperability, and demonstrable clinical effectiveness in encouraging uptake *(Alzghaibi, 2025; Greenhalgh et al., 2017).* However, the (Mexican-specific) barrier of cost to patients

emerged strongly here, an issue that is currently less emphasized in studies from countries with broader health technology economic facilities. This underscores the importance of considering local health system financing structures when interpreting global evidence and applying it to national policies.

5.2 Significance of the study

The research holds both practical and academic significance by providing an evidence-based understanding of how healthcare professionals in Mexico, divided by career stage, perceive and are prepared to adopt wearable devices for the management of T2D.

The research findings aligned with and extended the literature. Consistent *with Lee and Lee*. and *Gu et al*., junior professionals in Mexico demonstrated a higher readiness to adopt wearable devices, supported by stronger agreement on the potential benefits of these tools *(Lee and Lee, 2020; Gu et al., 2021)*. Statistical comparisons, using chi-square test analysis for perceived benefits ($\chi^2 = 11.916$, p-value = 0.008), confirmed significant differences between career stages, with junior respondents showing greater optimism, which resonates with international studies that link digital nativity with a higher acceptance of technology in healthcare.

Echoing the cost-related concerns identified by *WHO* and *Alotaibi, Wilson, and Traynor,* device affordability emerged as the most prominent barrier in the study, cited by over 75% of participants across both groups *(WHO, 2021; Alotaibi, Wilson, and Traynor, 2025).* While juniors were most enthusiastic overall, some barriers, such as data privacy and cost for institutions, were strongly dominated by the senior professional group. This suggests that certain adoption challenges are more systemic than generational.

viewed alongside the literature review, the study reinforces established facilitators, including institutional support, training programs, and proven clinical benefits.

At the same time, it also draws attention to context-specific issues, like limited insurance coverage for wearables in Mexico and inconsistent access to reliable infrastructure, which may hinder the widespread adoption despite the levels of professional interest.

Practically speaking, the results provide a concrete guide for policymakers, healthcare leaders, and technology suppliers. Addressing affordability is paramount; initiatives like including wearable devices in public insurance coverage or negotiating reduced prices for institutions could have a significant impact on adoption rates.

Academically speaking, the study contributes to the growing literature on digital health adoption by providing comparative, statistically tested data from a Latin American context, an area commonly underrepresented in wearable technology research.

In summary, the research not only deepens understanding of professionals' perspectives and attitudes toward wearable devices in Mexico but also delivers practical guidance for both implementation and academic work, connecting theoretical frameworks with real-world practice in a setting where the burden of Type 2 Diabetes calls for innovative, scalable solutions.

5.3 Limitations

While the study provides valuable insights into the perceptions, barriers, and facilitators of wearable device adoption for Type 2 Diabetes management among healthcare professionals in Mexico, several limitations must be acknowledged.

First, the original target sample size of 196 participants could not be reached, with the final sample consisting of 103 respondents. This shortfall was primarily due to the high data collection deadline and participants' professional responsibilities, which limited their availability to complete the survey. While the achieved sample still allowed for meaningful statistical analysis, it may reduce the power to detect smaller effects and limit representativeness.

Second, the use of a cross-sectional survey design limits the ability to establish a causal relationship between variables like career stage, perceptions, and the likelihood of adoption.

Thirdly, the study relied on self-reported data, which may be subject to social desirability bias, particularly when participants reported familiarity or readiness to use wearable devices.

Fourthly, the categorisation of career stage into "Junior" and "Senior" was based on self-identification, which, while practical, may not fully capture the diversity of experience levels, specialisations, or prior exposure to wearable technologies.

Finally, the findings are context-specific to Mexico, and while they align with international evidence in several areas, generalisation to other countries should be made cautiously, especially those with different healthcare financing, infrastructure, and regulatory contexts.

5.4 Recommendations

Based on the research findings, several recommendations can be made for several areas, including practice and future research.

5.4.1 Increase awareness and training opportunities for healthcare professionals

One of the clearest findings from the study was the strong willingness, especially among junior professionals, to receive training on wearable devices. Training programs could help fill gaps in technical skills and confidence. This appears to be one of the most direct and feasible ways to close the readiness gap between interest and actual adoption.

5.4.2 Address affordability for both patients and healthcare institutions

The high proportion of participants citing cost as a major barrier shows that financial accessibility remains a key challenge. Efforts to negotiate insurance coverage, implement government subsidies, or introduce lower-cost device models could help overcome this barrier.

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5.4.3 Strengthen institutional support and infrastructure

Responses showed that both junior and senior professionals recognise the role of institutional backing in enabling adoption. Investment in infrastructure, integration of wearable data into existing medical systems, and clear organisational policies could

provide the supportive environment needed for these technologies to be used effectively.

5.4.4 Improve patient data security

Concerns over data protection were widespread, reflecting a theme that emerged in both the literature and the data findings. Addressing these through clear regulations and robust security systems could increase trust in wearable technologies.

5.4.5 Future research

This study serves as a stepping stone for further investigation. A larger, more representative sample could explore whether the patterns observed in this study hold true across different regions of Mexico. Longitudinal research could also help understand how attitudes evolve as wearable devices become more integrated into healthcare practice. Additionally, qualitative studies could explore in more depth the personal experiences and contextual challenges that influence adoption.

6.0 References

6Wresearch (2024). *Mexico Wearable Technology Market (2024-2030) | Revenue, Value, Growth, Trends, Outlook, Companies, Industry, Share, Analysis, Size & Forecast*. [online] 6wresearch.com. Available at: https://www.6wresearch.com/industry-report/mexico-wearable-technology-market.

Adepoju, V.A., Jamil, S., Biswas, M.S. and Chowdhury, A.A. (2024). Wearable Technology in the Management of Chronic Diseases: A Growing Concern. *Chronic Diseases and Translational Medicine*, [online] p.n/a. doi:https://doi.org/10.1002/cdt3.156.

Admin (2025). *Managing Diabetes with Wearable Technology: Trends for 2025 - Smiles Med Supply*. [online] Smiles Med Supply. Available at: https://smilesmed.com/managing-diabetes-with-wearable-technology-trends-for-2025/ [Accessed 13 Jun. 2025].

Ahmed, A., Aziz, S., Abd-alrazaq, A., Farooq, F., Househ, M. and Sheikh, J. (2023). The Effectiveness of Wearable Devices Using Artificial Intelligence for Blood Glucose Level Forecasting or Prediction: Systematic Review. Journal of Medical Internet Research, [online] 25(1), p.e40259. doi:https://doi.org/10.2196/40259

Alaslawi, H., Berrou, I., Al Hamid, A., Alhuwail, D. and Aslanpour, Z. (2022). Diabetes Self-management Apps: Systematic Review of Adoption Determinants and Future Research Agenda. *JMIR Diabetes*, 7(3), p.e28153. doi:https://doi.org/10.2196/28153.

Alcántara-Aragón, V. (2019). Improving Patient self-care Using Diabetes Technologies. *Therapeutic Advances in Endocrinology and Metabolism*, [online] 10(1). doi:https://doi.org/10.1177/2042018818824215

Alotaibi, N., Wilson, C.B. and Traynor, M. (2025). Enhancing digital readiness and capability in healthcare: a systematic review of interventions, barriers, and facilitators. *BMC Health Services Research*, 25(1). doi:https://doi.org/10.1186/s12913-025-12663-3.

Alzghaibi, H. (2025). Perspectives of people with diabetes on AI-integrated wearable devices: perceived benefits, barriers, and opportunities for self-management. Frontiers in Medicine, 12. doi:https://doi.org/10.3389/fmed.2025.1563003.

American Medical Association. (2022). *5 insights into how physicians view, use digital health tools*. [online] Available at: https://www.ama-assn.org/practice-management/digital-health/5-insights-how-physicians-view-use-digital-health-tools [Accessed 28 Jun. 2025].

Anzaldo-Campos, M.C., Contreras, S., Vargas-Ojeda, A., Menchaca-Díaz, R., Fortmann, A. and Philis-Tsimikas, A. (2016). Dulce Wireless Tijuana: A Randomized Control Trial Evaluating the Impact of Project Dulce and Short-Term Mobile Technology on Glycemic Control in a Family Medicine Clinic in Northern Mexico. *Diabetes Technology & Therapeutics*, [online] 18(4), pp.240–251. doi:https://doi.org/10.1089/dia.2015.0283.

Atlas de la Diabetes. (2025). *México*. [online] Available at: https://diabetesatlas.org/es/data-by-location/country/mexico/. [Accessed 30 May 2025]

Beck, R.W., Riddlesworth, T.D., Ruedy, K., Ahmann, A., Haller, S., Kruger, D., McGill, J.B., Polonsky, W., Price, D., Aronoff, S., Aronson, R., Toschi, E., Kollman, C. and Bergenstal, R. (2017). Continuous Glucose Monitoring Versus Usual Care in Patients With Type 2 Diabetes Receiving Multiple Daily Insulin Injections. *Annals of Internal Medicine*, 167(6), p.365. doi:https://doi.org/10.7326/m16-2855.

Bent, B., Goldstein, B.A., Kibbe, W.A. and Dunn, J.P. (2020). Investigating sources of inaccuracy in wearable optical heart rate sensors. *npj Digital Medicine*, 3(1). doi:https://doi.org/10.1038/s41746-020-0226-6.

Bianchi, C., Tuzovic, S. and Kuppelwieser, V.G. (2022). Investigating the drivers of wearable technology adoption for healthcare in South America. *Information Technology & People*. doi:https://doi.org/10.1108/itp-01-2021-0049.

Bonoto, B.C., de Araújo, V.E., Godói, I.P., de Lemos, L.L.P., Godman, B., Bennie, M., Diniz, L.M. and Junior, A.A.G. (2017). Efficacy of Mobile Apps to Support the Care of Patients With Diabetes Mellitus: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *JMIR mHealth and uHealth*, [online] 5(3), p.e4. doi:https://doi.org/10.2196/mhealth.6309.

Brommeyer, M., Whittaker, M. and Liang, Z. (2024). Organizational Factors Driving the Realization of Digital Health Transformation Benefits from Health Service Managers: A Qualitative Study. *Journal of Healthcare Leadership*, Volume 16, pp.455–472. doi:https://doi.org/10.2147/jhl.s487589.

Brückner, S., Sadare, O., Fesl, S., Scheibe, M., Lang, C. and Gilbert, S. (2025). Attitudes of healthcare professionals and researchers toward wearable and app derived patient generated health data. *npj Digital Medicine*, [online] 8(1). doi:https://doi.org/10.1038/s41746-025-01568-4.

Canali, S., Schiaffonati, V. and Aliverti, A. (2022). Challenges and Recommendations for Wearable Devices in Digital health: Data quality, interoperability, Health equity, Fairness. *PLOS Digital Health*, [online] 1(10). doi:https://doi.org/10.1371/journal.pdig.0000104.

Chambers.com. (2024). *Digital Healthcare 2024 - Mexico | Global Practice Guides | Chambers and Partners*. [online] Available at: https://practiceguides.chambers.com/practice-guides/digital-healthcare-2024/mexico/trends-and-developments/O17423. [Accessed 19 Jun 2025]

ÇİĞDEM, M. and ŞAHİN, S. (2022). A research on the perceptions of individuals and health professionals about the wearable technologies used in healthcare services. *Journal of International Health Sciences and Management*. doi:https://doi.org/10.48121/jihsam.903224.

Clinic, C. (2024). *Cleveland Clinic Survey: Majority of Adults in Mexico Use Health Monitoring Technology, with most users Experiencing Significant Physical and Mental Benefits*. [online] Cleveland Clinic. Available at: https://newsroom.clevelandclinic.org/2024/02/19/cleveland-clinic-survey-majority-of-adults-in-mexico-use-health-monitoring-technology-with-most-users-experiencing-significant-physical-and-mental-benefits. [Accessed by 25 Jun 2025]

Coffetti, E., Paans, W., Roodbol, P.F. and Zuidersma, J. (2022). Individual and team factors influencing the adoption of information and communication technology by nurses. CIN: Computers, Informatics, Nursing, 41(4). doi:https://doi.org/10.1097/cin.0000000000000931

Contreras, I. and Vehi, J. (2018). Artificial Intelligence for Diabetes Management and Decision Support: Literature Review. *Journal of Medical Internet Research*, 20(5), p.e10775. doi:https://doi.org/10.2196/10775.

Cummins, N. and Schuller, B.W. (2020). Five Crucial Challenges in Digital Health. *Frontiers in Digital Health*, [online] 2(536203). doi:https://doi.org/10.3389/fdgth.2020.536203.

Daniela Chueke, B.S.S. (2023). Persisting Barriers to the Adoption of Telemedicine in Latin America After the COVID-19 Pandemic. *Telehealth and Medicine Today*, [online] 8(5). doi:https://doi.org/10.30953/thmt.v8.423.

De, D., Sahar Borna, Maniaci, M.J., Coffey, J.D., Haider, C.R., Demaerschalk, B.M. and Forte, A.J. (2024). Economic Perspective of the Use of Wearables in Health Care: A Systematic Review. *Mayo Clinic proceedings. Digital health*, 2(3). doi:https://doi.org/10.1016/j.mcpdig.2024.05.003.

De la Peña-López, I.J. and Acosta-Gonzaga, E. (2025). Adoption of Technology in Older Adults in Mexico City: An Approach from the Technology Acceptance Model. *Brain Sciences*, [online] 15(6), p.632. doi:https://doi.org/10.3390/brainsci15060632.

Dexcom.com. (2025). *Dexcom Unveils New Report on Type 2 Diabetes Management in the U.S. at ADA 2025*. [online] Available at: https://investors.dexcom.com/news/news-details/2025/Dexcom-Unveils-New-Report-on-Type-2-Diabetes-Management-in-the-U-S--at-ADA-2025/default.aspx [Accessed 28 Jun. 2025].

Diabetes Atlas. (2025). *Mexico*. [online] Available at: https://diabetesatlas.org/data-by-location/country/mexico/. [Accessed 23 Jun 2025]

Diabetes Atlas. (2025). *Fact sheets*. [online] Available at: https://diabetesatlas.org/resources/factsheets/. [Accessed 8 Jun 2025].

Diabetes Resource Coalition of Long Island |. (2024). *How Wearable Technology is Transforming Diabetes Management*. [online] Available at: https://www.longislanddiabetes.org/how-wearable-technology-is-transforming-diabetes-management.html [Accessed 13 Jun 2025]

Didyuk, O., Econom, N., Guardia, A., Livingston, K. and Klueh, U. (2020). Continuous glucose monitoring devices: Past, present, and future focus on the history and evolution of technological innovation. *Journal of Diabetes Science and Technology*, [online] 15(3), p.193229681989939. doi:https://doi.org/10.1177/1932296819899394.

Dinh-Le, C., Chuang, R., Chokshi, S. and Mann, D. (2019). Wearable health technology and electronic health record integration: Scoping review and future directions. *JMIR mHealth and uHealth*, [online] 7(9). doi:https://doi.org/10.2196/12861.

Du, Z., Zhang, F., Ge, Y., Liu, Y., Yu, H., Wang, Y., Dalan, R. and Shen, X. (2025). Application of Wearable Devices in Diabetes Management. *Health and Metabolism*, p.7. doi:https://doi.org/10.53941/hm.2025.100007

Dudovskiy, J. (2025). *Deductive Approach (Deductive Reasoning)*. [online] Business Research Methodology. Available at: https://research-methodology.net/research-methodology/research-approach/deductive-approach-2/.
[Accessed 30 Jun 2025]

Endocrine Society (2018). *Experts Recommend Continuous Glucose Monitors for Adults with Type 1 Diabetes*. [online] Endocrine.org. Available at: https://support.endocrine.org/news-and-advocacy/news-room/2018/experts-recommend-continuous-glucose-monitors-for-adults-with-type-1-diabetes [Accessed 14 Jun. 2025].

Essaycompany. (2017). *essaycompany.com | Research Onion - Explanation of the Concept*. [online] Available at: https://www.essaycompany.com/essays/psychology/explanation-of-the-concept-of-research-onion-psychology-essay [Accessed 9 Jul. 2025].

F6S (2025). *5 top Diabetes companies and startups in Mexico in June 2025*. [online] F6S. Available at: https://www.f6s.com/companies/diabetes/mexico/co [Accessed 25 Jun. 2025].

Fuller, D., Colwell, E., Low, J., Orychock, K., Tobin, M.A., Simango, B., Buote, R., Heerden, D.V., Luan, H., Cullen, K., Slade, L. and Taylor, N.G.A. (2020). Reliability and Validity of Commercially Available Wearable Devices for Measuring Steps, Energy Expenditure, and Heart Rate: Systematic Review. *JMIR mHealth and uHealth*, 8(9), p.e18694. doi:https://doi.org/10.2196/18694.

Gagnon, M.-P., Ouellet, S., Eugène Attisso, Supper, W., Amil, S., Rhéaume, C., Paquette, J.-S., Chabot, C., Marie-Claude Laferrière and Sasseville, M. (2024). Wearable Devices for Supporting Chronic Disease Self-Management: A Scoping Review (Preprint). *Interactive Journal of Medical Research*, [online] 13, pp.e55925–e55925. doi:https://doi.org/10.2196/55925.

Ginsburg, G.S., Picard, R.W. and Friend, S.H. (2024). Key Issues as Wearable Digital Health Technologies Enter Clinical Care. *The New England Journal of Medicine*, 390(12), pp.1118–1127. doi:https://doi.org/10.1056/nejmra2307160.

Glen, S. (2021). *Sample Size in Statistics (How to Find it): Excel, Cochran's Formula, General Tips*. [online] Statistics How To. Available at: https://www.statisticshowto.com/probability-and-statistics/find-sample-size/.
[Accessed 04 July 2025]

Gob.mx. (2023). Regulatory Certainty Strategy for the Medical Devices Sector. Available at: https://www.gob.mx/cms/uploads/attachment/file/874923/Regulatory_Certainty_Strategy__1_.pdf. [Accessed 26 Jun 2025]

Gözde Tetik, Serkan Türkeli, Pinar, S. and Mehveş Tarim (2024). Health information systems with technology acceptance model approach: A systematic review. *International Journal of Medical Informatics*, 190, pp.105556–105556. doi:https://doi.org/10.1016/j.ijmedinf.2024.105556.

Greenhalgh, T., Wherton, J., Papoutsi, C., Lynch, J., Hughes, G., A'Court, C., Hinder, S., Fahy, N., Procter, R. and Shaw, S. (2017). Beyond Adoption: A New Framework for Theorizing and Evaluating Nonadoption, Abandonment, and Challenges to the Scale-Up, Spread, and Sustainability of Health and Care Technologies. *Journal of Medical Internet Research*, [online] 19(11), p.e367. doi:https://doi.org/10.2196/jmir.8775.

Group, G.L. (2025). *International Comparative Legal Guides*. [online] International Comparative Legal Guides International Business Reports. Available at: https://iclg.com/practice-areas/digital-health-laws-and-regulations. [Accessed 29 Jun 2025]

Gu, D., Khan, S., Khan, I.U., Khan, S.U., Xie, Y., Li, X. and Zhang, G. (2021). Assessing the Adoption of e-Health Technology in a Developing Country: An Extension of the UTAUT Model. *SAGE Open*, 11(3), p.215824402110275. doi:https://doi.org/10.1177/21582440211027565.

Guk, K., Han, G., Lim, J., Jeong, K., Kang, T., Lim, E.-K. and Jung, J. (2019). Evolution of Wearable Devices with Real-Time Disease Monitoring for Personalized Healthcare. *Nanomaterials*, [online] 9(6), p.813. doi:https://doi.org/10.3390/nano9060813.

Halis Kaan Akturk and Anila Bindal (2024). Advances in diabetes technology within the digital diabetes ecosystem. *Journal of Managed Care & Specialty Pharmacy*, 30(10-b Suppl), pp.S7–S20. doi:https://doi.org/10.18553/jmcp.2024.30.10-b.s7.

Hospitals, in (2024). *Needle.Tube - Diagnostic Lab Supplies, Great Prices, Fast Delivery, Blood Collection Needles, Blood Collection Tubes, Infusion Needles*. [online] Needle.Tube - Diagnostic Lab Supplies, Great Prices, Fast Delivery, Blood Collection Needles, Blood Collection Tubes, Infusion Needles. Available at: https://www.needle.tube/resources-58/Challenges-and-Strategies-for-Implementing-Wearable-Health-Monitoring-Technology-in-Hospitals [Accessed 14 Jun. 2025].

ICLG (2025). Digital Health Laws and Regulations Mexico 2025
| *Laws and Regulations | Mexico | ICLG*, [online] 1(1). Available at: Digital Health Laws and Regulations Report 2025 Mexico [Accessed 22 Jun 2025]

Imarcgroup.com. (2025). *Mexico Wearable Technology Market Size, Share, Trends and Forecast by Product, Application, and Region, 2025-2033*. [online] Available at: https://www.imarcgroup.com/mexico-wearable-technology-market [Accessed 9 Jun. 2025].

Ift.org.mx. (2023). *Encuesta Nacional sobre Disponibilidad y Uso de Tecnologías de la Información en los Hogares (ENDUTIH) 2023. (Comunicado de prensa) 13 de junio | Instituto Federal de Telecomunicaciones - IFT*. [online] Available at: https://www.ift.org.mx/comunicacion-y-medios/comunicados-ift/es/encuesta-nacional-sobre-disponibilidad-y-uso-de-tecnologias-de-la-informacion-en-los-hogares-endutih-1. [Accessed 25 Jun 2025]

INEGI. (2023). *Estadísticas sobre disponibilidad y uso de tecnologías de información en los hogares*. [online] Instituto Nacional de Estadística y Geografía. Available at: https://www.inegi.org.mx [Accessed 17 Jun 2025]

Insights10 (2022). *Insights10*. [online] Insights10.com. Available at: https://www.insights10.com/report/mexico-digital-health-market-analysis/ [Accessed 26 May 2025].

Iranifard, E. and Roudsari, R.L. (2022). Comparative research: An old yet unfamiliar method. *Journal of Midwifery and Reproductive Health*, [online] 10(3), pp.3317–3318. doi:https://doi.org/10.22038/jmrh.2022.66873.1954.

Ishtiaq, M. (2019). *(PDF) Book Review Creswell, J. W. (2014). Research Design: Qualitative, Quantitative and Mixed Methods Approaches (4th ed.). Thousand Oaks, CA: Sage*. [online] ResearchGate. Available at: https://www.researchgate.net/publication/332246566_Book_Review_Creswell_J_W_2014_Research_Design_Qualitative_Quantitat

Jadhav, A. (2024). *The Rise of Wearable Tech in Healthcare*. [online] Neurealm. Available at: https://neurealm.com/blogs/the-rise-of-wearable-tech-in-healthcare/ [Accessed 9 Jun. 2025].

Jarva, E., Oikarinen, A., Andersson, J., Tuomikoski, A., Kääriäinen, M., Meriläinen, M. and Mikkonen, K. (2022). Healthcare professionals' perceptions of digital health competence: A qualitative descriptive study. *Nursing Open*, 9(2). doi:https://doi.org/10.1002/nop2.1184.

Jobin, A., Ienca, M. and Vayena, E. (2019). The Global Landscape of AI Ethics Guidelines. *Nature Machine Intelligence*, [online] 1(9), pp.389–399. doi:https://doi.org/10.1038/s42256-019-0088-2.

Johnson, C. (2025). *Cochran's Sample Size Calculator & Formula*. [online] Dissertation Data Analysis Help. Available at: https://dissertationdataanalysishelp.com/cochrans-sample-size-calculator/. [Accessed 9 Jul 2025].

Klonoff, D.C., Buckingham, B., Christiansen, J.S., Montori, V.M., Tamborlane, W.V., Vigersky, R.A. and Wolpert, H. (2011). Continuous Glucose Monitoring: An Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism*, 96(10), pp.2968–2979. doi:https://doi.org/10.1210/jc.2010-2756.

Kostkova, P., Brewer, H., de Lusignan, S., Fottrell, E., Goldacre, B., Hart, G., Koczan, P., Knight, P., Marsolier, C., McKendry, R.A., Ross, E., Sasse, A., Sullivan, R., Chaytor, S., Stevenson, O., Velho, R. and Tooke, J. (2016). Who Owns the Data? Open Data for Healthcare. *Frontiers in Public Health*, 4(7). doi:https://doi.org/10.3389/fpubh.2016.00007.

Kuek, A. and Hakkennes, S. (2020). Healthcare staff digital literacy levels and their attitudes towards information systems. *Health Informatics Journal*, [online] 26(1). doi:https://doi.org/10.1177/1460458219839613.

Krouwer, J.S. (2025). Minimum requirements for continuous glucose monitors: What does it mean? *Journal of Diabetes Science and Technology*. doi:https://doi.org/10.1177/19322968251343645.

LAVCA. (2024). *2023 LAVCA Trends in Tech*. [online] Available at: https://www.lavca.org/research/2023-lavca-trends-in-tech/?utm_source=chatgpt.com [Accessed 25 Jun. 2025].

Lee, S.M. and Lee, D. (2020). Healthcare wearable devices: an analysis of key factors for continuous use intention. Service Business, 14(4). doi:https://doi.org/10.1007/s11628-020-00428-3.

Legault, L. (2017). *Self-determination theory*. [online] ResearchGate. Available at: https://www.researchgate.net/publication/317690916_Self-Determination_Theory. [Accessed 17 Jun 2025]

Levine, J.A. (2017). The Application of Wearable Technologies to Improve Healthcare in the World's Poorest People. *Technology and Investment*, 08(02), pp.83–95. doi:https://doi.org/10.4236/ti.2017.82007.

Lokuge, S., Sedera, D., Grover, V. and Dongming, X. (2019). Organizational readiness for digital innovation: Development and empirical calibration of a construct. *Information & Management*, 56(3), pp.445–461. doi:https://doi.org/10.1016/j.im.2018.09.001

Loconti, C. (2024). *What to Know About Insulin Patch Pumps*. [online] WebMD. Available at: https://www.webmd.com/diabetes/what-to-know-about-insulin-patch-pumps.

Lu, L., Zhang, J., Xie, Y., Gao, F., Xu, S., Wu, X. and Ye, Z. (2020). Wearable Health Devices in Health Care: Narrative Systematic Review. *JMIR mHealth and uHealth*, [online] 8(11). doi:https://doi.org/10.2196/18907.

Mansour, M., Saeed Darweesh, M. and Soltan, A. (2024). Wearable devices for glucose monitoring: A review of state-of-the-art technologies and emerging trends. *Alexandria Engineering Journal*, [online] 89, pp.224–243. doi:https://doi.org/10.1016/j.aej.2024.01.021.

Market.us. (2024). *Diabetes Wearables Market*. [online] Available at: https://market.us/report/diabetes-wearables-market/. [Accessed 21 Jun 2025].

MarketWatch. (2025). *2025 Mexico EHR Market Report: Technology Growth Amid Structural and Regulatory Barriers, Released by Black Book Research*. [online] Available at: https://www.marketwatch.com/press-release/2025-mexico-ehr-market-report-technology-growth-amid-structural-and-regulatory-barriers-released-by-black-book-research-50ee2d44 [Accessed 29 Jun. 2025].

Mexico Business. (2021). *Digital Health Regulation in Mexico: Hits and Opportunities*. [online] Available at: https://mexicobusiness.news/health/news/digital-health-regulation-mexico-hits-and-opportunities. [Accessed 17 Jun 2025]

Mexico Business. (2025). *Jobs, Digital Tools, Equity: The Week in Health*. [online] Available at: https://mexicobusiness.news/health/news/jobs-digital-tools-equity-week-health [Accessed 29 Jun. 2025].

Mexico Business. (2024). *Mexico Launches 2024 National Health, Nutrition Survey*. [online] Available at: https://mexicobusiness.news/health/news/mexico-launches-2024-national-health-nutrition-survey. [Accessed 20 Jun 2025]

Mexicohistorico.com. (2023). *The Development of Digital Healthcare Solutions in Mexico*. [online] Available at: https://www.mexicohistorico.com/paginas/The-Development-of-Digital-Healthcare-Solutions-in-Mexico.html [Accessed 25 Jun. 2025].

MobiHealthNews. (2017). *In study, Dexcom finds CGMs can benefit Type 2 patients, too*. [online] Available at: https://www.mobihealthnews.com/content/study-dexcom-finds-cgms-can-benefit-type-2-patients-too [Accessed 13 Jun. 2025].

Mobility Foresights (2025). *Mexico Wearable Medical Devices Market Size and Forecasts 2030*. [online] Mobility Foresights. Available at: https://mobilityforesights.com/product/mexico-wearable-medical-devices-market/ [Accessed 16 May 2025].

Morley, J., Floridi, L., Kinsey, L. and Elhalal, A. (2020). From What to How: An Initial Review of Publicly Available AI Ethics Tools, Methods and Research to Translate Principles into Practices. *Science and Engineering Ethics*, [online] 26(4). doi:https://doi.org/10.1007/s11948-019-00165-5.

Nascimento, I.J.B. do , Abdulazeem, H., Vasanthan, L.T., Martinez, E.Z., Zucoloto, M.L., Østengaard, L., Muscat, N.A., Zapata, T. and Ortiz, D.N. (2023). Barriers and facilitators to utilizing digital health technologies by healthcare professionals. *npj Digital Medicine*, [online] 6(1), pp.1–28. doi:https://doi.org/10.1038/s41746-023-00899-4.

OECD. (2025). *Digital Government in Mexico*. [online] Available at: https://www.oecd.org/en/publications/digital-government-in-mexico_6db24495-en.html.

Oudbier, S.J. (2024). Implementation barriers and facilitators of remote monitoring, remote consultation and digital care platforms through the eyes of healthcare professionals: a review of reviews. *BMJ open*, 14(6), pp.e075833–e075833. doi:https://doi.org/10.1136/bmjopen-2023-075833

Pascale (2025). *Technology Adoption in Care – What Are the Success Factors?(Part 3)*. [online] SocietyByte. Available at: https://www.societybyte.swiss/en/2025/06/10/technology-adoption-in-care-what-are-the-success-factorspart-3/ [Accessed 28 Jun. 2025].

Pavlovic, A., Rajovic, N., Pavlovic Stojanovic, J., Akinyombo, D., Ugljesic, M., Pavlica, M., Pavlovic, V., Randjelovic, S., Spaic, D., Masic, S., Stanisavljevic, D. and Milic, N. (2021). Electronic Health Record Acceptance by Physicians: A Single Hospital Experience in Daily Practice. *BioMedInformatics*, 1(1), pp.6–17. doi:https://doi.org/10.3390/biomedinformatics1010002.

Peng, P., Zhang, N., Huang, J., Jiao, X. and Shen, Y. (2023). Effectiveness of wearable activity monitors on metabolic outcomes in patients with type 2 diabetes: a systematic review and meta-analysis. *Endocrine Practice*. doi:https://doi.org/10.1016/j.eprac.2023.02.004.

Perlman, S.E. (2021). Use and Visualization of Electronic Health Record Data to Advance Public Health. *American Journal of Public Health*, 111(2), pp.180–182. doi:https://doi.org/10.2105/ajph.2020.306073.

Piwek, L., Ellis, D.A., Andrews, S. and Joinson, A. (2016). The Rise of Consumer Health Wearables: Promises and Barriers. *PLOS Medicine*, [online] 13(2), p.e1001953. doi:https://doi.org/10.1371/journal.pmed.1001953.

Poncette, A.-S., Mosch, L., Stablo, L., Spies, C., Schieler, M., Weber-Carstens, S., Feufel, M.A. and Balzer, F. (2021). Human-Centered Design with Usability Evaluation of a Remote Patient Monitoring System for Intensive Care Medicine: A Mixed-Methods Study (Preprint). *JMIR Human Factors*, 9(1). doi:https://doi.org/10.2196/30655.

Prime, R. (2024). *Positivism Philosophy in Research and Its Role in Research Paradigms*. [online] Bestdissertationwriter.com. Available at: https://bestdissertationwriter.com/positivism-philosophy-in-research/. [Accessed 1 July 2025]

Rodriguez-Leon, C., Villalonga, C., Munoz-Torres, M., Ruiz, J.R. and Banos, O. (2020). Mobile and Wearable Sensing for the Monitoring of Diabetes-related Parameters: Systematic Review (Preprint). *JMIR mHealth and uHealth*, 9(6). doi:https://doi.org/10.2196/25138.

Rodrigues, D.A., Roque, M., Mateos-Campos, R., Figueiras, A., Maria Teresa Herdeiro and Roque, F. (2024). Barriers and facilitators of health professionals in adopting digital health-related tools for medication appropriateness: A systematic review. *DIGITAL HEALTH*, [online] 10. doi:https://doi.org/10.1177/20552076231225133

Rouidi, M., Elouadi, A. and Hamdoune, A. (2022). Acceptance and use of telemedicine technology by health professionals: Development of a conceptual model. *DIGITAL HEALTH*, 8, pp.1–9. doi:https://doi.org/10.1177/20552076221081693.

Salinas, M.A. (2021). Cost of diabetes treatment in Mexico. *Mexican Journal of Medical Research ICSA*, 9(17), pp.16–21. doi:https://doi.org/10.29057/mjmr.v9i17.5593.

Schwarz, P. (2025). IDF global clinical practice recommendations for managing type 2 diabetes – 2025. *Diabetes Research and Clinical Practice*, p.112158. doi:https://doi.org/10.1016/j.diabres.2025.112158.

See, W. (2025). *Wearable Devices To Manage Diabetes Will See Growth In The EU Following Funding, But Will Not Disrupt The Diabetes Tech Market*. [online] Fitch Solutions. Available at: https://www.fitchsolutions.com/medical-devices/wearable-devices-manage-diabetes-will-see-growth-eu-following-funding-will-not-disrupt-diabetes-tech-market-20-05-2025 [Accessed 13 Jun. 2025].

Seidl, F., Hinterwimmer, F., Vogt, F., Edenharter, G.M., Braun, K.F., von Eisenhart-Rothe, R., Biberthaler, P. and Pförringer, D. (2025). Use and Acceptance of Innovative Digital Health Solutions Among Patients and Professionals: Survey Study. *JMIR Human Factors*, [online] 12. doi:https://doi.org/10.2196/60779.

Sharma, A. (2025). *Different generations engage with digital health in diverse ways depending on age, habits and comfort with tech.* [online] Linkedin.com. Available at: https://www.linkedin.com/posts/ajoosharma_different-generations-engage-with-digital-activity-7340829617726857218-72dr/ [Accessed 7 Jul. 2025].

Sharon, T. (2018). When digital health meets digital capitalism, how many common goods are at stake? *Big Data & Society*, 5(2), p.205395171881903. doi:https://doi.org/10.1177/2053951718819032.

Smuck, M., Odonkor, C.A., Wilt, J.K., Schmidt, N. and Swiernik, M.A. (2021). The emerging clinical role of wearables: factors for successful implementation in healthcare. *npj Digital Medicine*, [online] 4(1), pp.1–8. doi:https://doi.org/10.1038/s41746-021-00418-3.

Soto-Estrada, G., Moreno-Altamirano, L., Naghielli Álvarez-Chombo and García-García, J.J. (2025). Epidemiological panorama of type 2 diabetes in Mexico: differences by state and social determinants. *Revista Médica Del Hospital General De México*, [online] 88(1). doi:https://doi.org/10.24875/hgmx.24000029

Statista. (2024). *Number of people without access to health services in Mexico 2018*. [online] Available at: https://www.statista.com/statistics/1042175/mexico-number-population-lack-access-health-services/. [Accessed 6 Jul. 2025].

Tanenbaum, M.L., Adams, R.N., Hanes, S.J., Barley, R.C., Miller, K.M., Mulvaney, S.A. and Hood, K.K. (2017). Optimal Use of Diabetes Devices: Clinician Perspectives on Barriers and Adherence to Device Use. *Journal of Diabetes Science and Technology*, 11(3), pp.484–492. doi:https://doi.org/10.1177/1932296816688010.

Tentori, M., Ziviani, A., Muchaluat-Saade, D.C. and Favela, J. (2020). Digital healthcare in Latin America. *Communications of the ACM*, 63(11), pp.72–77. doi:https://doi.org/10.1145/3423923.

Theodos, K. and Sittig, S. (2020). Health information privacy laws in the digital age: HIPAA doesn't apply. *Perspectives in Health Information Management*, [online] 18(1), p.1l. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC7883355/.

Tsao, D.N. (2025). *Transforming Diabetes Care with Digital Health Innovations*. [online] IDTechEx. Available at: https://www.idtechex.com/en/research-article/transforming-diabetes-care-with-digital-health-innovations/32916 [Accessed 13 Jun. 2025].

Unimrkt Research (2023). *An Expert's Guide to Successful Quantitative Descriptive Research*. [online] Unimrkt Research. Available at: https://www.unimrkt.com/blog/an-experts-guide-to-successful-quantitative-descriptive-research.php. [Accessed 30 Jun 2025].

Vivanco, J.S., Angel, M. and Adame, M.G. (2017). *Challenges for using IT in Mexico's health care industry (Aguascalientes México Case)*. [online] Available at: https://www.researchgate.net/publication/354791656_Challenges_for_using_IT_in_Mexico. [Accessed 9 Jun 2025]

Watson, A. (2022). *How Much Does a Continuous Glucose Monitor Cost and Will Insurance Pay For It?* [online] Goodrx.com. Available at: https://www.goodrx.com/conditions/diabetes/continuous-glucose-monitor-cost.
[Accessed 19 Jun 2025]

Weidmann, T. (2024). *The adoption of digitalisation by healthcare professionals: Insights and Opportunities*. [online] digitalswitzerland. Available at: https://digitalswitzerland.com/digital-health-study-the-adoption-of-digitalisation-by-healthcare-professionals/. [Accessed 9 Jun 2025]

Weiner, B.J. (2020) 'A Theory of Organizational Readiness for Change'. *Research Papers in Economics*, pp. 215–232. Available at: https://EconPapers.repec.org/RePEc:elg:eechap:18688_8. [Accessed 16 Jun 2025]

World Health Organization (2021). *Ethics and governance of artificial intelligence for health*. [online] www.who.int. Available at: https://www.who.int/publications/i/item/9789240029200. [Accessed 16 Jun 2025]

Yang Meier, D., Barthelmess, P., Sun, W. and Liberatore, F. (2020). An Empirical Study on Wearable Technology Acceptance in Healthcare: A Cross-Country Analysis Between Chinese and Swiss Consumers Based on Differences in National Culture (Preprint). *Journal of Medical Internet Research*, 22(10). doi:https://doi.org/10.2196/18801.

Zaghloul, H., Arayssi, T., Rakab, A., Lina, A., Maryam, A., Varghese, S., Omar, S., Al-Najjar, Y., El-Khory, R. and Gray, J. (2024). Digital Health Literacy in Patients with Common Chronic Diseases: A Systematic Review and Meta-analysis (Preprint). [online] doi:https://doi.org/10.2196/preprints.56231.

APPENDICES

Appendix A – Online survey (Google Form)

Assessing professionals' perspectives on wearable devices for type 2 diabetes management

Start of Block:

The purpose of this study is to explore the readiness and willingness of healthcare professionals to incorporate wearable technologies (e.g., continuous glucose monitors, smart watches, smart Insulin pens) into their routine practice when caring for patients with Type 2 Diabetes. Results will help to gain insight into key challenges, ethical concerns, and practical needs that should be addressed to support an effective implementation. As a healthcare professional, your participation is essential. your input will contribute to a better understanding if wearables can be implemented as a common routine practice for Type 2 Diabetes In Mexico. The survey will take approximately **5-10** minutes to complete. All responses are **anonymous** and will be treated with strict **confidentiality**. **Participation is entirely voluntary**. You may withdraw at any time without any consequence. Thank you so much for considering participating in this study.

Page Break

Do you consent to take part in this study?

- ○ Yes, I consent to take part in this study
- ○ No, I do not consent to take part in this study

What age range are you in?

- ○ Under 30
- ○ 30-39
- ○ 40-49
- ○ 50-59
- ○ 60+

Professional Role

- ○ General Practicioner
- ○ Resident/Intern
- ○ Specialist (Please specify)

_____

- ○ Other (Please specify)

How many years of professional experience do you have

- ○ Less than 5
- ○ 5-10
- ○ 11-15
- ○ 16-20
- ○ More than 20

Page Break

Section 1 In this section, we would like to know your familiarity and use of wearable devices. 1- How familiar are you with wearable devices for diabetes management (continuous glucose monitors, Smart watches, Smart insulin pens/patches)?

- ○ Not at all familiar
- ○ Slightly familiar
- ○ Familiar
- ○ Very familiar
- ○ Extremely familiar

2- Have you ever recommended a wearable device to a patient with type 2 Diabetes?

- ○ Yes
- ○ No

3- Do you currently use or have you personally used wearable devices in your clinical practice?

- ○ Yes
- ○ No

Section 2 Instructions: For each of the following questions, please indicate your level of agreement using the following scale: 1- Strongly Disagree 2- Disagree 3- Neither Agree Nor Disagree 4- Agree 5- Strongly Agree 4-
I am familiar with how wearable devices (e.g., continuos glucose monitors, Smart watches) function in managing type 2 diabetes

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither Agree Nor Disagree
- ○ Agree
- ○ Strongly Agree

Page Break

5- Wearable devices provide valuable real-time data for Type 2 Diabetes management.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly Agree

Page Break

6- I feel confident in my ability to interpret data provided by wearable health devices

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly Agree

7- I am open to adopting wearable health technologies as part of my professional practice in the future

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly Agree

8- Concerns about the privacy and security of patient data from wearable devices are significant.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly Agree

9- The cost of wearable devices is a major barrier for patients

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly Agree

10- I am willing to receive training on wearable devices for diabetes management

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly Agree

11- Younger healthcare professionals are generally more comfortable using new digital health tools.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

12- Older healthcare professionals tend to rely more on traditional methods than on digital technologies.

- ○ Strongly Disagree
- ○ Disagree
- ○ Neither agree nor disagree
- ○ Agree
- ○ Strongly agree

End of Block:

Start of Block:

Section 3 In this section, we like to gain a clear insight into your readiness to adopt wearable devices. Instructions: Please rank the following factors in order of importance

for increasing your willingness to incorporate wearable technology into your clinical practice. (1= Most important, 6= Least important)

_____ More training and education about wearables
_____ Demonstrated clinical effectiveness of wearables
_____ Better data privacy and security
_____ Institutional support and infrastructure
_____ Affordability and insurance coverage for patients
_____ Availability of technical support

Page Break

14- If wearable devices were to be introduced in your clinical practice, what do you think would be the three biggest challenges to using them? (Please select up to 3)

- [ ] Devices price
- [ ] Lack of training about how to use them
- [ ] Concerns about patient data privacy
- [ ] Changes in how work is done
- [ ] Doubts about how accurate the devices are
- [ ] Not enough support from institutions
- [ ] Other (Please explain)

15- If not using, what would most help you or your institution to adopt wearable devices? (Select all that apply)

- ☐ Lower costs or insurance coverage for devices
- ☐ Training programs about how to use wearables
- ☐ Devices that are simple to use and work well with other systems
- ☐ Better protection for patient data
- ☐ support or advice from coworkers
- ☐ Other (Please explain what)

16- Please provide any additional comments or thoughts regarding wearable devices in Type 2 Diabetes management in Mexico..

_____

_____

_____

_____

_____

End of Block:

Start of Block:

Section 4 For this last section we will like to ask you some questions regarding your professional experience and perspective

17- About how many patients with type 2 diabetes do you see in a typical month?

- ○ Fewer than 10
- ○ 10-30
- ○ 31-50
- ○ More than 50

21- How likely are you to recommend wearable devices to your patients in the near future?

- ○ Very unlikely
- ○ Unlikely
- ○ Not sure
- ○ Likely
- ○ Very likely

22- In the future, do you think the use of wearable devices for diabetes management will:

- ○ Increase a lot
- ○ Increase somewhat
- ○ Stay about the same
- ○ Decrease
- ○ Not sure

23- Which of the following do you consider to be the main challenges to adopting wearable devices for diabetes in Mexico (select all that apply)

- ☐ Cost to healthcare institutions
- ☐ Cost to patients
- ☐ Limited access to reliable internet or technology infrastructure
- ☐ Limited training opportunities for healthcare professionals
- ☐ Concerns about data privacy and security
- ☐ Access to health devices
- ☐ Regulatory or policy barriers
- ☐ Patient digital literacy
- ☐ Other (please specify)

_____

Appendix B – Ethics Form

Ethics Application & Declaration Form

DISSERTATION TITLE: “PERCEPTION AND READINESS OF HEALTHCARE PROFESSIONALS AT DIFFERENT CAREER STAGES IN MEXICO IN ADOPTING WEARABLE DEVICES IN TYPE 2 DIABETES MANAGEMENT”.

RESEARCHER’S NAME: Cristina Granados Alvarado

PROGRAMME OF STUDY: MSc In Digital Transformation

SUPERVISOR'S NAME: Dr Brendan McLaughlin

DECLARATION:
The information in this application form is accurate to the best of my knowledge. I undertake to abide by the principles outlined by Innopharma/Griffith College ethics policy in my research dissertation. I confirm that I have completed a full ethics assessment for my research dissertation as per the college guidelines. I will not begin my primary research until such approval from my supervisor and/or ethics Committee has been obtained.
I pledge to carry out my research according to the Innopharma/Griffith College academic integrity standards. Any results presented in my dissertation will be from my own, original research, I will reference and/or acknowledge any material or sources used in its preparation and I will not plagiarise the work of anyone else.

For Student:
STUDENT SIGNATURE: 

DATE: 25/06/2025

The research contained within this research dissertation proposal has been approved.

For Supervisor:

Ethics Committee Approval Required: Yes ☐ No ☒

SUPERVISOR SIGNATURE: Brendan McLaughlin

DATE:25/06/2025

For Ethics Committee (if required):

Ethics Committee Approval Given: Yes ☐ No ☐

ETHICS COMMITTEE MEMBER SIGNATURE:

DATE:

NOTE: Supervisors are responsible for ensuring their students fill in this form correctly and that all ethical areas have been considered.

SECTION 1: DESCRIPTION OF RESEARCH STUDY

1.1 **Purpose and objectives of research**. While literature has reported multiple benefits in the use of wearable devices in healthcare management, there is still a crucial gap that this study aims to answer regarding the Mexican healthcare system, where infrastructural, cultural, and economic factors influence adoption. By exploring the differences between junior and senior healthcare professionals, understanding that individuals' career stages may influence the level of digital literacy, openness to innovation, and trust in technology; tailored training and implementation strategies can be developed *(Weidmann, 2024)*

This research has the following objectives:

5- Assess the perception and understanding of wearable devices for type 2 diabetes management among junior and senior healthcare professionals in Mexico.
6- To explore and compare perceptions regarding benefits, risks, and limitations in using wearable technologies in the care and monitoring of diabetes between junior and senior healthcare practitioners.
7- To observe the readiness and willingness of these practitioners to integrate wearable devices into medical practice for diabetes management.
8- To explore and identify key challenges and enablers influencing the adoption of wearable devices in medical practice in Mexico from the perspectives of junior and senior professionals.
    - And observe if there is a difference in perspective between them.

1.2 **Research methodology**: This research applies a positivism philosophy with a deductive approach, focusing on a mixed-methods quantitative strategy to explore the adoption of wearable technologies in type 2 Diabetes management (T2D), focusing on healthcare professionals' perspectives and perceived readiness. This methodology enables a comprehensive understanding of the differences in perception and readiness between junior and senior healthcare professionals by adopting the use of quantitative data in the form of surveys, which provides insight into patterns, trends, and correlations between medical professionals at different career stages in Mexico.
Data will be collected through online platforms applying surveys with the following characteristics: Likert-scale items to assess attitudes, perceived challenges/benefits, and readiness, closed-ended Yes/No questions for professional background, and open-ended questions to provide broader insights and enrich findings. The participants will combine a mix of residents, early-career doctors, specialists, and clinicians with more than 10 years of experience working in Mexico.
Quantitative data from the surveys will be analyzed using descriptive statistics, utilizing Excel and JASP to identify trends, patterns, and correlations. The data from the dataset will then be compared to triangulate and strengthen interpretations. The findings will be presented through tables and charts, utilizing Tableau and Power BI tools.

SECTION 2: POSSIBLE ETHICAL ISSUES

Answer 'yes' or 'no' to the following questions.

SUBJECT MATTER

Does the research proposal involve:

Research into specific company activities that would be deemed sensitive or confidential No

Research into politically and/or racially/ethnically and/or commercially sensitive areas	No
Sensitive, personal, professional or corporate issues	No

RESEARCH PROCEDURES

Does the research proposal involve:

Research that might damage the reputation of companies or participants	No
Research that may negatively affect the reputation of Griffith College/Innopharma	No
Use of personal records without consent	No
Use of company data without consent	No
The offer of any inducements to participate	No
Audio or visual recording without consent	No
Using a language other than English	No

PARTICIPANTS

Does the research proposal involve:

People who are not competent and/or fluent in English	No
Does your research group include any of the following vulnerable groups	No

If you have answered NO to ALL questions, please go straight to Section 4.

If you have answered YES to ANY question in SECTION 2, you must fill in SECTION 3.

SECTION 3: STEPS TAKEN TO AVOID ETHICAL ISSUES

3.1. If your ethics relates to ***Subject Matter***, outline your action plan to work around any sensitive issues.
3.2. If your ethics relates to ***Research Procedures***, outline your action plan to deal with possible ethical issues in your research procedures.
3.3. If your ethics relates to ***Participants***, outline how you will protect vulnerable persons or those that do not have English as their first language.

SECTION 4: ABOUT YOUR PARTICIPANTS

4.1. Outline your participant profile and why you have chosen them for this study.
Participants for this study include general practitioners, specialists, and healthcare professionals involved in the management of type 2 diabetes in Mexico, they were selected due to their direct and sustained involvement in the diagnosis, treatment, and long-term management of patients with T2D, and their critical role in the potential integration of wearable technologies into routine practice. They were also specifically selected based on the stages in their professional careers, a careful selection between young practitioners with less than 5 years of experience and more experienced clinicians with over 10 years of practice.
In the majority of cases GPs are the first point of contact for patients in Mexico and are responsible for a broad range of preventive, diagnostic, and follow-up care tasks, they often manage a large number of T2D patients and are well-positioned to observe the potential benefits or risks of integrating wearables into daily practice. Their perspectives will help assess the general readiness and viability of implementation at a primary care level.
On the other hand, specialists like endocrinologists and Nutritionists, are in charge of managing patients with more advanced or poorly controlled T2D and are directly involved in more specialized interventions, like insulin management, comorbidity coordination. They are also more likely to engage with advanced diagnostic and monitoring tools, which is why their opinions can critically evaluate the clinical utility of wearable devices. The distinction between career stages enables the study to assess how professional maturity, clinical exposure, and technological familiarity affect toward digital tools.
Specialized nurses in diabetes care, like diabetes educators and chronic care nurses, provide patient education, follow-up care, lifestyle counselling, and support for self-management. They frequently serve as intermediaries between patients and physicians, being responsible for helping patients understand and use wearable

technologies. Their daily contact with patients gives them a unique perspective on patient engagement and usability on wearables that often physicians don't have.

4.2 How do you plan to gain access to/contact/approach your participant(s).
The use of professional contacts will be employed as the primary means of gaining access to hospitals and clinics in a city located in Mexico. A survey link will be distributed among healthcare professionals working as General Practitioners or Specialists in Diabetes management.
In order to reach the desired target Participants, the use of online platforms like linkedIn and facebook will be employed to distribute the survey link.
Targeting healthcare professionals working in a foreign country will be highly considered at the moment of distributing the survey.

SECTION 5: INFORMATION, CONSENT AND CONFIDENTIALITY

5.1 **Participant Information Letter (PIL) for participants**

Please confirm below that your information letter covers:

Description of the research topic and method	Yes
Details of what participation will involve	Yes
Rights to anonymity	Yes
Confidentiality	Yes
Rights to withdraw from the research	Yes
The contact details of the researcher and supervisor (if necessary)	Yes

5.2 **Informed Consent Form (ICF) for participants**

Please indicate below if your research requires a signed consent form by selecting the relevant option only:
.
No: my research study involves an online survey only and/or does not require signed consent. Consent will be included on the survey as follows:

1. **Do you consent to take part in this study?**

   Yes, I consent to take part.
   No, I do not consent to take part.

SECTION 6: STORAGE OF DATA

6.1. How will you store the research data and for how long? How will you manage data protection issues?

All data will be handled following the GDPR and national data protection laws. All research data, including surveys and data analysis, will be stored in a soft copy format, on a password-protected, encrypted cloud storage account (OneDrive), that is accessible only to authorized individuals. All research data will be stored for a period of two years after the qualification is rewarded, in accordance with the data protection regulations management policies. After this retention period, all data will be securely deleted.

All participants identities will be protected through anonymization, without any personal information attached

Personal information will be collected only with previous consent, and participants will be informed of their right of withdraw at any moment.

SECTION 7: NON-DISCLOSURE AGREEMENT & STUDENT CONSENT

7.1 **Non-Disclosure Agreement (NDA)**
Will the final dissertation contain any information pertaining to any source what would warrant the use of a Non-Disclosure Agreement (NDA) e.g. industry-based research?

No

7.2 **Student consent**
If a Non-Disclosure Agreement (NDA) is not required, does the Student consent to allow their completed dissertation to be held/published by Innopharma/Griffith College?

Yes

SECTION 8: RECORDING AND RETENTION OF DISSERTATION VIVA

8.1 **Viva Recording**
The Dissertation viva will be recorded. This recording may be used to facilitate assessment by Innopharma staff, a third reader if necessary and/or if requested by the external examiner for the Programme. The recording will be held in line with current GDPR guidelines and will not be made publicly available.

SECTION 9: DOCUMENT CHECKLIST

NOTE: Applicants must attach the following documents in electronic format to the appendix.

Which documents are added to the appendix? Please tick N/A if not applicable:

9.1 Participant Information Letter (PIL) for participant	Yes
9.2 Informed Consent Form (ICF) for participant	Yes
9.3 Questions/survey for interviewees/focus groups etc *(can be in draft form)*	Yes
9.4 Any other documents e.g. Non-Disclosure Agreement	N/A

I confirm that this application is complete and all required documents are included in the appendix.

For Student:
STUDENT SIGNATURE: 

DATE 25/06/2025