Transforming Wellness: Perceptions on the Impact of Innovative Digital Technologies in Fitness Centers

Bernardo Leony Filho

Dissertation written under the supervision of Professor Henrique Martins

Dissertation submitted in partial fulfilment of requirements for the MSc in Management with Specialization in Strategic Marketing, at the Universidade Católica Portuguesa, September 2023.

Abstract

Title: Transforming Wellness: Perceptions on the Impact of Innovative Digital Technologies in Fitness Centers

Author: Bernardo Leony Filho

This study investigates the relationship between promoting wellness and physical activity using innovative digital technology. We highlight the undeniable connection between regular physical activity and well-being. We also address the pressing issue of the physical inactivity epidemic and the need for diverse strategies to combat it.

The main focus of this study is the crucial role of innovative digital technologies in fitness facilities. Firstly, it aims to elucidate the potential impact of these technologies, exploring how they can transform health and well-being by providing personalized guidance, facilitating instant access to data, and enhancing the overall user experience.

Secondly, it investigates the diverse perspectives of users and consumers, shedding light on their experiences and concerns when engaging with these technologies.

Lastly, it places significant emphasis on understanding the impacts on the healthcare system and explores sustainable ways for organizations to adopt these technologies, including the business aspects.

Despite the potential benefits of digital technologies, we identify obstacles, including user resistance and privacy concerns. However, we also recognize the evident potential for enhancing well-being.

Based on our findings, we offer practical suggestions for stakeholders, such as the Health Ministry and facility managers. To utilize digital technology for wellness, these guidelines emphasize informed decision-making, data protection, education, and collaboration.

Cutting-edge digital technologies hold the potential to improve population's health boost fitness center productivity and, consequently the quality of health care and system effectiveness.

To effectively promote wellness, this study urges stakeholders to embrace digital opportunities while addressing related challenges.

Keywords: Chronic diseases, Digital technology, Disruptive innovation, Fitness, Apps, Mobile health, Healthcare, Mental health, Physical activity, Quality of life, Well-being, Wellness.

Resumo

Título: Transformar o bem-estar: Percepções sobre o impacto das tecnologias digitais inovadoras nos centros fitness

Autor: Bernardo Leony Filho

Este estudo investiga a relação entre a promoção do bem-estar e a atividade física utilizando tecnologia digital inovadora. Destacamos a inegável ligação entre a atividade física regular e o bem-estar.

Abordamos também a questão da inatividade física e a necessidade de estratégias diversificadas para a combate-la. O estudo foca no papel das tecnologias digitais nas instalações de fitness.

Primeiro, explora o impacto dessas tecnologias na saúde e no bem-estar, fornecendo orientação personalizada, acesso instantâneo a dados e melhorando a experiência do usuário.

Em segundo lugar, investiga as diversas perspectivas dos utilizadores e consumidores sobre as suas experiências e preocupações quando utilizam estas tecnologias.

Por último, foca na compreensão dos impactos no sistema de saúde e explora formas sustentáveis para organizações adotarem essas tecnologias.

Apesar dos enormes benefícios das tecnologias digitais, identificamos obstáculos, incluindo a resistência dos utilizadores, preocupações com a privacidade e a necessidade de aconselhamento especializado.

No entanto, também reconhecemos o potencial evidente de melhoria do bem-estar. Com base nas conclusões, apresentamos sugestões práticas para as partes interessadas, como o Ministério da Saúde, gestores de instalações e indivíduos, enfatizando a importância na tomada de decisões baseadas em informação, proteção de dados, educação e colaboração.

As tecnologias digitais têm o potencial de melhorar a saúde da população, aumentar a produtividade dos centros de fitness e, consequentemente, a qualidade dos cuidados e a eficácia do sistema de saúde como um todo.

Para promover o bem-estar, é importante abraçar as oportunidades digitais e abordar os desafios relacionados.

Palavras-chave: Doenças crónicas, Tecnologia digital, Inovação disruptiva, Fitness, Apps, Saúde móvel, Assistência Médica, Saúde mental, Atividade física, Qualidade de vida, Bem-estar.

Acknowledgements

I want to sincerely thank the people and organizations listed below who contributed significantly to the completion of my dissertation:

First, I want to express my gratitude to Professor Henrique Martins, who served as my dissertation supervisor, for his continuous support and direction. Your feedback and insights have greatly influenced the direction of my work.

I would also like to extend my sincere gratitude to all the participants and fitness facilities who generously agreed to take part in my interviews. Their valuable contributions and cooperation were crucial in enabling me to achieve my research objectives.

In addition, I would like to express my gratitude to my family for their unwavering support and encouragement during my master's studies at Universidade Católica Portuguesa. Their love and support have been a constant source of strength and motivation throughout my academic journey.

Finally, I would like to thank my dear friend Juliana Jordão, who has been at my side constantly and supported me throughout my master's studies. Your unwavering friendship, support, and guidance in every course, challenge, and during the master's thesis writing process have been invaluable. I am grateful for your presence in my life.

Table of Contents

List of Fugures

List of Tables

List of Abreviations

ACSM – American College of Sports Medicine
CRM – customer Relationship Management
eHealth – Electronic Health Care
EHR – Electronic Health Records
mHealth – Mobile Health
PT – Persuasive Technology
WHO – World Health Organization

1. Introduction

1.1. Problem Definition and Relevance

"Once a new technology rolls over you, if you're not part of the steamroller, you're part of the road." – Stewart Brand

The emergence of new technological developments in a world of constant digital revolution has significantly impacted our way of life (Pew Research Center, 2021). The constant innovation and advancements in digital technology, including a wide range of digital tools and solutions, have the power to influence various aspects of our lives, such as our physical health, general well-being, combating physical inactivity, treating, and preventing non-communicable chronic diseases, and improving the overall public health system (Wadhera et al., 2020). This study embarks on a journey to investigate this dynamic relationship, where the synergy between regular physical activity and overall well-being is unmistakable.

The promotion of wellness and physical activity within the modern landscape is intricately tied to innovative digital technology (Li et al., 2017). At the heart of our inquiry lies the pivotal role of cutting-edge digital technologies within fitness facilities. According to Vatandoost and Litkouhi, (2019) the transformative potential of these technologies has the capacity to reshape a new era of wellness and health.

The expanding healthcare issues that modern society is facing, are primarily defined by the rise in chronic diseases and the burden on healthcare resources (Abernethy et al., 2022). In the grander scheme of public health, the paper (Stoumpos, Kitsios, & Talias, 2023), highlights the immense potential of digital innovation in addressing these broader health issues.

Looking ahead, it is anticipated that this technology will develop further and have a greater impact on the healthcare system (Accenture, 2019). Further adoption of these innovative digital technology in fitness centers is projected in the upcoming years and it is something that is already happening in many facilities (Angosto et al., 2020).

These cutting-edge digital technologies hold the potential to not only enhance individual health but also boost the productivity of fitness centers, exploring sustainable approaches for organizations, including the associated business aspects (Siegel & Krishnan, 2020),

The potential benefits of digital technologies are substantial, yet they are not without their challenges, including user resistance and privacy concerns (Siegel & Krishnan, 2020). To effectively promote wellness in this digital age, consequently improving the quality of healthcare and system effectiveness, is necessary for stakeholders, such as the Health Ministry and facility managers, to embrace the opportunities presented by these digital advancements while actively addressing the challenges that accompany them (Roy et al., 2018).

1.2 Aims of the Study

The main objective of this dissertation is to investigate how advanced digital technologies, particularly those integrated into fitness facilities, can enhance population health and overall well-being while assessing their potential impact on the healthcare system. To achieve this goal, the study will focus on several specific objectives:

- Examine the Role of Innovative Digital Technologies: The first objective is to investigate the role of innovative digital technologies, such as fitness trackers and smartwatches, in promoting physical activity and improving individual health. This involves analyzing the effectiveness of wearables in boosting physical activity levels and contributing to enhanced physical health among users.

- Explore the Adoption Factors: This research aims to investigate the factors influencing the adoption of digital tools and technologies in the context of fitness facilities. By understanding the enablers and barriers associated with the utilization of these innovations, the study seeks to identify strategies to encourage their widespread adoption.

- Assess the Impact on Chronic Disease Management: Given the epidemic proportions of chronic diseases (Bull et al., 2020), another crucial objective is to assess how digital technologies integrated into fitness centers can contribute to better management of chronic illnesses. This involves examining whether these technologies can improve health outcomes for individuals grappling with such conditions.

- Investigate Mental Health and Well-Being Implications: Beyond physical health, the study aims to explore the potential of digital interventions to positively impact mental health, overall quality of life, and general well-being. This includes assessing how digital tools within fitness facilities can address psychological well-being and improve the overall quality of life for users.

- Understand Broader Public Health Implications: Lastly, this research aims to understand the broader implications of digital innovation in the context of public health. By examining how these technologies can contribute to population health and potentially alleviate the burden on healthcare resources, the study seeks to shed light on the larger societal benefits of such advancements.

- Examine Business Model Adaptations: In addition to the health and well-being aspects, this study will look at how companies, notably fitness centers and other associated service providers, might modify their business models to take advantage of and accommodate cutting-edge digital technologies. We want to demonstrate the potential advantages for organizations, such as improved customer engagement, increased operational efficiency, and new revenue streams, by investigating cutting-edge business methods that are in line with these technologies. We'll also examine how adopting digital technologies might position

companies to prosper in a fitness and wellness market that is rapidly changing, eventually encouraging sustainability and growth. This examination of the commercial side will give readers a thorough understanding of the overall effects of cutting-edge digital technology on both people's well-being and the fitness sector.

1.3 Research Questions

The following research questions will guide the analysis of this dissertation:

1. What is the importance of physical activity to human health and what role does technology play in this?
2. What evidence is there to support the use of innovative digital technologies in fitness clubs to promote wellness?
3. What are the main barriers and opportunities for fitness clubs to adopt innovative digital technologies to promote wellness?

1.4 Structure of the Thesis

Chapter 1 introduced the study's purpose, its relevance, and the three main research questions.

Chapter 2 is a comprehensive but selective literature review of previous studies on the same topic or related to the research questions to better inform the methodology and discussion.

Chapter 3 of the dissertation explains the research methodology used, including all the steps and decisions made to answer the research questions, such as the type of research, the procedures used, and the analysis of the data collected.

Chapter 4 presents the results, while Chapter 5 offers a detailed discussion and interpretation of them and their implications.

The final chapter contains concluding remarks based on the analyses performed, presenting relevant recommendations, possible limitations, and future work.

2. Background Review

2.1. The importance of exercise and its crucial impact on your overall health and well-being

2.1.1. Determining Physical Exercise & Physical Activity

In 1985, Dr. Caspersen and Dr. Powell published a paper that defined and distinguished health-related research. For the first time, they attributed separate meanings to physical activity and physical exercise. According to them, "Physical activity and Physical Exercise are terms that describe different concepts, however, they are often confused with one another, and the terms are sometimes used interchangeably" (Caspersen, Powell, & Christenson, 1985).

To this day, the World Health Organization (WHO) uses the same distinct definitions coined by Dr. Caspersen and Dr. Powell, as shown below:

"Physical activity refers to any bodily movement produced by skeletal muscles that results in energy expenditure." Physical activity can be categorized into occupational, work, household chores, transportation (e.g., walking or cycling to work), and leisure activities (e.g., playing or dancing).

Physical exercise, on the other hand, is defined as "a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness."

2.1.2. Determining Health

The definition of health was early described by the World Health Organization's 1948 declaration as "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (Larsen, 2022).

2.1.3. Physical exercise and physical health: their relationship

After conducting extensive research, Warburton, Nicol, and Bredin (2006) conclude that regular physical exercise is crucial for maintaining excellent physical health. One of the most well-established connections between exercise and health revolves around cardiovascular well-being. Warburton's meta-analysis emphasizes the cardiovascular benefits of exercise, such as reducing the risk of heart disease, lowering blood pressure, and enhancing vascular function. These findings are reinforced by the work of Myers (2017), highlighting that exercise represents a powerful prescription for a healthy heart.

Early research by Drewnowski and Evans (2001) also highlights the importance of exercise for cardiovascular health. The research emphasizes how physical activity improves cardiovascular

system performance and serves as a protective barrier against heart diseases by lowering risk factors, including high blood pressure. In addition, exercise affects metabolic health by assisting with weight control, improving insulin sensitivity, and reducing diseases like obesity and type 2 diabetes.

In essence, physical exercise has numerous benefits and plays a crucial role in improving physical health in all of its manifestations. Ruegsegger and Booth (2018) provide a comprehensive review of the physical health benefits associated with physical exercise. The research conducted emphasizes the role of exercise in enhancing overall quality of life and how regular physical exercise is associated with increased energy levels, improved sleep patterns, and a greater sense of vitality.

2.1.4. Physical exercise and mental health: their relationship

Stubbs' 2017 study explores the complex relationship between exercise and anxiety. Using data from the World Health Survey, the study highlights the significance of exercise in reducing anxiety symptoms. The research indicates that leading an active lifestyle can help to alleviate nervous symptoms.

In a separate study, Meyer (2016) investigates the connection between physical activity intensity and depressed mood. The research illuminates how different levels of physical activity intensity can affect individuals who are depressed. Meyer concludes that single sessions of light, moderate, and hard intensity exercise could have useful therapeutic effects in depression.

While these studies capture a range of mental health benefits associated with physical exercise, Rebar's 2019 work delves deeper into the perceptions and experiences of motivation among people with depression. This qualitative study uncovers how motivation plays a pivotal role in driving individuals to engage in exercise for mental health enhancement.

Furthermore, Rebar's meta-analysis examines the relationship between different types of physical activity and their impact on depression and anxiety in non-clinical adult populations, revealing that various forms of physical activity can have different positive effects on reducing symptoms of depression and anxiety.

Collectively, these research papers underscore the importance of physical exercise not only as a means of improving physical health but also as a potent tool for nurturing mental well-being.

2.1.5. Physical exercise and social health: their relationship

The importance of physical activity extends beyond its positive impact on physical well-being. Studies have shown the undeniable connection between physical activity and social health, revealing how consistent physical activity can facilitate the establishment of meaningful social connections and enhance overall social well-being.

In a 2017 study conducted by Lindwall and Ljung, the complex relationship between exercise and health-related quality of life was explored. The research examined various dimensions, including physical and psychological aspects, and their impact on the social facets of well-being. The study found that physical activity can have a positive effect on social interactions and relationships.

People who exercise may have better social health due to the increased opportunities for interaction and involvement with others.

Furthermore, a 2017 study investigated the interplay between social support, physical exercise, and general quality of life. Their study emphasizes that robust social networks can amplify the positive effects of physical activity on individuals, as social support acts as a mediator between exercise and well-being. The findings suggest that due to the multifaceted benefits of exercise on both physical and social health, individuals who receive social support may experience greater improvements in their quality of life.

These studies highlight the critical role that physical activity plays in promoting social health. Exercise has the ability to not only enhance physical health but also foster social connections, fortify social networks, and improve overall quality of life. By understanding the relationship between physical and social well-being, people can use exercise to improve both their physical and social lives (Leavell et al., 2019).

2.2. Current concerns and challenges regarding the physical inactivity epidemic

Recent studies shed light on the present worries and issues associated with the global physical inactivity epidemic. Ding's 2016 research demonstrates the significant healthcare expenses related to serious non-communicable diseases caused by physical inactivity. This highlights the need to address the epidemic's impact on healthcare systems and the economy worldwide.

Furthermore, the study conducted a comprehensive analysis of the economic costs associated with diseases such as heart disease, stroke, type 2 diabetes, and breast and colon cancers that are linked to physical inactivity. The researchers found that physical inactivity was responsible for a significant portion of the economic costs related to these NCDs, including both direct healthcare expenditures and productivity losses due to disability and premature mortality. The paper highlights the global scale of this issue, emphasizing that the economic burden of physical inactivity affects countries across the world (Ding et al., 2016).

Physical inactivity is not just a concern for adults. According to Guthold's 2020 review of trends in insufficient physical activity, young people are also at risk, potentially creating a cycle of health issues that spans generations.

Kohl's 2012 research accurately describes physical inactivity as a pandemic that requires immediate global intervention. This comprehensive research is a call to action to prioritize programs that promote physical activity as a way to prevent non-communicable diseases and reduce the financial burden on healthcare systems.

These studies demonstrate that the global physical inactivity epidemic is not only a health disaster but also a critical social, economic, and public health issue that calls for concerted efforts and creative solutions to address its wide-ranging effects (Kohl et al. (2012).

According to the World Health Organization (WHO), “31% of people aged 15 years and older are physically inactive”. Problems associated with physical inactivity “contribute to the deaths of approximately 3.2 million people” worldwide each year, making physical inactivity the fourth largest risk factor for death (Hall, 2021).

Despite awareness of the alarming effects of physical inactivity, the latest worldwide estimates show that 27.5% of adults and over 81% of adolescents do not meet the aerobic physical activity guidelines established in the 2010 Global Physical Activity for Health Recommendations (Bull, 2020).

These findings from Bull, (2020) raise concerns about physical inactivity, which is now recognized as a global epidemic and public health threat. Many health experts also refer to this problem as the "evil of the century."

2.3. The relationship between noncommunicable chronic diseases to physical activity and its consequences to the healthcare system

“We confirm that there is irrefutable evidence of the effectiveness of regular physical activity in the primary and secondary prevention of several chronic diseases (e.g., cardiovascular disease, diabetes, cancer, hypertension, obesity, depression, and osteoporosis) and premature death” (Warburton et al., 2006).

Growing research and concern are focused on the complex relationship between noncommunicable chronic diseases, physical inactivity, and their effects on healthcare systems. Ding's (2016) study emphasizes the financial burden caused by physical inactivity and its link to serious non-communicable diseases. This thorough research highlights the need for efficient solutions to reduce this costly burden by emphasizing the significant impact on healthcare systems and economies around the world.

Lee's (2012) study explores the multifaceted costs of physical inactivity, particularly in the setting of chronic diseases. Their findings highlight the cascading effects of sedentary behavior that lead to higher healthcare costs. It is crucial to treat the root cause of physical inactivity to relieve the strain on healthcare resources because these costs not only impact individual patients but also healthcare systems.

The World Health Organization's guidelines for sedentary behavior and physical exercise emphasize the link between these habits and non-communicable illnesses. These recommendations offer a modern foundation for understanding the effects of physical inactivity and methods to lessen its negative effects on healthcare systems (Bull et al., 2020).

According to a 2010 study by McKinsey & Company, healthcare spending is often high on the political agenda in most countries. By 2050, healthcare spending is projected to account for 20-30% of GDP in some countries, making it economically unsustainable.

2.4. The role of new innovative digital technology – how it may impact the health sector

Innovative digital technology has transformed the contemporary wellness and fitness landscape, revolutionizing how people interact with their health and fitness goals (Patel, Asch, & Volpp, 2015).

According to Patel, the integration of technology and wellness has led to the growth of wearable gadgets. Fitness facilities now offer real-time tracking of a person's physical activity, heart rate, and other crucial information thanks to wearable technology.

Moreover, the use of digital technology in exercise facilities extends beyond physical measurements. Peter, (2018) highlights the various applications, including customized exercise regimens, interactive classes, and online communities. These resources provide an all-encompassing wellness experience, accommodating personal preferences, and encouraging adherence to exercise routines.

2.4.1. Innovative technologies

The role of technology as an enabler in the fitness industry has been researched and evidence exists of its current application and benefits to promote wellness. A closer look at some of the innovative technology trends is also useful background.

Persuasive technology (PT): Persuasive technology is the concept of using technology to influence and alter people's health-related decisions and actions. It emerged from the junction of technology and health habits (Orji, 2018).

Orji and Moffatt defined PT as "interactive systems designed to aid and motivate people to adopt behaviors that are beneficial to them and their community while avoiding harmful ones." They said that "The use of PT, aimed at bringing about desirable change by shaping and reinforcing behavior and/or attitude is growing in virtually all areas of health and wellness" (Orji, 2018).

PT uses design elements and process models based on the ideas presented by Oinas-Kukkonen and Harjumaa (2009) to encourage behavior change through digital interventions. This field of study delves into the psychology of behavior modification and the design tactics that benefit from interactions between people and computers.

PT is based on the idea that small changes can have a big impact. These behavioral changes, brought on by well-designed technology, may influence people to make better decisions. Bickmore and Picard's (2016) research investigates the development of long-term human-computer connections, supporting the notion that technology can persuade users in ways that go beyond immediate impact and encourage long-lasting behavior change.

In 2018, Rita Orji and Karyn Moffatt from McGill University in Canada published a paper that included an extended empirical review of 85 different papers and research findings over a 16-year period of literature on persuasive technology (PT) for health and wellness. The aim was to analyze how technology could play a persuasive role in promoting behavior change in health and wellness.

Of the 85 studies analyzed, 75% reported a consistently positive outcome of using PT to influence a particular health behavior. 17% were somewhat positive, and only 8% of all studies did not provide the desired results.

The study concludes that 92% of all studies evaluated reported positive outcomes from the use of PT, suggesting that persuasive technologies are effective in promoting various health and wellness-related behaviors (Orji, 2018).

Wearable Technology: Wearable devices have rapidly become potent forces in the fitness and health environment. Recent research has explored the complex role and bright prospects that these technologies offer in improving personal well-being (Baumann, L. M. (2016).

Bauman explains in his study The Story of Wearable Technology that "Wearable technology is many different forms of body-mounted/worn technology, and that the main idea behind wearable computing is the augmentation of human capabilities by wearing devices."

Lewis's qualitative study (2020) explores the real-world integration of wearable fitness trackers, emphasizing their value in routine management. This realization highlights how wearables go beyond being devices to become crucial allies in encouraging healthy habits and self-monitoring.

The trials by Maddison (2019) focus on specific health circumstances, highlighting the revolutionary potential of wearables. These researches showcase wearables technologies' ability to monitor, inspire, and improve fitness while raising people's self-efficacy in a variety of applications, from real-time cardiac telerehabilitation to cardiovascular disease management.

Furthermore, Eguchi's (2023) research emphasizes the accuracy that wearable technologies provide for health evaluation. The study highlights the flexibility of these devices in measuring cardiometabolic health beyond the scope of basic fitness tracking. It contrasts wrist-based wearables to continuous ECG for calculating heart rate variability.

The advancements of this innovative technology have made it possible for people to track and monitor nearly every aspect of their daily life. Today, people have more access to information about themselves than ever before, ranging from daily activities like walking, eating, and sleeping to mood and health (Jin et al., 2020).

Below, (Figure 1) from (Piwek et al. 2016) lists many of the possibilities associated with wearables.

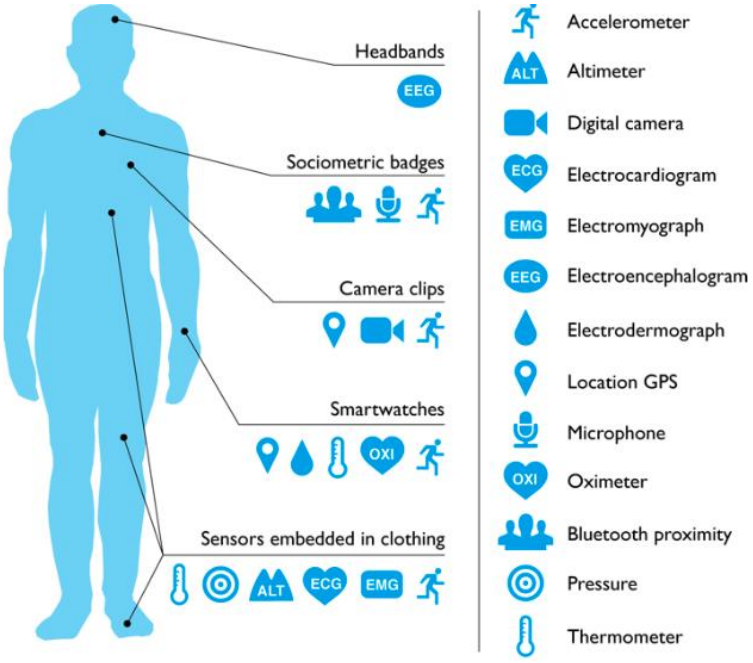

Figure 1: Consumer opportunities for wearable technology

Mobile health (mHealth): In 2016, Bardus evaluated the qualities of popular commercial weight-management applications, examining factors such as engagement and information quality. This showcases how mHealth can support fitness and health objectives by providing users with customized tools for weight management.

With a growing selection of options for those interested in improving their physical fitness and overall health, as well as monitoring and managing chronic diseases, these apps are now prominently displayed in the two main application stores, the Google (Play Store) and the App Store (iOS) (Xu, 2015).

In fact, more than 32,700 health and fitness apps have been developed solely in these two major app stores. According to a study by the College of Communication Arts and Sciences at Michigan State College, one in five smartphone owners has at least one app related to their health (Yuan, 2015).

The same Michigan State College study analyzed data from a Pew Research Internet Project survey and found that many smartphone owners use mobile apps as part of their daily routine. According to the study, 38% of health and fitness app users use them to monitor their exercise, 31% to monitor their diet, and 12% to monitor their weight (Yuan, 2015).

Research also shows that these applications can play an important role in personal motivation, as the relationship between task motivation and fitness tracking shows that fitness tracking increases users' drive to be physically active (Butryn, 2016).

Another study conducted in 2017 by Pettinico and Milne found that fitness tracker adoption increases users' expected motivation for physical activity, "the significant impact of quantified self-data on increasing perceived feedback meaningfulness, self-empowerment, goal focus, and anticipated motivation in the pursuit of a fitness goal".

Customer relationship management (CRM): Technology has become a powerful tool for enhancing customer relationship management (CRM) tactics in the dynamic world of fitness clubs. Leśniewska's research on CRM demonstrates how fitness applications use technology to strengthen ties between fitness centers and their customers, personalize experiences, and foster bonds.

The case study inquiry focuses on the relationship between technology adoption and customer involvement in the fitness business. The report dissects the complex interaction between technology and CRM, revealing the techniques used by fitness centers to take advantage of technology's potential for building enduring client relationships (Leśniewska, 2014).

Pardede, Sinaga, and Lintong's 2020 work demonstrates the creation of a mobile application intended to support CRM in fitness centers. This illustration showcases how technology can improve communication, streamline interactions, and ultimately enhance the customer experience.

Virtual reality and Gamification: Virtual reality (VR) and gamification technologies have opened up creative approaches to improving physical health and overall quality of life. Recent research reveals the numerous opportunities that VR and gamification present for transforming experiences in fitness and wellness (Pasco, 2013).

According to Pasco, Virtual reality can aid in many different aspects of health, this comprises physical exercise practices, as well as exercises aimed at rehabilitation, bettering mental health, and alleviating pain.

Studies like Maillot, Perrot, and Hartley's 2019 inquiry demonstrate that VR has the potential to improve physical and cognitive function, particularly in older individuals. VR can make exercise appealing and accessible for seniors by incorporating interactive physical-activity video-game training, potentially transforming health and fitness centers into inclusive venues catering to a diverse age range.

This new technological trend in fitness facilities will be able to provide virtual reality tools to make exercise more interesting and demanding, for example by simulating outdoor adventures, movie scenes, or breathtaking scenery (Mestre et al., 2011).

Defined by Sebastian Deterding, the term gamification is "the use of game design elements in non-game contexts" (Deterding , 2011).

When gamification is present in a fitness experience, it creates a fun and challenging environment for participants. With this technology, “players” are “transported” to an alternate world where exercise and training looks a lot more like a real-life video game (Zuckerman, 2014).

According to Zuckerman, “The underlying assumption is that gamification would make physical activity more enjoyable, thereby motivate users to become more active”.

2.5 Current barriers and concerns for fitness clubs to adopt innovative digital technologies

In this section, we will reflect on the cautions and key issues that may cause limitations in the use and implementation of new innovative technologies in fitness and wellness centers. Additionally, this discussion will help us understand the key barriers and opportunities for fitness clubs and wellness centers to adopt innovative digital technologies to promote wellness.

Non-evidence-based fitness apps: As technology advances, the number of fitness apps is growing exponentially. Today, there are over 100,000 health-related apps. However, caution should be exercised when adopting and selecting these apps (Xu, 2015).

According to Xu, despite their widespread availability, the lack of sound evidence and theory in most available physical activity apps can become a major problem when it comes to safe and effective use.

A 2017 study by Lynn Katherine Herrmann and Jinsook Kim examined 379 applications and compared them to the national physical activity recommendations. The study found that not a single app adhered to the aerobic physical activity recommendations, and only seven of those apps followed the physical activity recommendations through strength training.

The Bardus et al. (2016) study examines the characteristics of well-known weight-loss apps, revealing elements like engagement, functionality, and information quality. These findings highlight the dangers that non-evidence-based apps may pose, since a lack of precise and trustworthy information could mislead users and jeopardize their health and wellbeing.

Similar to this, a study conducted by François Modave examined a set of 30 popular mobile apps for physical activity programming on an iPhone device. Following the American College of Sports Medicine (ACSM) guidelines for exercise programming, Modave used a weighted scoring method to compare the quality of these apps based on the principles of intensity, frequency, time, type of

exercise in question, individual progression analysis, individual health status, and specific goals (Mondave, 2015).

Mondave concluded that "When looking at popular free apps related to physical activity, we observe that very few of them are evidence-based and respect the guidelines for aerobic activity, strength/resistance training, and flexibility, set forth by the ACSM".

Despite the wide availability, the lack of grounding evidence and theories in most available physical activity applications can become a major problem when it comes to a safe and effective use. However, future app developers may use this as a chance to enhance the quality of these programs and offer proper physical activity instruction based on research and evidence-based recommendations (Herrmann, 2017).

Exercising without professional guidance: Physical activity is important for health, however, current research highlights the serious consequences of exercising on one's own or without a trainer. This research highlights possible dangers that can jeopardize both short-term well-being and long-term fitness goals, despite the attractiveness of self-directed exercises and haphazard exercise regimens appearing to be powerful.

The research by Malhotra, Aggarwal, and Bhanot (2020) focuses on the injuries sustained by recreational runners who started self-recommended training regimens but were not coached. This study highlights the significance of appropriate supervision because unsupervised exercise can result in overexertion and injuries that would have been avoided with qualified supervision. (Malhotra, Aggarwal, and Bhanot, 2020)

According to Wyatt, (2014) a small number of research have reported that many app developers have little or no formal medical training. Additionally, because these qualified professionals are frequently excluded from the process, they are often not aware of the patient safety concerns brought up by unsuitable app content or functionality.

Injuries are a major problem with exercising without the assistance of a qualified specialist. The lack of guidance and follow-up can lead to diminishing returns, caused by factors such as inadequate exercise intensity, objectives that are incompatible with age and physical ability, incorrect choice of exercises, misuse of equipment and lack of the necessary adaptation period (Bahr & Krosshaug, 2005).

Other more serious risks should also be considered, such as heart problems, blood pressure, diabetes, and the risk of fractures or muscular injuries. Before beginning an exercise program, it is extremely important to obtain proper medical guidance in order to prevent these issues and identify risk factors, such as a family history of heart disease, diabetes, high blood pressure, or back problems (Siscovick, Laporte, & Newman, 1985).

Collectively, these studies convey a strong message: while physical activity is advantageous, exercising without a doctor's advice can have negative effects. Protecting physical wellbeing and maintaining a sustainable approach to fitness require taking important precautions, such as asking for advice from competent fitness specialists, being aware of one's limitations, and customizing training routines to individual needs.

Security flaws (Personal data): Digital security plays an important role in our daily lives. Our right to privacy and security must evolve with the new technologies that have recently emerged to

regulate the modern world in which we live. However, many of these programs fall far short when it comes to protecting the privacy of their users.

The paper by Jin, Luo, Li and Mathhew (2019), addresses the larger implications of data vulnerability in digital health contexts, promotes privacy-preserving health data exchange methods. The report emphasizes the importance of protecting private health information, such as workout regimens and personal health data, from unwanted access, even though it is not exclusive to fitness apps.

Today's top concerns for health service providers in terms of security and data privacy are the confidentiality, integrity, and availability of customer data given the growing usage of electronic health records (EHR) and electronic healthcare (eHealth) (Adhikari, Richards, & Scott, 2014).

Additionally, research by McCarthy, (2013) brought attention to this current problem. In her study, she reviewed 43 health and fitness apps, reporting that of the 43 apps analyzed only 74% of the free apps and 60% of the paid apps had an explicit privacy policy that was either accessible within the app or on the developer's website.

In essence, these studies emphasize the essential need to put security first when using fitness apps. Although there is no denying the advantages of these technologies, users must be cautious in their search for better health, making sure that the ease of tracking does not compromise the privacy of their personal information

3. Methodology

The main objective of this study is to investigate self-reported perceptions and attitudes regarding how new innovative digital technologies in the health and wellness sector can improve people's overall quality of life. Additionally, the study seeks to identify key factors and barriers influencing people's willingness to use these new digital technologies in the fitness industry and determine ways to increase their usage.

To achieve these goals, the best research method is qualitative research. This approach allows for complex inquiry and collection of rich, detailed data through techniques such as interviews, observations, and document analysis (Denzin, Lincoln, Giardina, & Cannella, 2023).

Qualitative research is the preferred choice for researching emerging topics, as it allows for the exploration of complex and nuanced phenomena in their natural context when little or no preestablished theories or significant amount of evidence exist (Wilhelmy & Köhler, 2022).

As Robert K. Yin once said, "Qualitative research is like a microscope, designed to explore and reveal the complexity and depth of the phenomena that it examines." - Robert K. Yin

3.1. Research Approach

A set of semi-structured interviews was developed and conducted to gather diverse and unique experiences and perspectives from research participants.

In-depth interviews enable a deeper understanding of participants' opinions by exploring their subjective and personal experiences, beliefs, and attitudes about the main topic (Seidman, 2019).

3.2. Respondent Selection and Recruitment

Properly selecting individuals to participate in an interview is one of the most important steps towards a successful in-depth interview (Seidman, 2019). For this study, the population of interest consisted of opinion leaders and individuals with valuable information about wellness and fitness centers. Therefore, the main target population for these interviews included employees, managers, and self-employed workers from such centers.

A random sample of wellness and fitness clubs was selected based on their availability, diverse background, location, and willingness to participate in the study. It was important to segment both the facility and the respondents' profiles to obtain a more diverse and representative data response. Market segmentation can be carried out based on different factors:

Geographic segmentation divides the market into different geographic units such as cities and neighborhoods. Understanding regional variations in technology adoption is important in this regard as different areas may have varying access to technology infrastructure and fitness facilities. For

example, urban and rural populations might have different levels of exposure to and comfort with fitness technology (Kotler & Keller, 2016).

Demographic segmentation is another approach to market segmentation. Factors such as gender, age, and occupation were considered in selecting respondents for this study. Gender and age, for instance, can reveal how different age groups and genders perceive and interact with technology in fitness centers. Younger individuals might be more tech-savvy and open to technology integration, while older participants may have different preferences or concerns. Occupation can provide insights into how professional demands might influence their technology expectations and adoption (Kotler & Keller, 2016).

Finally, economic considerations such as monthly admission fees can provide insights into the economic aspects of adopting fitness technology. Higher fees may indicate a willingness to invest in advanced fitness technology, while lower fees might suggest a preference for more traditional fitness approaches. This information can help fitness centers tailor their pricing strategies and technology offerings accordingly.

Table 1 provides a visual representation of the gender, age, occupation, facility location, and monthly admission cost per customer (in euros) for each participant.

Participants	Gender	Age	Occupation	Location	Monthly Admission Fee
P1	Male	22 years old	Front Desk Staff	Porto, PT	€ 28,90
P2	Male	27 years old	Personal Trainer	Lisbon, PT	€ 46,50
P3	Female	32 years old	Personal Trainer	Lisbon, PT	€ 49,00
P4	Female	29 years old	Personal Trainer	Salvador, BR	€ 18,13
P5	Male	28 years old	Maintenance Staff	Lisbon, PT	€ 34,90
P6	Male	19 years old	Maintenance Staff	Rio de Janeiro, BR	€ 43,16
P7	Female	25 years old	Physical Therapist	Lisbon, PT	€ 94,90
P8	Male	35 years old	Sales Consultant	Salvador, BR	€ 42,04
P9	Female	22 years old	Front Desk Staff	Lisbon, PT	€ 68,00
P10	Female	34 years old	Gym Manager	Salvador, BR	€ 53,74

Table 1: List of the experts' interviewees

3.3. Drafting the questions and interview guide

Developing questions and an interview guide for an in-depth interview is often considered the most important step in the research process (Rubin & Rubin, 2011). The structure of the interview guide and the selection of questions were based on the content and knowledge gained through literature review.

Therefore, a semi-structured interview (Appendix 1) was devised to achieve the main objective: analyzing how new innovative digital technologies in the health and wellness sector can improve people's overall quality of life and identifying the main enables and barriers that influence people's

willingness to use these technologies today and in the near future. The goal is to answer and clarify our key research questions by the end of the study.

Below, (Table 2) shows the structure of the interview guide, based on the content and findings from the secondary research conducted in our literature review.

<table>
<tr><th colspan="3">Research Question #1:</th></tr>
<tr><td colspan="3">What is the importance of physical activity to human health and what role does technology play in this?</th></tr>
<tr><th colspan="3">Narrow Topic 1.1</th></tr>
<tr><td colspan="3">The importance of physical activities in wellness.</td></tr>
<tr><th>Author, (Year)</th><th>Main Idea</th><th>Questions for Interview</th></tr>
<tr><td>Berger, (2009)</td><td>The advantages of adopting healthy activities over a sedentary lifestyle are significant and manifest both physically and psychologically</td><td rowspan="3">Q1. What do you think is the relationship between physical activity and overall health and well-being?

Q2. What do you think about the use and advancement of technology in our daily lives?</td></tr>
<tr><td>Miles, (2007)</td><td>The connection between physical activity and human health is currently well established and is growing on the solid foundation of many published sports medicine research.</td></tr>
<tr><td>Berger, (1993)</td><td>Its advantages extend to the emotional side as well, leading to an improved self-esteem, overall daily energy as well as a decrease the levels of anxiety, stress, and depression.</td></tr>
<tr><th colspan="3">Narrow Topic 1.2</th></tr>
<tr><td colspan="3">Current concerns and challenges regarding the physical inactivity epidemic.</td></tr>
<tr><th>Author, (Year)</th><th>Main Idea</th><th>Questions for Interview</th></tr>
<tr><td>Tipton, (2014)</td><td>In 1968, Peter Karpovich wrote “there is growing evidence on the preventive value of exercise, and it is possible that, in the not too distance future, physical education will become a part of medicine”</td><td rowspan="3">Q3. In my literature review, I found that physical inactivity has become a major public health problem and is the fourth largest risk factor for death. Imagine you were a member of the World Health Organization, what solution would you propose to improve this situation?

Q4. How do you see new and innovative digital technologies helping with the sedentary lifestyles issue?</td></tr>
<tr><td>Hall, (2021)</td><td>Based on these statistics from The World Health Organization (WHO), sedentary behavior is today, the fourth greatest risk factor for death.</td></tr>
<tr><td>Prakash, (2002)</td><td>Sedentary lifestyles are one of the most important yet under-addressed public health issues of our time, with 60 to 85% of people in the world from</td></tr>
</table>

	both developed and developing countries suffering with this issue.	
Narrow Topic 1.3		
The relationship between noncommunicable chronic diseases to physical activity and its consequences to the healthcare system		
Author, (Year)	**Main Idea**	**Questions for Interview**
Tipton, (2014)	Claudius Galen a Greek physician considered to be the father of Anatomy, believed that every from of disease could be treated with some form of exercise in one way or another	**Q5.** The increase in chronic diseases is now a heavy burden in terms of morbidity and mortality, while threatening the long-term sustainability of healthcare systems. How do you think physical activity can help improve chronic disease management? **Q6.** How do you think new and innovative digital technologies can help in the fight against chronic diseases?
Warburton, (2006)	Years of research have provided irrefutable evidence for the benefit of exercise in the prevention of chronic diseases.	
WHO, (2014)	The World Health Organization (WHO) indicates that a small number of risk factors, including physical inactivity, are the leading cause of most deaths from chronic noncommunicable diseases.	
Research Question #2:		
What evidence is there to support the use of innovative digital technologies in fitness clubs to promote wellness?		
Author, (Year)	**Main Idea**	**Questions for Interview**
Richard, (1997)	Motivation plays an important role in people's willingness to engage in physical activity. (Technology falls into the extrinsic category of motivation)	**Q7.** How do you think the growth of innovative digital technologies in fitness centers to promote wellness and health will evolve over the next 5 to 10 years? Can you provide examples? **Q8.** After my literature review, I have discovered the key current applications and benefits, as well as key observations regarding the advancement and future applications of technology in this industry. With that in mind, can you please indicate the following: (Multiple questions)
Piwek, (2016)	According to many studies wearable technology has such enormous promise for promoting physical activity and good health.	
Attig, (2019)	Study shows that utilizing fitness trackers increases users' expected motivation for physical exercise while motivation for physical activity decreases when fitness trackers are not available to them.	
Research Question #3:		
What are wellness and fitness centers currently doing to adapt to innovative digital technologies to promote wellness?		
Author, (Year)	**Main Idea**	**Questions for Interview**

Pham, (2022)	Extensive research indicates many opportunities of implementing new Innovative Technology to change the future of Fitness and Wellness Centers.	**Q9.** If a new innovative digital technology is offered to this facility (like the ones above), how do you intend to acquire the necessary know-how to manage this technology? **Q10.** If a new innovative digital technology could be implemented in this fitness center, who do you believe would be more open and who do you believe would be more resilient to adopt this change? Why? **Q11.** In your opinion, what strategies could be used to convert people who are resilient to these changes? **Q12.** From your perspective, is the staff here interested in these innovations, why? **Q13.** What about yourself? Are you personally interested in these innovations, why? **Q14.** When compared to other priorities – where is "new innovative digital technologies" on the priority list for this facility? Can you explain why is it low or high priority? **Q15.** What measures should this facility take to keep up, learn and adapt to new technologies in the fitness industry?
Fernández, (2018)	Fitness clubs and wellness centers are looking for ways to stand out from the competition and gain a competitive edge in the market.	
Patel, (2015)	Customers are now frequently requesting that these facilities support the newest technologies in the market.	
Research Question #4:		
What are the main barriers and opportunities for fitness clubs to adopt innovative digital technologies to promote wellness?		
Author, (Year)	**Main Idea**	**Questions for Interview**
Modave, (2015)	Most physical activity related apps are evidence based, and respect the guidelines for aerobic activity, strength/resistance training, and flexibility, set forth by the American College of Sports Medicine (ACSM).	**Q16.** In your opinion, what is the biggest barrier, challenge, or concern for fitness clubs to adopt innovative digital technologies? **Q17.** When taking into consideration the relationship between people and technology, what do you believe are the mains barriers users may face when adoption a new innovative digital technology in fitness centers?
Wyatt, (2014)	A number of research have reported that many app developers have little or no formal medical training, bringing concerns to users' safety by unsuitable app content or functionality.	

Adhikari, (2014)	Given the growing usage of electronic health records (EHR) and electronic healthcare (eHealth), security, data privacy, confidentiality, and integrity, became top concerns for health service providers.	**Q18.** After conducting my literature review, I discovered the main barriers and enables for fitness clubs and wellness centers to adopt innovative digital technologies to promote wellness. With that in mind, can you please indicate the following: (Multiple questions)

Table 2: Interview Guide

3.4. Techniques and conduction of the interviews

First, personal contacts were made with the staff of the selected facility. The first step was to clearly explain to them the purpose of the study and the reasons why they were eligible to participate in the survey.

In the second stage, they were asked if they would be interested in participating in the study. In the case of a positive response, a specific date and time for the interview was set, based on the availability of each applicant.

Interviews were conducted in a restrained, quiet, and comfortable environment to allow respondents more freedom to express their opinions and the opportunity to elaborate on their answers.

To ensure comprehensive insight and allow for later analysis of the data, each interview was recorded (with the participant's consent) and subsequently transcribed.

As interviewer and moderator, I remained neutral throughout the interview, avoided biased comments or opinions on the topic, and showed interest and empathy throughout the interview.

3.5. Data Analysis

Proper data analysis is critical to drawing valid conclusions and answering research questions in an in-depth interview study. After conducting the interviews, the first step is to transcribe the audio recordings and notes from the interviews.

Next, the transcripts are reviewed to identify the major themes, patterns, and insights that emerge from the participants' responses to each question.

The next step is to organize and sort the data in a way that allows for meaningful comparison and analysis and finally, use interpretive analysis to examine the meaning and significance of each participants' response in more depth.

4. Results

4.1. The importance of exercise and its crucial impact on your overall health and well-being

The first question asked participants to express their opinion about the relationship between physical activity and general health and well-being. Some participants emphasized that physical activity could help improve physical and mental health and reduce the risk of chronic diseases such as heart disease, diabetes, and obesity. Other participants emphasized that physical activity could increase energy, concentration, flexibility, reduce stress, and improve mood.

In summary, in general, all responses indicated that physical activity is considered a critical factor in overall health and well-being, both physical, mental, and social.

In addition, responses from question #2, highlighted key benefits of technology, such as making tasks more efficient and easier to complete, improving communication, and opening new opportunities and possibilities. However, they also pointed out negative consequences to the excessive use of technology, such as reduced social communication, feelings of seclusion and isolation, and impacts on mental health and well-being.

4.2. Current concerns and challenges regarding the physical inactivity epidemic

Respondents were asked to propose a solution as a member of the World Health Organization and to give their opinion on how new digital technologies could solve the problem of sedentary lifestyle.

It is interesting to note that the responses suggested different approaches to solving the problem of physical inactivity. We can interpret from the responses that there is no single solution to the problem of physical inactivity and that different approaches can be effective for different people.

Some participants suggested policy-level solutions, while others suggested educational and marketing efforts. In addition, several responses emphasized the importance of creating infrastructures and incentives that make it easier for people to be active in their day-to-day lives.

Regarding the role of new digital technologies towards helping fix this issue, within this broad range of options given by the respondents, we can highlight the following:

- Instant exercise monitoring
- Instant health monitoring
- Personalized training and exercise options

4.3. The relationship between noncommunicable chronic diseases to physical activity and its consequences to the healthcare system

Participants commented from a variety of perspectives on how physical activity can improve chronic disease management. These perspectives included:

- Reduced risk of chronic diseases through aerobic exercise and improved cardiovascular status (responses 1 and 7).
- Reduced risk of developing diseases such as obesity and heart disease through regular physical activity (response 2).
- Improved overall physical health and mobility, especially in older people (response 3).
- Importance of physical activity for people with conditions that affect mobility, such as arthritis or Parkinson's disease (Answer 4).
- Promotion of physical and mental well-being, including stress reduction and improvement of mood and self-esteem (Answer 5).
- Improving sleep quality, which may be important for people with chronic conditions (Answer 6).
- Helping people lose weight and improve their health, which is especially important for people with obesity or diabetes (Answer 8).

As for future measures and opportunities that new digital technologies can offer in the fight against chronic diseases, all participants give several contributes, mainly:

- Instant access to your personal data
- Increased access to healthcare programs
- Use of artificial intelligence and algorithms to prevent and treat disease
- Personalized nutrition and wellness plans

4.4. The role of new innovative digital technology – how it may impact the health sector

Based on participants' responses to question #7, we can conclude that there is a wide range of opinions about how technology will evolve in fitness centers over the next 5 to 10 years. The most recurring ideas include:

- Increased use of wearable technology
- Adoption of virtual reality-based exercises
- The use of artificial intelligence to improve the user experience
- Increase the support on tracking and management your own health and fitness goals

As acknowledged in the literature review, there are major technology applications that are currently being used today in fitness and wellness centers to incentivize the improvement of health. When asked how familiar they were with these technologies and to express their opinions on the key benefits and barriers to implementing this innovative digital technology in fitness centers, the results were the following:

In a first analysis, we can clearly see that 3 of the 7 technologies questioned stand out. These are wearable technology, mobile health (mHealth) applications, and CRM technology, where 100% of

the participants indicated that they are familiar with the concept and are using this innovative digital technology in their facilities.

Analyzing the results on Persuasive Technology and Gamification, we can see that the results were quite similar as most of the participants are familiar with the concept and are also using this technology in their facilities.

From the interpretive analysis, 80% of the participants are familiar with the concept of Virtual Reality and its applications. However, only 20% of facilities are using this innovative digital technology.

Finally, when looking at the results on sustainable technology, we can see that although the vast majority of participants are familiar with the concept of sustainable fitness centers, most facilities (80%) are not using this technology.

All participants were able to mention different opinions in regards of the key benefits and key challenges that fitness facilities face with the implementation of these technologies. To facilitate the analysis, a frequency table was created with the participants' responses.

Answer:	Frequency:
Provide personal encouragement to achieve health goals	19
Optimize the use of resources to make processes more efficient, easier, and organized	12
Offering diverse training and exercise options	11
Making physical exercises more fun and attractive	10
Optimize the customer management	10
Better tracking and monitoring of progress and performance	9
Personalizing the customer experience in gyms	6

Table 3: Perceived benefits of implementing digital technology in fitness centers

Answer:	Frequency:
Resistance to technology acceptance and adaptation	25
Lack of confidence in applications and technology	21
Infeasibility of Resources (Financial and Technical)	17
Privacy and Security with Personal Data	6
Negative impacts of technology on health	6

Table 4: Perceived barriers and challenges of implementing digital technology in fitness centers

In a nutshell, provide personal encouragement to achieve health goals and optimizing the use of resources to make processes more efficient, easier, and organized are the main benefits of implementing digital technology in fitness centers. While Resistance to technology acceptance and adaptation and Lack of confidence in applications and technology can be seen as the major barriers and challenges of implementing digital technology in fitness centers.

When asked if they would personally be interested in these innovations, we found that while some responses expressed concerns about over-reliance on technology and loss of human contact (responses 4 and 8), while others were skeptical of technology adoption due to cost and usability issues (response 6), the majority of participants still expressed enthusiasm for technology, particularly (response 7), which viewed technology as critical to the future of fitness training.

Additionally, respondents were asked to determine whether they considered these technologies to be a low, medium, or high priority to the fitness centers they were employed, the most common responses were "high" priority (5 responses), followed by "low" priority (3 responses) and "medium" priority (2 responses).
Responses to Question #9 indicate that most participants recognize the importance of seeking outside help or specialized training to deal with the adoption and implementation of new digital technology in fitness facilities. Participants suggested that to adapt to such changes, they should, for example:

- Participate in online discussion groups
- Seek out online resources such as (webinars, articles, and videos)
- Build strong relationships with technology providers

When asked which group they thought would be more open or resistant to adopting technological changes, we can see that the responses make it clear that young people (response 1 and 3), people who already exercise regularly (response 2, 5, and 8), and finally people who are familiar with technological applications (response 4, 6, 7, 9, and 10) would be more open to adopting technology.

4.5. Current barriers and concerns for fitness clubs to adopt innovative digital technologies

Finally, as acknowledged in the literature review, there are major constraints to the use and implementation of new innovative technologies in fitness and wellness centers. Our final interview question (Question 17) asked participants for their opinion on each limitation and barrier found in our literature review, as well as their opinion on what solution could be implemented to address this issue, the results were the following:

When asked about their individual assessment of the importance they place on fitness apps based on data and evidence, all responses agree that the quality of the applications is of paramount importance, with the safety and well-being of clients being the primary concern.

From their responses we can also see different strategies that can be used to solve this problem. Overall, the responses suggest that fitness centers should take proactive steps to ensure that their users have access to high-quality apps and can use them safely and effectively. This can include careful evaluation and selection of apps, staff training, user education, and strategic partnerships.

When addressing the importance of appropriate professional guidance in physical exercise, taking into account the risks associated with inadequate execution. All the participants' responses emphasize the importance of appropriate professional guidance when exercising and the responsibility of Fitness Centers to provide a safe environment and appropriate guidance to their clients to minimize the risk of injury and maximize exercise effectiveness.

In terms of solutions that could be implemented to address this issue, responses emphasized that fitness centers could also offer additional services such as stretching and massage sessions and encourage users to seek professional guidance before starting an exercise program, especially if they have pre-existing or chronic conditions or injuries.

Finally, we addressed the issue of lack of security of personal data. All responses seem to agree that fitness centers should implement security measures to protect customer data before introducing new innovative technologies. This is essential to protect customer privacy and ensure transparency of services.

According to participants' responses, key strategies that fitness centers can implement to address these concerns include implementing advanced security measures, clear privacy policies, employee training and monitoring, implementing regular backup systems, regular security assessments, contingency plans, regular monitoring of data security technologies and systems, and third-party security audits.

5. Discussion

5.1. What is the importance of physical activity to human health and what role does technology play in this?

Based on the literature review conducted for this paper, we can conclude that there is an indisputable connection between physical activity and overall health and well-being. All participants in the study emphasized the positive impacts of physical activity on physical and mental health. These included reduced risk of chronic diseases, increased energy, better concentration, stress reduction, and improved mood. This corroborates the notion that physical activity is universally acknowledged as a critical factor in overall health and well-being. (Warburton, Nicol, and Bredin, 2006)

Regarding the role of technology in physical activity, overall, responses indicate an awareness of the pros and cons of technology and the importance of its balanced use in our daily lives. This aligns with the studies researched, which demonstrate the importance of creating a balance between the benefits of technology and its potential drawbacks. Encouraging individuals to use technology as a tool to enhance their physical activity and health while being mindful of its potential negative consequences, such as sedentary behavior and reduced social interaction, is crucial. (Walsh et al.'s study, 2019)

When addressing the physical inactivity epidemic, it is possible to conclude from existing literature, as well as the opinions of the respondents, that technology can be a valuable ally in combatting physical inactivity.

Overall, the responses suggest that addressing physical inactivity requires a multidimensional approach that includes individual, community, and policy interventions. Importantly, these proposed solutions can be implemented collaboratively to address physical inactivity more comprehensively.

These findings align with the existing literature, which comments on how this issue is not only a health disaster but also a critical social, economic, and public health issue that calls for concerted efforts and creative solutions to address its wide-ranging effects. (Kohl et al., 2012)

Moreover, we have gathered crucial insights from people in the fitness and health industry that shed light on how digital technologies can help solve this problem. For example, by providing instant access to personal health data, increasing access to healthcare programs, using artificial intelligence and algorithms to prevent and treat diseases, and offering personalized nutrition and wellness plans, these technological advancements can empower individuals to take control of their health and make informed choices to combat the physical inactivity epidemic.

5.2. What evidence is there to support the use of innovative digital technologies in fitness clubs to promote wellness?

The literature review conducted underscores the transformative impact that innovative digital technologies can have on the fitness and wellness industry. Technologies such as wearable devices, mobile health (mHealth) applications, persuasive technology (PT), customer relationship management (CRM), virtual reality (VR), and gamification have the power to reshape how fitness centers engage with their members and promote wellness (Walsh et al.'s study, 2019).

The responses from our interview point to a growing awareness of the importance of healthy habits and the need to make them more engaging and motivating for people. Overall, these findings suggest that technology will continue to be an important part of the fitness world in the coming years, and that companies in the industry will need to adapt and innovate to keep up with this technological evolution.

Moreover, the results suggest that there may still be room for more awareness and education, indicating a potential opportunity for companies and businesses seeking to differentiate themselves in a competitive market.

Participants generally perceive innovative digital technologies as a high priority for fitness clubs. This aligns with the literature review (Walsh et al.'s study, 2019), which underscores the transformative potential of these technologies in promoting wellness.

Moreover, the qualitative research findings suggest that certain demographic groups, such as young people, regular exercisers, and those familiar with technology, are more likely to be open to adopting technological changes in fitness clubs. This insight is valuable for fitness club managers and marketers, as it helps identify target audiences for technology-driven wellness initiatives.

Participants' responses to question #7 reveal a range of opinions about the future of technology in fitness clubs. Many anticipate increased use of wearable technology, adoption of virtual reality-based exercises, and the use of artificial intelligence to improve user experiences. These trends align with the ongoing innovation in the fitness and wellness industry.

In conclusion, the evidence from your literature review and qualitative research strongly supports the use of innovative digital technologies in fitness clubs to promote wellness. Overall, these responses indicate that the adoption of innovative digital technology can be a valuable strategy for increasing the competitiveness and quality of services offered by a fitness center.

Moreover, these benefits can complement and reinforce each other, creating a virtuous cycle in which more motivated and satisfied customers lead to better financial and operational outcomes for the fitness center.

However, the results also indicate that there are several obstacles to overcome for the successful adoption of innovative digital technologies in fitness and wellness centers. The most common response is "resistance to technology acceptance and adaptation," suggesting that many people may have difficulty adapting to new forms of exercise and health monitoring.

Lack of trust in applications and technology is also a major concern, cited second most often. This suggests that users may have doubts about the accuracy and effectiveness of these digital resources.

The infeasibility of resources, including financial and technical limitations, is another challenge that can hinder the adoption of digital technology. However, this is shown to be particularly relevant for smaller gyms or in areas with limited resources.

Concerns about privacy and security of personal information are also mentioned, suggesting that participants may have fears about sharing personal information with apps and digital devices.

The high priority assigned to these technologies by fitness professionals underscores their potential to transform the wellness landscape in fitness clubs. As technology continues to evolve, fitness clubs that embrace these innovations are likely to stay at the forefront of promoting wellness and meeting the diverse needs of their members. By understanding the preferences and concerns of different demographic groups, fitness clubs can tailor their technology-driven initiatives to maximize their impact on wellness promotion.

5.3. What are the main barriers and opportunities for fitness clubs to adopt innovative digital technologies to promote wellness?

According to the participants, the barriers to adopting innovative digital technologies in fitness clubs are multifaceted and require careful consideration. Although these barriers are significant, they can also represent opportunities to enhance offerings and promote wellness effectively. The results showed that all respondents place great value on overcoming these issues.

The interviews confirmed that non-evidence-based fitness apps pose risks to users' health and well-being, emphasizing the need for quality evaluation and user education. This is supported by studies such as Herrmann and Kim's (2017) and Bardus et al.'s (2016). Exercising without professional guidance can result in injuries and overexertion, highlighting the importance of safe exercise environments and professional supervision. This is supported by the findings of Malhotra, Aggarwal, and Bhanot (2020) and Serravite, Rho, which underscore the potential dangers of such practices.

Finally, security flaws, particularly in data protection, can compromise user privacy. This emphasizes the need for robust security measures and privacy policies, as indicated by (Adhikari, Richards, & Scott, 2014).

By prioritizing evidence-based apps, user safety, and professional guidance, fitness clubs can differentiate themselves and attract health-conscious individuals. Implementing stringent data security measures not only protects user privacy but also fosters trust and confidence in digital technologies.

Fitness centers and organizations can take strategic actions to overcome obstacles in adopting innovative digital technologies. First and foremost, they should prioritize selecting and endorsing premium fitness apps with a proven track record of reliability and effectiveness (Herrmann & Kim, 2017). Stringent evaluation procedures are used to ensure that the apps adhere to evidence-based guidelines and do not compromise user health. Additionally, fitness facilities can invest in staff training to educate them on the selected applications and prepare them to assist users safely and

effectively. User education is also critical, and fitness facilities can provide resources and information to help users make informed decisions about app usage. Collaborating with reputable partners in the health and wellness industry can also expand service offerings and provide consumers with the support they need to achieve their fitness goals (Bardus et al., 2016).

Fitness center managers must adapt to the evolving world of fitness technology and stay up to date with these changes to provide effective leadership. To encourage staff to embrace technology changes and continually learn about new digital tools, managers should foster an innovative culture within their centers. Creating a welcoming environment where staff feel empowered to experiment with new technology and incorporate it into fitness programs is crucial. To set a standard for client care and safety, managers should also emphasize the importance of expert supervision and safety standards in their fitness centers. By keeping up with the latest advancements in fitness technology and regularly updating their facilities and services, fitness center managers can maintain competitiveness and meet the changing needs of health-conscious customers.

For fitness facilities aiming to implement cutting-edge digital technologies, a marketing strategy should prioritize user trust, differentiation, and comprehensive wellness solutions. Fitness centers should promote evidence-based apps and qualified counseling as fundamental services to demonstrate their commitment to user safety and quality. By expressing this commitment in promotional materials and online channels, they can attract health-conscious individuals seeking safe and effective workout solutions. Fitness facilities should also make significant investments in strong data security mechanisms, clearly communicate privacy policies, and submit to third-party security audits to ensure user data protection and foster trust. Partnering with healthcare professionals or bundling services such as stretching and massage sessions can differentiate fitness centers in the market and position them as all-inclusive wellness destinations. By adapting their strategies in accordance with these principles, fitness centers can successfully navigate the potential and risks associated with cutting-edge digital technologies and thrive in the changing health and wellness landscape.

Ultimately, fitness clubs that navigate these barriers and leverage these opportunities can position themselves as leaders in adopting innovative digital technologies to promote wellness. They can offer their members safe, effective, and privacy-conscious solutions for achieving their health and fitness goals.

6. Recommendations

6.1. Recommendations for The Health Ministry:

Promote Public Awareness and Education: The Health Ministry should initiate public awareness campaigns highlighting the critical importance of regular physical activity in maintaining overall health and well-being. These campaigns should emphasize the positive impact of exercise in reducing the risk of chronic diseases, improving mental health, and enhancing overall quality of life.

Support Research and Development: Allocate funding for research and development in the field of innovative digital technologies for promoting wellness. Encourage partnerships between research institutions, technology companies, and fitness centers to develop evidence-based fitness apps and wearable devices that prioritize user safety and effectiveness.

Establish Guidelines and Standards: Collaborate with fitness professionals, experts, and technology developers to establish clear guidelines and standards for the quality and safety of fitness apps and digital technologies. These guidelines should address issues such as data privacy, security, and evidence-based content.

Incentivize Technology Adoption: Create incentives and subsidies for fitness centers that adopt innovative digital technologies to promote wellness. These incentives can include tax breaks, grants, or reduced regulatory burdens to encourage fitness centers to invest in technology that enhances the well-being of their members.

6.2. Recommendations for Board Administrations and Directors of Fitness Centers:

Prioritize Evidence-Based Apps: Fitness centers should prioritize the use of evidence-based fitness apps and digital technologies. They should invest in research to evaluate the effectiveness of these technologies in improving member health and fitness outcomes.

Professional Training: Fitness centers should invest in ongoing training for their staff to ensure they can effectively guide members in using digital technologies safely and responsibly. This includes educating staff on the proper use of wearable devices, fitness apps, and other digital tools.

Data Security Measures: Implement robust data security measures to protect member privacy. Fitness centers should regularly update their data security protocols, conduct security audits, and establish clear privacy policies to build trust with members.

Customization and Personalization: Utilize digital technologies to provide personalized fitness plans and recommendations to members. By tailoring workouts and nutrition guidance to individual needs, fitness centers can enhance member engagement and outcomes.

6.3. Recommendations for Fitness Center Professionals:

Stay Informed: Fitness professionals should stay updated on the latest developments in digital health technologies, including wearable devices, mobile apps, and virtual reality tools. This knowledge will enable them to provide informed guidance to clients.

Promote Balanced Technology Use: Encourage clients to use technology as a tool to enhance their fitness journey but also emphasize the importance of maintaining a balanced lifestyle. Discuss the potential drawbacks of excessive screen time and sedentary behavior.

Individualized Guidance: Provide personalized guidance to clients on selecting and using fitness apps and wearable devices that align with their goals and fitness levels. Consider clients' preferences and technological literacy when making recommendations.

Collaboration: Collaborate with technology developers and fitness centers to provide feedback on app features and usability. Your insights can help improve the effectiveness and user-friendliness of these technologies.

6.4. Recommendations for Individuals choosing a Fitness Center:

Informed Choices: When selecting fitness centers, individuals should prioritize those that embrace innovative digital technologies to enhance wellness. Research and choose fitness centers that offer evidence-based fitness apps, wearable device integration, and personalized fitness plans.

Balanced Use: Be mindful of your technology usage. While fitness apps and wearables can be valuable tools, remember to maintain a balanced lifestyle that includes face-to-face social interactions and outdoor activities.

Regular Check-Ins: Continuously assess your progress and seek guidance from fitness professionals as needed. Use the technology available to you for tracking and monitoring your health and fitness goals, but don't hesitate to consult with experts for personalized advice.

Advocacy: Share your positive experiences with technology-assisted fitness and wellness with friends and family. Encourage them to make informed choices when it comes to adopting digital technologies to support their health goals.

By implementing these recommendations, stakeholders in the fitness and wellness industry can work collaboratively to harness the potential of innovative digital technologies for promoting wellness while addressing associated challenges and concerns. These steps can contribute to a healthier and more digitally empowered society, improving overall health and well-being.

7. Limitations and Future Research Directions

Despite providing valuable insights, this study has certain limitations that must be considered. The main limitations are as follows:

- The participants were selected from a narrow geographic area, and the sample size was modest. Consequently, the findings may not be applicable to different areas or populations. For future investigations, a larger and more diverse sample may be used to enhance the external validity of the results.

- The qualitative research approach used in this study might have limited the generalizability of the results. To obtain a deeper understanding of the topic, future studies could use a mixed methods approach that combines qualitative and quantitative data.

- This study focused on the opinions and experiences of managers, independent contractors, and employees in wellness and fitness facilities. Future studies could also include the perspectives and perceptions of end-users, such as gym-goers and individuals who use cutting-edge digital technology to support their fitness and health.

- The study exclusively examined how innovative digital technologies are employed in fitness facilities. Future research could explore the use and impact of these technologies in various contexts, such as workplace wellness programs, community health campaigns, and home fitness programs.

- This study did not investigate the long-term effects of innovative digital technologies on health outcomes. To evaluate the effectiveness of these interventions, future research could track the health outcomes of individuals using these technologies over an extended period.

- Finally, this study identified various obstacles to the adoption of innovative digital technologies in fitness centers. Future research could explore the strategies that fitness clubs can employ to overcome these barriers, such as cost-effective implementation methods, employee training programs, and data security measures.

In conclusion, this study provides valuable insights into the role of innovative digital technologies in promoting physical activity and wellness in fitness centers. Future research could build on these findings by addressing the aforementioned limitations and exploring new avenues for research in this rapidly evolving field.

8. Conclusion:

In this study the intersection of physical activity, innovative digital technologies and wellness promotion was explored from the perspective and attitudes of fitness industry actors. The main conclusions are:

- Physical inactivity epidemic seems to be felt as an urgent issue, that poses a multifaceted challenge to public health. There is no one-size-fits-all solution to this pervasive problem, highlighting the need for diverse strategies ranging from policy-level interventions to infrastructural enhancements.

- The role of innovative digital technologies in shaping the future of fitness centers emerged as a pivotal theme in our research. Fitness centers are increasingly using digital tools such as wearable devices, mobile health apps, and virtual reality-based exercises to enhance their members' well-being. These technologies promise personalized guidance, instant access to health data, and improved user experiences.

- Research uncovered barriers that accompany the adoption of these innovative digital technologies, including resistance to technology, privacy concerns, and the need for professional guidance. Despite these challenges, our research underscored that the benefits of technology adoption far outweigh the drawbacks.

- Based on] findings, we offer recommendations for various stakeholders, including the health ministry, board administrations and directors of fitness centers, fitness center professionals, and fitness center individuals. These recommendations emphasize the importance of informed decision-making, data security, education, and collaboration in leveraging digital technologies for wellness promotion.

- A set of targeted recommendations was outlined and may be valuable to foster a culture of wellness that embraces the opportunities presented by digital technologies while addressing their associated challenges. By doing so, we can collectively work towards a healthier and more digitally empowered society.

In summary, this research affirms that physical activity is crucial for human health and well-being. Innovative digital technologies serve as powerful tools to facilitate, enhance, and personalize physical activity experiences. Integrating these technologies into fitness centers and individuals' lives has the potential to mitigate the physical inactivity epidemic and empower individuals to take charge of their health.

As technology continues to be an integral part of daily life, this research serves as a reminder that, when wielded wisely, it can be a potent ally in our quest for physical and mental well-being. We anticipate further advancements in the field of digital health technologies and an ever-expanding role for them in promoting wellness.

9. References

Abernethy, A., Adams, L., Barrett, M., Bechtel, C., Brennan, P., Butte, A., ... & Valdes, K. (2022). The promise of digital health: Then, now, and the future. NAM perspectives, 2022.

Accenture. (2019). Today's consumers reveal the future of healthcare. Retrieved January 26, 2022, from https://www.accenture.com/us-en/insights/health/todays-consumers-reveal-future-healthcare

Adhikari, R., Richards, D., & Scott, K. (2014). Security and privacy issues related to the use of mobile health apps. ACIS.

Angosto, S., García-Fernández, J., Valantine, I., & Grimaldi-Puyana, M. (2020). The intention to use fitness and physical activity apps: a systematic review. Sustainability, 12(16), 6641.

Attig, C., & Franke, T. (2019). I track, therefore I walk–Exploring the motivational costs of wearing activity trackers in actual users. International Journal of Human-Computer Studies, 127, 211-224.Bahr, R., & Krosshaug, T. (2005). Understanding injury mechanisms: a key component of preventing injuries in sport. British journal of sports medicine, 39(6), 324-329.

Bardus, M., van Beurden, S. B., Smith, J. R., & Abraham, C. (2016). A review and content analysis of engagement, functionality, aesthetics, information quality, and change techniques in the most popular commercial apps for weight management. International Journal of Behavioral Nutrition and Physical Activity, 13(1), 1-9.

Baumann, L. M. (2016). The story of wearable technology: A framing analysis (Doctoral dissertation, Virginia Tech).

Berger, B. G. (2009). Roles of exercise in quality of life: Exploring integral relationships. Sport and Exercise Psychology Review, 5, 60-62.

Berger, B. G., & McINMAN, A. (1993). Exercise and the quality of life. Handbook of research on sport psychology, 729-760.Bickmore, T. W., & Picard, R. W. (2005, June). Establishing and maintaining long-term human-computer relationships. ACM Transactions on Computer-Human Interaction, 12(2), 293–327.

Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., ... & Willumsen, J. F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. British journal of sports medicine, 54(24), 1451-1462.

Butryn, M. L., Arigo, D., Raggio, G. A., Colasanti, M., & Forman, E. M. (2016). Enhancing physical activity promotion in midlife women with technology-based self-monitoring and social connectivity: a pilot study. Journal of health psychology, 21(8), 1548-1555.

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. Public health reports, 100(2), 126.

Denzin, N. K., Lincoln, Y. S., Giardina, M. D., & Cannella, G. S. (Eds.). (2023). The Sage handbook of qualitative research. Sage publications.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September). From game design elements to gamefulness: defining" gamification". In Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments (pp. 9-15).

Ding, D., Lawson, K. D., Kolbe-Alexander, T. L., Finkelstein, E. A., Katzmarzyk, P. T., Van Mechelen, W., & Pratt, M. (2016). The economic burden of physical inactivity: a global analysis of major non-communicable diseases. The Lancet, 388(10051), 1311-1324.

DiPietro, L., Al-Ansari, S. S., Biddle, S. J., Borodulin, K., Bull, F. C., Buman, M. P., ... & Willumsen, J. F. (2020). Advancing the global physical activity agenda: recommendations for future research by the 2020 WHO physical activity and sedentary behavior guidelines development group. International Journal of Behavioral Nutrition and Physical Activity, 17(1), 1-11.

Drewnowski, A., & Evans, W. J. (2001). Nutrition, physical activity, and quality of life in older adults: summary. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 56(suppl_2), 89-94.

Eguchi, K., & Aoki, R. (2023). Practical RR Interval Editing for Heart Rate Variability Analysis Using Single-Channel Wearable ECG Devices. IEEE Access, 11, 25543-25582.

García-Fernández, J., Gálvez-Ruíz, P., Fernández-Gavira, J., Vélez-Colón, L., Pitts, B., & Bernal-García, A. (2018). The effects of service convenience and perceived quality on perceived value, satisfaction and loyalty in low-cost fitness centers. Sport Management Review, 21(3), 250-262.

Groarke, J. M., Richmond, J., Kelly, M. G., McSharry, J., Groarke, A., Kerr, T., ... & Walsh, J. (2019). Examining the impact of a personalized self-management lifestyle program using mobile technology on the health and well-being of cancer survivors: protocol and rationale for a randomized controlled trial (the moving on study). JMIR Research Protocols, 8(8), e13214.

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1· 6 million participants. The Lancet Child & Adolescent Health, 4(1), 23-35.

Hall, G., Laddu, D. R., Phillips, S. A., Lavie, C. J., & Arena, R. (2021). A tale of two pandemics: How will COVID-19 and global trends in physical inactivity and sedentary behavior affect one another?. Progress in cardiovascular diseases, 64, 108.

Herrmann, L. K., & Kim, J. (2017). The fitness of apps: a theory-based examination of mobile fitness app usage over 5 months. Mhealth, 3.

Jin, D., Halvari, H., Maehle, N., & Olafsen, A. H. (2022). Self-tracking behaviour in physical activity: a systematic review of drivers and outcomes of fitness tracking. Behaviour & Information Technology, 41(2), 242-261.

Jin, H., Luo, Y., Li, P., & Mathew, J. (2019). A review of secure and privacy-preserving medical data sharing. IEEE Access, 7, 61656-61669.

Kohl, H. W., Craig, C. L., Lambert, E. V., Inoue, S., Alkandari, J. R., Leetongin, G., & Kahlmeier, S. (2012). The pandemic of physical inactivity: global action for public health. The lancet, 380(9838), 294-305.

Kotler, P., & Keller, K. L. (2016). Marketing management (15th global ed.). England: Pearson, 803-829.

Larsen, L. T. (2022). Not merely the absence of disease: A genealogy of the WHO's positive health definition. History of the Human Sciences, 35(1), 111-131.

Leavell, M. A., Leiferman, J. A., Gascon, M., Braddick, F., Gonzalez, J. C., & Litt, J. S. (2019). Nature-based social prescribing in urban settings to improve social connectedness and mental well-being: a review. Current environmental health reports, 6, 297-308.

Lee, I. M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., & Katzmarzyk, P. T. (2012). Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. The lancet, 380(9838), 219-229.

Leśniewska, A. (2014). Customer relationship management in a fitness club–case study of it solutions applied in a selected organization. Informatyka Ekonomiczna, (34), 66-76.

Lewis, T. L., & Wyatt, J. C. (2014). mHealth and mobile medical apps: a framework to assess risk and promote safer use. Journal of medical Internet research, 16(9), e3133.

Lewis, Z. H., Pritting, L., Picazo, A. L., & JeanMarie-Tucker, M. (2020). The utility of wearable fitness trackers and implications for increased engagement: An exploratory, mixed methods observational study. Digital health, 6, 2055207619900059.

Li, X., Dunn, J., Salins, D., Zhou, G., Zhou, W., Schüssler-Fiorenza Rose, S. M., ... & Snyder, M. P. (2017). Digital Health: Tracking Physiomes and Activity Using Wearable Biosensors Reveals Useful Health-Related Information. PLoS Biology, 15(1), e2001402. DOI: 10.1371/journal.pbio.2001402

Lindwall, M., & Ljung, T. (2017). The relationship between exercise and health-related quality of life. Quality of Life and Exercise, 51-67.

Maddison, R., Rawstorn, J. C., Stewart, R. A., Benatar, J., Whittaker, R., Rolleston, A., ... & Gant, N. (2019). Effects and costs of real-time cardiac telerehabilitation: randomised controlled non-inferiority trial. Heart, 105(2), 122-129.

Malhotra, V., Aggarwal, A., & Bhanot, R. (2020). Injuries in self-referred untrained recreational runners: A 5-year observational retrospective study at a tertiary care hospital in India. Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology, 12(1), 1-7

Mani, Z., & Chouk, I. (2022). Impact of privacy concerns on resistance to smart services: does the 'Big Brother effect'matter?. In The Role of Smart Technologies in Decision Making (pp. 94-113). Routledge.

McCarthy, M. (2013). Experts warn on data security in health and fitness apps. BMJ: British Medical Journal (Online), 347.

McGrath, M. J., & Scanaill, C. N. (2013). Sensor technologies: Healthcare, wellness, and environmental applications (p. 336). Springer Nature.

Mestre, D. R., Ewald, M., & Maiano, C. (2011). Virtual reality and exercise: behavioral and psychological effects of visual feedback. Annual Review of Cybertherapy and Telemedicine 2011, 122-127.)

Meyer, J. D., Koltyn, K. F., Stegner, A. J., Kim, J. S., & Cook, D. B. (2016). Influence of exercise intensity for improving depressed mood in depression: a dose-response study. Behavior therapy, 47(4), 527-537.

Modave, F., Bian, J., Leavitt, T., Bromwell, J., Harris III, C., & Vincent, H. (2015). Low quality of free coaching apps with respect to the American College of Sports Medicine Guidelines: a review of current mobile apps. JMIR mHealth and uHealth, 3(3), e4669.

Myers, J., McAuley, P., Lavie, C. J., Despres, J. P., Arena, R., & Kokkinos, P. (2017). Physical activity and cardiorespiratory fitness as major markers of cardiovascular risk: their independent and interwoven importance to health status. Progress in cardiovascular diseases, 60(1), 71-76.

Oinas-Kukkonen, H., & Harjumaa, M. (2009). Persuasive Systems Design: Key Issues, Process Model, and System Features. Communications of the Association for Information Systems, 24.

Oliveira, A. J., Monteiro, D., & Monteiro, J. (2017). Relationship between physical activity, social support and quality of life in adults. Clinical Practice & Epidemiology in Mental Health, 13, 9-16.

Orji, R., & Moffatt, K. (2018). Persuasive technology for health and wellness: State-of-the-art and emerging trends. Health informatics journal, 24(1), 66-91.

Pardede, F. E., Sinaga, N. Y. M., & Lintong, J. R. (2020). Developing a mobile application to improve customer relationship management for fitness centers. International Journal of Scientific & Technology Research, 9(1), 1315-1318.

Pasco, D. (2013). The potential of using virtual reality technology in physical activity settings. Quest, 65(4), 429-441.

Patel, M. S., Asch, D. A., & Volpp, K. G. (2015). Wearable devices as facilitators, not drivers, of health behavior change. Jama, 313(5), 459-460.

Perrot, A., Maillot, P., & Hartley, A. (2019, February). Cognitive Training Game Versus Action Videogame: Effects on Cognitive Functions in Older Adults. Games for Health Journal, 8(1), 35–

Peters, D., Calvo, R. A., & Ryan, R. M. (2018). Designing for motivation, engagement and wellbeing in digital experience. Frontiers in psychology, 797.

Pettinico, G., & Milne, G. R. (2017). Living by the numbers: understanding the "quantification effect". Journal of Consumer Marketing, 34(4), 281-291.

Pew Research Center. (2021). Mobile Technology and Home Broadband 2021.

Pham, H., Bandaru, A. P., Bellannagari, P., Zaidi, S., & Viswanathan, V. (2022). Getting fit in a sustainable way: Design and optimization of a low-cost regenerative exercise bicycle. Designs, 6(3), 59.

Piwek, L., Ellis, D. A., Andrews, S., & Joinson, A. (2016). The rise of consumer health wearables: promises and barriers. PLoS medicine, 13(2), e1001953.

Prakash, R. (2002). Physical inactivity a leading cause of disease and disability, warns WHO. WHO. World Health Organization, 4.

Rawassizadeh, R., Price, B. A., & Petre, M. (2014). Wearables: Has the age of smartwatches finally arrived?. Communications of the ACM, 58(1), 45-47.

Rebar, A. L., Stanton, R., Geard, D., Short, C., Duncan, M. J., & Vandelanotte, C. (2015). A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. Health psychology review, 9(3), 366-378.

Richard, M., Christina, M. F., Deborah, L. S., Rubio, N., & Kennon, M. S. (1997). Intrinsic motivation and exercise adherence. Int J Sport Psychol, 28(4), 335-354.

Roy, S. K., Balaji, M. S., Quazi, A., & Quaddus, M. (2018). Predictors of customer acceptance of and resistance to smart technologies in the retail sector. Journal of Retailing and Consumer Services, 42, 147-160.

Rubin, H. J., & Rubin, I. S. (2011). Qualitative interviewing: The art of hearing data. sage.

Ruegsegger, G. N., & Booth, F. W. (2018). Health benefits of exercise. Cold Spring Harbor perspectives in medicine, 8(7), a029694.

Seidman, I. (2006). Interviewing as qualitative research: A guide for researchers in education and the social sciences. Teachers college press.

Siegel, J., & Krishnan, S. (2020). Cultivating invisible impact with deep technology and creative destruction. Journal of Innovation Management, 8(3), 6-19.

Siscovick, D. S., Laporte, R. E., & Newman, J. M. (1985). The disease-specific benefits and risks of physical activity and exercise. Public health reports, 100(2), 180.

Soysal, P., Veronese, N., Thompson, T., Kahl, K. G., Fernandes, B. S., Prina, A. M., ... & Stubbs, B. (2017). Relationship between depression and frailty in older adults: a systematic review and meta-analysis. Ageing research reviews, 36, 78-87.

Stoumpos, A. I., Kitsios, F., & Talias, M. A. (2023). Digital Transformation in Healthcare: Technology Acceptance and Its Applications. International journal of environmental research and public health, 20(4), 3407.

Vatandoost, M., & Litkouhi, S. (2019). The future of healthcare facilities: how technology and medical advances may shape hospitals of the future. Hospital Practices and Research, 4(1), 1-11.

Wadhera, R. K., Steen, D. L., Khan, S. U., Giugliano, R. P., Foody, J. M., & Amin, A. P. (2020). Association of Internet Availability and Access with Self-Rated Health and Depression Amongst Medicare Beneficiaries. Journal of the American Heart Association, 9(5), e014828. https://doi.org/10.1161/JAHA.119.014828

Warburton, D. E., Nicol, C. W., & Bredin, S. S. (2006). Health benefits of physical activity: the evidence. Cmaj, 174(6), 801-809.

Wilhelmy, A., & Köhler, T. (2022). Qualitative research in work and organizational psychology journals: Practices and future opportunities. European Journal of Work and Organizational Psychology, 31(2), 161-185.

Xu, W., & Liu, Y. (2015). mHealthApps: a repository and database of mobile health apps. JMIR mHealth and uHealth, 3(1), e4026.

Yuan, S., Ma, W., Kanthawala, S., & Peng, W. (2015). Keep using my health apps: Discover users' perception of health and fitness apps with the UTAUT2 model. Telemedicine and e-Health, 21(9), 735-741.

Zuckerman, O., & Gal-Oz, A. (2014). Deconstructing gamification: evaluating the effectiveness of continuous measurement, virtual rewards, and social comparison for promoting physical activity. Personal and ubiquitous computing, 18, 1705-1719.

10. Appendixes

Appendix 1: Interview Questions – Participants [1-10]

Q1. Qual é, na sua opinião, a relação entre a atividade física e a saúde e o bem-estar?

Q2. O que pensa sobre a utilização e o avanço da tecnologia na nossa vida quotidiana?

Q3. Na minha revisão de literatura, descobri que a inatividade física se tornou um grande problema de saúde pública e é o quarto maior fator de risco de morte. Imagine ser membro da Organização Mundial de Saúde, que solução proporia para melhorar esta situação?

Q4. Como vê as novas e inovadoras tecnologias digitais a ajudar e melhorar na questão dos estilos de vida sedentários?

Q5. O aumento das doenças crónicas é agora um fardo pesado em termos de morbilidade e mortalidade, ameaçando ao mesmo tempo a sustentabilidade a longo prazo dos sistemas de saúde. Como pensa que a atividade física pode ajudar a melhorar a gestão das doenças crónicas?

Q6. Como pensa que as novas e inovadoras tecnologias digitais podem ajudar na luta contra as doenças crónicas?

Q7. Como pensa que o crescimento de tecnologias digitais inovadoras em centros de fitness para promover o bem-estar e a saúde irá evoluir nos próximos 5 a 10 anos? Pode dar exemplos?

Q8. Após a minha revisão de literatura, descobri as principais aplicações e benefícios atuais, bem como observações-chave relativas ao avanço e aplicações futuras da tecnologia nesta indústria. Com isso em mente, pode indicar o seguinte:

I. **Papel da Tecnologia Persuasiva (PT) nos Comportamentos de Saúde: "Sistemas interativos concebidos para ajudar e motivar as pessoas a adoptar comportamentos que lhes sejam benéficos"**
   a. **Está familiarizado com este conceito? (Sim ou Não)**
   b. **Esta Instalação está a utilizar esta tecnologia digital inovadora? (Sim ou Não)**
   c. **Na sua opinião, quais são os principais benefícios de implementar esta tecnologia digital inovadora em centros de fitness?**
   d. **Na sua opinião, quais são os principais obstáculos e desafios à introdução desta tecnologia digital inovadora nos ginásios?**

II. **As Possibilidades da Tecnologia Vestível: "O termo " Tecnologia Vestível " refere-se a um grupo de dispositivos móveis que são feitos para serem usados como acessórios ao longo do dia, tais como relógios inteligentes, bandas inteligentes, óculos inteligentes, auscultadores, dispositivos de realidade virtual, e aparelhos de atividade física".**
   a. **Está familiarizado com este conceito? (Sim ou Não)**

b. **Esta Instalação está a utilizar esta tecnologia digital inovadora? (Sim ou Não)**
c. **Na sua opinião, quais são os principais benefícios de implementar esta tecnologia digital inovadora em centros de fitness?**
d. **Na sua opinião, quais são os principais obstáculos e desafios à introdução desta tecnologia digital inovadora nos ginásios?**

III. **O Potencial das Aplicações de Saúde Móvel (mHealth): "Tecnologia de aptidão física e dispositivos de rastreio que utilizam várias tecnologias de sensores para recolher uma grande quantidade de dados sobre a sua atividade física e comportamentos de saúde".**
a. **Está familiarizado com este conceito? (Sim ou Não)**
b. **Esta Instalação está a utilizar esta tecnologia digital inovadora? (Sim ou Não)**
c. **Na sua opinião, quais são os principais benefícios de implementar esta tecnologia digital inovadora em centros de fitness?**
d. **Na sua opinião, quais são os principais obstáculos e desafios à introdução desta tecnologia digital inovadora nos ginásios?**

IV. **Tecnologia como ferramenta para melhorar a Gestão da Relação com o Cliente (CRM): "Com a utilização desta tecnologia, todas as suas operações comerciais podem ser geridas por uma única ferramenta, permitindo-lhe ver tudo o que ocorre no seu negócio num único local".**
a. **Está familiarizado com este conceito? (Sim ou Não)**
b. **Esta Instalação está a utilizar esta tecnologia digital inovadora? (Sim ou Não)**
c. **Na sua opinião, quais são os principais benefícios de implementar esta tecnologia digital inovadora em centros de fitness?**
d. **Na sua opinião, quais são os principais obstáculos e desafios à introdução desta tecnologia digital inovadora nos ginásios?**

V. **Realidade Virtual e suas Aplicações: "ferramentas de realidade virtual para tornar o exercício mais interessante e exigente, por exemplo, simulando aventuras ao ar livre, cenas de cinema, ou cenários de cortar a respiração durante a prática de exercício físico".**
a. **Está familiarizado com este conceito? (Sim ou Não)**
b. **Esta Instalação está a utilizar esta tecnologia digital inovadora? (Sim ou Não)**
c. **Na sua opinião, quais são os principais benefícios de implementar esta tecnologia digital inovadora em centros de fitness?**
d. **Na sua opinião, quais são os principais obstáculos e desafios à introdução desta tecnologia digital inovadora nos ginásios?**

VI. **Tornar os hábitos mais saudáveis e mais divertidos através da gamificação: Definido por Sebastian Deterding, o termo gamificação é "a utilização de elementos de design de jogos em contextos não relacionados com jogos (e sim na vida real)" - "O mesmo se aplica às aplicações baseadas em jogos de fitness que estão a ser lançados com a intenção de promover hábitos diários mais saudáveis no exercício e nutrição".**
a. **Está familiarizado com este conceito? (Sim ou Não)**
b. **Esta Instalação está a utilizar esta tecnologia digital inovadora? (Sim ou Não)**
c. **Na sua opinião, quais são os principais benefícios de implementar esta tecnologia digital inovadora em centros de fitness?**
d. **Na sua opinião, quais são os principais obstáculos e desafios à introdução desta tecnologia digital inovadora nos ginásios?**

VII. Centros de Fitness Sustentável: A ideia por detrás do ginásio sustentável é a de criar um ambiente de exercício que seja simultaneamente eficiente e autossustentável. Por exemplo, uma instalação capaz de colher energia através de bicicletas e máquinas elípticas em treinos cardiovasculares.

- **a. Está familiarizado com este conceito? (Sim ou Não)**
- **b. Esta Instalação está a utilizar esta tecnologia digital inovadora? (Sim ou Não)**
- **c. Na sua opinião, quais são os principais benefícios de implementar esta tecnologia digital inovadora em centros de fitness?**
- **d. Na sua opinião, quais são os principais obstáculos e desafios à introdução desta tecnologia digital inovadora nos ginásios?**

Q9. Se for oferecida uma nova tecnologia digital inovadora a esta instalação (como as acima referidas), como pretende adquirir o conhecimento necessário para gerir esta tecnologia?

Q10. Se uma nova tecnologia digital inovadora pudesse ser implementada neste centro fitness, que tipo de cliente acredita que seria mais aberto ou quem acredita que seria mais resiliente para adoptar esta mudança? Por quê?

Q11. Na sua opinião, que estratégias poderiam ser utilizadas para converter as pessoas que são resistentes a estas mudanças?

Q12. Na sua perspectiva, os funcionários aqui estão interessado nestas inovações, por quê?

Q13. E quanto a si? Está pessoalmente interessado nestas inovações, por quê?

Q14. Quando comparado com outras prioridades - onde estão as "novas tecnologias digitais inovadoras" na lista de prioridades para esta facilidade? Pode explicar por que é que tem prioridade baixa, média ou alta?

Q15. Na sua opinião, qual é a maior barreira, desafio ou preocupação dos clubes de fitness para adoptarem tecnologias digitais inovadoras?

Q16. Ao tomar em consideração a relação entre as pessoas e a tecnologia, quais são, na sua opinião, as principais barreiras que os utilizadores podem enfrentar quando adotam uma nova tecnologia digital inovadora em centros fitness?

Q17. Depois de ter feito a minha revisão bibliográfica, descobri as principais barreiras dos clubes de fitness e centros de bem-estar adoptarem tecnologias digitais inovadoras para promover o bem-estar. Com isso em mente, pode indicar o seguinte:

I. Aplicativos de Fitness não baseados em dados e evidências: "Quando olhamos para aplicações gratuitas populares relacionadas com a atividade física, observamos que muito poucas delas são baseadas em dados e evidências, não respeitando as diretrizes para a atividade aeróbica, treino de força/resistência, e flexibilidade".

- **a. Acredita que os Centros de Fitness devem valorizar e priorizar a qualidade das Aplicações de Fitness antes de as adoptarem nas suas instalações? Por quê? Qual é a sua opinião sobre esta questão?**
- **b. Que estratégias poderiam os Centros de Fitness implementar para ajudar a resolver esta questão?**

II. **Riscos envolvidos no exercício físico sem uma orientação profissional adequada: "Exercitar-se sozinho pode ser perigoso para a sua saúde e bem-estar físico e pode até ser ineficaz". Os principais riscos são o aumento de lesões, má execução, preocupações relacionadas com o exercício sem uma orientação médica adequada, e fatores de risco não identificados (tais como histórico familiar de doenças cardíacas, diabetes, tensão arterial elevada, ou problemas de dores crônicas).**
   a. **Acredita que os Centros de Fitness devem ter em consideração os riscos individuais para os seus clientes quando se exercitam sem uma orientação profissional adequada? Por quê? Qual é a sua opinião sobre esta questão?**
   b. **Que estratégias poderiam os Centros de Fitness implementar para ajudar a resolver este problema?**

III. **Falhas de segurança como fator de risco (dados pessoais): As principais preocupações atuais dos prestadores de serviços de saúde em termos de segurança e privacidade dos dados são a confidencialidade, integridade e disponibilidade dos dados dos clientes, dada a crescente utilização dos registos de saúde electrónicos.**
   a. **Acredita que os Centros de Fitness deveriam implementar medidas de segurança para proteger os dados pessoais dos clientes antes de adoptarem uma nova tecnologia inovadora nas suas instalações? Por quê? Qual é a sua opinião sobre esta questão?**
   b. **Que estratégias poderiam os Centros de Fitness implementar para ajudar a resolver esta questão?**