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CAN WEARABLE AND DIGITAL TECHNOLOGIES AUGMENT BUSINESS-TO-CONSUMER DATA DRIVEN OUTCOMES IN HEALTH AND FITNESS INDUSTRY?

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Czy technologie ubieralne i cyfrowe mogą zwiększyć wyniki oparte na danych przesyłanych między przedsiębiorstwami a konsumentami w branży zdrowia i fitnessu?

Streszczenie

W artykule wyjaśniono potencjalną rolę, jaką technologie ubieralne i cyfrowe mogą odgrywać w relacjach między specjalistami zajmującymi się zdrowiem i fitnessem a konsumentami. Ta pozytywna relacja może potencjalnie zmienić dynamikę relacji między przedsiębiorstwami a konsumentami (B2C) w branży. Celem tego artykułu jest dostarczenie czytelnikom informacji i wskazówek w następujących aspektach: *A*) identyfikacja aktualnych zastosowań technologii ubieralnych i innych zasobów cyfrowych w codziennych praktykach specjalistów zajmujących się zdrowiem i fitnessem, *B*) zrozumienie potencjału tych narzędzi w zakresie kompleksowej obsługi klientów i pacjentów monitorowanie, niezależnie od wieku i umiejętności cyfrowych oraz *C*) optymalizacja wykorzystania tych zasobów w celu zwiększenia zaangażowania konsumentów w działania na rzecz zdrowia i sprawności fizycznej. Badanie obejmuje technologie ubieralne, aplikacje fitness i narzędzia oparte na danych. Co więcej, wymieniono praktyczne spostrzeżenia na temat zastosowania i użyteczności powszechnie przyjętych wersji sztucznej inteligencji, aby uwzględnić różnorodne cele użytkowników w zakresie zdrowia i sprawności fizycznej, takie jak wzmocnienie pozycji

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dzięki technologii, ulepszona łączność między profesjonalistami a klientami, zoptymalizowana dynamika branży i potencjał ciągłej ewolucji.

Słowa kluczowe: technologia ubieralna, technologia cyfrowa, sztuczna inteligencja, napędzane danymi, aplikacja fitness, branża fitness.

Abstract

This paper explains the potential role wearable and digital technologies might play in the relationship between health and fitness professionals and consumers. This positive relationship could, potentially, change the industry's Business-to-Consumer (B2C) dynamics. This article aims to provide information and guidance to readers in the following aspects: *A*) identifying current applications of wearable technologies and other digital resources in the daily practices of health and fitness professionals, *B*) understanding the potential of these tools for comprehensive client and patient monitoring, irrespective of age or digital literacy, and *C*) optimizing the utilization of these resources to enhance consumer engagement in health and fitness endeavors. The examination encompasses wearable technologies, fitness applications, and datadriven tools. Moreover, practical insights into the applicability and usability of widely adopted artificial intelligence versions are enumerated to encompass diverse health and fitness user objectives such as empowerment via technology, enhanced professional-customer connectivity, optimized industry dynamics, and potential for continuous evolution).

Keywords: wearable technology, digital technology, artificial intelligence, data driven, fitness app, fitness industry.

Introduction

The global sports technology market is projected to exhibit continuous annual growth, reaching USD 40 billion within the next three fiscal years (2024-26), a trend corroborated by the latest *ACSM's Worldwide Survey of Fitness Trends* (A'Naja et al., 2024).

Extensively researched since 2016, wearable technology (also known as fitness and/or activity trackers – AT) offer real-time data including heart rate, step counts, active minutes, and sleep duration (Kroll et al., 2016; Wang Julie et al., 2015). This technology enables fitness professionals to personalize daily physical activity (PA) regimens for their clients, monitoring trends, performance metrics, and long-term progresses (Liguori et al., 2018; Picard et al., 2016). One significant categorization worthy of emphasis involves native mobile features and/or an external physical device linked to an application. In efforts to influence *Business-to-Consumer* (B2C) activity, strategies employed on smartphones tend to be more pragmatic than theory-based approaches (Bort-Roig et al., 2014). The range of novel and engaging intervention strategies used by smartphones (or other digital tools), and user perceptions on their usefulness and viability, highlights the potential such technology has for PA promotion.

So, is it still viable to pursue this strategy to foster engagement and promote behavioral changes in our health and fitness consumers? Are the creation of PA profiles, goal setting, real-time feedback, social support networks, and online expert consultations still relevant or already considered outdated?

Many health and fitness professionals, who themselves are active consumers, understand that the reliability of any app or device tracking human activity in most of cases depends on individual trust. There is evidence indicating that depending on whether the measurement is automatic (utilizing accelerometers, pedometers, calorimetry, energy expenditure detectors, etc., through direct or indirect means) or self-reported (involving different data extraction regarding healthy routines), there can be both overestimation and underestimation. These discrepancies may arise when using data across various levels (Evenson et al., 2015).

Wearable and Digital Technologies landscape

Since the initiation of the 21st century, the augmentation of PA within primarily sedentary adult populations has consistently occupied a prominent position on the public health agenda (Tudor-Locke & Myers, 2001). This commitment stands resolute as a perpetual cornerstone, as pillar number three out of seventeen, enshrined in *The 2030 Agenda for Sustainable Development* (Cf, O. D. D. S., 2015).

Over the past two decades, the significance of wearable technology has struggled to secure a definitive position, encountering ambiguity among both health and fitness practitioners and clients. For instance, this specific trend emerged initially in 2016 (ranking #1 until 2017, then dropping to #3 in 2018) due to the saturation of this "overbooked" sphere, where numerous commercial entities, primarily for-profit companies, vied for prominence without considering the myriad stakeholders involved in this industry (Thompson, 2018).

It is important to delineate the classification under which wearable technology falls: the domain of "digital" technologies (1). This territory primarily encompasses three key components: wearable technology or AT (ranked #1), mobile exercise apps (#7), and data-driven training technology (#18) (Table 1). An attempt to clarify the most pertinent aspects of these three digital pillars is underway.

Understandably, given the level of advancements reached, it seems plausible to envisage a potential shared trajectory among these three digital facets within the health and fitness industry, especially with recent discussions around artificial intelligence (AI) and big data approaches. Traditionally, wearables and apps have often been perceived as more established and interconnected in the timeline, whereas the emergence of data-driven training applications represents a relatively "fresh" introduction. However, it is likely that during this early

stage of technological stabilization or affirmation, these tools might evolve along different trajectories, albeit closely related, potentially forming distinct paths in the perceptions and applications within most B2C dynamics. Wearable technology primarily emphasizes continuous data collection and monitoring, mobile exercise apps predominantly offer guidance and tracking through smartphones, and data-driven training technology utilizes amassed/stored data to deliver personalized and optimized training plans (Bort-Roig et al., 2014). Each of these components possesses distinct strengths and serves varying user needs within the fitness and wellbeing sphere (Table 2). These practical actions aim to empower fitness and health professionals with tangible steps they can take in their daily practice to leverage digital technologies effectively and enhance consumer outcomes (Herberger & Litke, 2021; Monteiro-Guerra et al., 2019; Peart et al., 2019).

Table 1
Digital technologies trends comparison chart (*overall aspects*)

Aspect	**Wearable Technology**	**Mobile Exercise Apps**	**Data-Driven Training Technology**
Functionality	Captures biometric data	Provides workout guidance	Analyzes data for optimization
Portability	Worn on the body	Accessible on smartphones	Software-based, accessible online
Data Collection	Continuous monitoring	User input and tracking	Aggregates and analyzes various data
Features	Biometric tracking (HR, sleep, etc.)	Exercise guidance, tracking	Personalized training plans, analytics
Interactivity	Limited interaction	Moderate interaction	High interaction for analysis and adjustments
Customization	Limited customization	Some level of customization	Highly customizable plans based on data
Feedback	Real-time feedback	Post-workout analysis	Continuous feedback loop for improvement
Integration	Syncs with apps/software	Often stand alone	Integrates with various devices and platforms
Cost	Range of prices based on features	Often free with premium versions	Can vary based on complexity and services

Table 2
Practical tasks and actions for fitness and health professionals in day-to-day practice

Technology	Practical Tasks	Actions
Wearables	1. Conduct Device Assessments	regularly assess and recommend wearable devices based on client needs, considering factors like health goals and lifestyle preferences
	2. Educate on Biometric Data	explain the significance and limitations of biometric data to clients, ensuring they understand how to interpret and use the information
	3. Personalized Goal Setting	set personalized health and fitness goals based on the data collected by wearables, adjusting targets over time as clients progress
	4. Troubleshooting Guidance	provide troubleshooting tips for common wearable issues, enhancing user experience and adherence
	5. Stay Informed	stay updated on emerging wearable technologies and attend relevant workshops or training sessions to enhance proficiency
	6. Client Communication	effectively communicate with clients about privacy concerns, data security, and the importance of honest input for accurate insights
	7. Integration with Programs	seamlessly integrate wearable data into individualized fitness programs for a holistic approach to health improvement
Apps	1. App Familiarity	explore various fitness apps to recommend those aligning with client preferences, offering a diverse range of exercises and features
	2. App Personalization	guide clients in personalizing app settings, setting reminders, and adjusting preferences for tailored user experiences
	3. Regular App Updates	keep track of app updates and inform clients about new features or improvements that could enhance their experience
	4. Motivational Support	encourage clients to leverage app features for motivation, such as goal tracking, social sharing, and virtual challenges (including user gamification)
	5. Data Privacy Conversations	discuss the importance of data privacy with clients, helping them understand how their information is used and protected
	6. Training Program Integration	integrate app-based workout routines and nutrition plans into personalized training programs for consistent progress tracking
	7. User Training Sessions	conduct training sessions to familiarize clients with app features, ensuring they optimize the tools for their benefit

Table 2
Practical tasks and actions for fitness and health professionals in day-to-day practice (*cont.*)

Tech-nology	Practical Tasks	Actions
Data Driven	1. Technology Proficiency	develop proficiency in using sports data-driven technologies, attending training sessions or seeking certifications as needed
	2. Biomechanical Understanding	deepen understanding of biomechanics and physiological metrics collected by wearables, mobile apps and sensors
	3. Interdisciplinary Collaboration	collaborate with sports scientists, physiologists, and coaching staff to comprehensively analyze and interpret athlete data
	4. Video Analysis Workshops	conduct or participate in video analysis workshops to enhance the ability to provide feedback on technique improvement
	5. Injury Prevention Programs	develop and implement injury prevention programs based on insights derived from sports data analytics
	6. Regular Data Reviews	regularly review team-wide data, identifying patterns and areas for improvement in both individual and team performance
	7. Stay Tech-Savvy	stay updated on advancements in sports technology, attending conferences and engaging with industry publications

Consumer Typology Proficiency Dynamics

Digital technologies such as websites, online discussion forums, social media, content-sharing platforms, mobile apps, and wearable devices, have been available for over a decade as avenues for individuals, to acquire knowledge about and advocate for their health, physical fitness, and overall well-being in an age characterized by co-created content (Lupton, 2020). These insights acknowledge the physical, emotional, and relational aspects inherent in navigating digital health and fitness environments, surpassing human-centric viewpoints and perspectives. Within the portfolio of clients engaged with field practitioners, the primary differentiation often relies on the level of involvement with digital technologies, particularly evident following the thresholds set after the COVID-19 pandemic (Angosto et al., 2023). The differentiation among users of sports and fitness wearables requires an understanding of their behaviors, motivations, and interactions with these resources, typically categorized into three groups (Table 3): beginners, average users, and enthusiasts/experts (each group characterized by four main traits). Customer engagement varies significantly among these groups and has persisted since the postmodern era of the

health and fitness industry (Glassner, 1989). Enthusiastic users display higher engagement levels due to their deeper integration and exploration of wearable/digital features. They actively seek new functionalities, participate in communities, and provide feedback for enhancements. Average users maintain consistent engagement, driven by specific fitness goals and a desire for gradual progress. Beginners exhibit sporadic engagement, influenced by their evolving interest in fitness and health.

Table 3
Digital technologies levels and consumer typologies in health and fitness sector

Pillars	**Users**		
Traits	***Beginner***	***Average***	***Enthusiast/Expert***
1	*Low Commitment* often exhibiting low dedication levels using these devices intermittently, especially during initial phases of adopting a routine	*Consistent Usage* maintaining a moderate level of engagement, using regularly to monitor progress and maintain routines	*Self-Motivated & Competitive* largely self-motivated, driven by personal challenges, competitions, or mastery of their healty regime
2	*Basic Tracking* usage revolves around fundamental features like step counting or basic activity monitoring	*Goal-Oriented* focus on achieving specific fitness goals, utilizing to track progress, such as calorie burn, heart rate, and distance covered	*Tech-Savvy & Experimentation* inclination to experiment with different physical tools or apps, seeking the latest technology or features to optimize their routines
3	*Motivation* (pretended) newfound interest in active goals, seeking external motivation to kickstart a healthier lifestyle	*Social Integration* engaging more with social features, connecting with friends or communities for motivation and accountability	*Advanced Tracking & Analysis* exploring and utilizing various features extensively, including advanced metrics like sleep analysis, detailed workout breakdowns, and comprehensive health data
4	*Sporadic Engagement* fluctuating, influenced by external factors such as social support or initial (intrinsic) enthusiasm	*Incremental Growth* exploring gradually additional features beyond basic tracking, incorporating more advanced functionalities	*Highly Engaged* exhibiting high and sustained devotion, often integrating them deeply into their lifestyle (not only limited to physical activity)

It is worth emphasizing that active workers in health and fitness field are not only active consumers of these *general* tools, which act as the linchpin connecting them with consumers. They are, across various levels within this 'working class' classification, also influenced by customer relationship management software, i.e. often diverse programs or applications that their own facilities or employers employ to serve *specific* business objectives (Addolorato et al., 2024).

In commercial product-service research, factors like applicability, usability, personalization, social integration, and the ability of digital solutions to motivate diverse user groups are often examined (Addolorato et al., 2020). Comprehending these behaviors and motivations aids companies in tailoring their resources to better engage and retain users amidst the wave of enthusiasm associated with the "experience". Health and fitness professionals should recognize the fact that from the manufacturers/providers' perspective, they can be perceived as additional, on-the-field promoters of their creations along this continuum.

Digital technologies from now on

The health and fitness industry currently holds a favorable position owing to the longstanding adoption of digital technologies, a historical legacy that surpasses many other digital sectors. Over recent years, both industry professionals and the general public have gradually embraced this trend. Within AI-based digital technologies, exemplified by the latest fitness apps and their advancements, the effective integration of behavior change techniques stands as a pivotal factor in promoting active lifestyles and enhancing health outcomes (Kuru, 2023).

The incorporation of these solutions into wearable technology, mobile exercise apps, and data-driven training technology has the potential to revolutionize the health and fitness industry, benefiting both trainers and end-users (Anderson et al., 2022; Eysenbach, 2023). Goal setting, action planning, behavior self-monitoring, personalization, and social support represent primary and noteworthy effects of both conversational artificial intelligence (CAI) and generative artificial intelligence (GAI) when applied to instilling healthy habits (Table 4).

Table 4
Digital technologies levels and AI typologies in health and fitness sector

AI	**Digital Technologies**		
Typologies	***Wearables***	***Apps***	***Data Driven***
Conversational (interaction, CAI)	*Integration* utilize algorithms to provide deeper insights into health data. For instance, could analyze biometric data to detect patterns, predict health issues, and offer proactive suggestions for improvement	*Guidance* could enhance exercise by offering more personalized guidance. Advanced algorithms could analyze user behavior, preferences, and performance to recommend customized workout routines or nutrition plans	*Optimization* could leverage for more sophisticated data analysis. Identifying nuanced correlations within data sets to optimize training plans, foresee plateaus, and suggest adjustments for better results among varied data segments (up to what is in possession)

Table 4
Digital technologies levels and AI typologies in health and fitness sector (*cont.*)

AI	**Digital Technologies**		
Typologies	***Wearables***	***Apps***	***Data Driven***
Generative (prediction, GAI)	*Creation* generating personalized exercise routines or adaptive health goals based on real-time data. For example, a powered tool might create dynamic workout plans considering an individual's progress, energy levels, and overall health data	*Feature* might generate workout plans, dietary suggestions, or even mental health exercises tailored to individual needs. Could create adaptive, engaging content to keep users motivated and focused	*Customization* could create highly personalized training regimes by considering various factors such as genetics, lifestyle, and performance data (predicting proposals). It could dynamically adjust training plans in real-time, maximizing efficiency

CAI holds potential to support practitioners by leveraging extensive datasets, providing comprehensive insights for informed decision-making in training strategies, injury prevention, and personalized client recommendations (Uunona & Goosen, 2023). Meanwhile, GAI, by e.g. ChatGPT (Eysenbach, 2023), applied to tailored planning tools could aid professionals in devising hyper-personalized plans by utilizing client data to customize exercises, nutrition, and recovery strategies. CAI for consumers could offer highly personalized experiences, delivering bespoke exercise routines, dietary advice, and wellness plans adjusted to individual needs and objectives (Guelmami et al., 2023; Shajari et al, 2023; Zhou et al., 2022). Conversely, GAI might provide adaptive support through powered platforms capable of recognizing shifts in user behavior or health metrics, adjusting recommendations for continual improvement and motivation (Table 5).

Table 5
Practical interactions for fitness and health professionals to interact with conversational (*CAI*) *and generative artificial intelligence* (*GAI*) *based on user levels* (*beginners, average, and enthusiast/expert*) *across three different categories of digital technologies* (*wearables, apps, and data-driven platforms*)

Category	**User Level**	**Practical Interactions**	**CAI and GAI Routine Activities for Health and Fitness Professionals**
Wearables	Beginner	Personalized Setup Assistance	use conversational AI to guide through the setup process of wearable devices, explaining functionalities and providing step-by-step instructions
		Basic Data Interpretation	implement generative AI chatbots to interpret basic biometric data, offering simple explanations to beginners and ensuring they understand the significance
		Goal Setting Support	utilize conversational AI to assist in setting realistic health and fitness goals based on their current abilities and preferences

Table 5
Practical interactions for fitness and health professionals… (*cont.*)

Category	User Level	Practical Interactions	CAI and GAI Routine Activities for Health and Fitness Professionals
Wearables	Average	Progress Review Sessions	schedule regular AI-assisted progress review sessions, providing insights into their achievements, areas for improvement, and adjustments to goals
		Troubleshooting Guidance	use generative AI to troubleshoot common issues or questions that average users might encounter with their wearables
		User Education Webinars	conduct webinars with conversational AI support to educate on the advanced features and capabilities of their wearable devices
	Enthusiast / Expert	Advanced Data Analysis	collaborate with AI specialists to provide in-depth data analysis, leveraging advanced and predicting algorithms to extract actionable insights
		AI-Integrated Workshops	organize workshops integrating AI tools to educate on optimizing the use of wearables for specific health and fitness objectives
Apps	Beginner	App Onboarding with Chatbots	implement chatbots for guiding through mobile fitness app onboarding, explaining features, and answering basic questions
		AI-Personalized Workout Plans	utilize generative AI to create friendly-personalized workout plans within the app, ensuring appropriate exercises and intensity
		Motivational Chat Support	incorporate conversational AI for providing motivational chat support, encouraging adherence and positive behavior change
	Average	AI-Enhanced Progress Tracking	integrate AI algorithms for more sophisticated progress tracking, offering detailed insights and trend analysis
		Adaptive Training Recommendations	utilize generative AI to suggest adaptive training recommendations based on feedback, performance data, and changing/improving fitness levels
		Nutritional Guidance Chat	implement conversational AI for providing nutritional guidance and answering dietary questions
	Enthusiast / Expert	AI-Integrated Challenges	organize AI-driven fitness challenges within the app, creating personalized and competitive experiences (full app domain)
		AI-Enhanced Virtual Coaching	introduce AI-enhanced virtual coaching sessions, combining expert knowledge with generative AI insights for highly customized training

Table 5
Practical interactions for fitness and health professionals… (*cont.*)

Category	User Level	Practical Interactions	CAI and GAI Routine Activities for Health and Fitness Professionals
Data Driven	Beginner	AI-Guided Consumers Onboarding	utilize conversational AI to guide through the onboarding process of sports data-driven technologies, ensuring a smooth introduction
		Basic Performance Insights	implement generative AI for providing basic insights into athlete performance data, helping in understand key metrics
		AI-Enhanced Injury Prevention Tips	use conversational AI to deliver injury prevention tips and guidance based on their health or sports data
	Average	Automated Training Adjustments	integrate generative AI to automatically adjust training plans based on performance data and recovery metrics
		AI-Driven Recovery Strategies	provide advanced recovery strategies through AI algorithms, optimizing performance and reducing injury risks
		Performance Review Webinars	conduct webinars with AI support for reviewing performance data, offering insights and actionable recommendations to users
	Enthusiast / Expert	AI-Supported Game Strategy Sessions	collaborate with AI specialists to conduct game strategy sessions, incorporating AI insights for tactical improvements
		AI-Integrated Sports Science Workshops	organize workshops integrating AI tools to provide them with in-depth insights from sports science and technology

While the potential of these technological advancements is encouraging, it is imperative to exercise meticulous deliberation concerning data privacy, the ethical application of artificial intelligence, and the preservation of equilibrium between automation and human expertise, encompassing the enduring dynamics of human-machine interactions. The primary aim is to empower both professionals and consumers (patients and general clients) with state-of-the-art technology that optimizes health outcomes while respecting individual preferences and privacy concerns.

Conclusion

This article delves into the transformative capacity of wearable and digital technologies in revolutionizing B2C dynamics within the health and fitness industry. Acting as a bridge between professional practices and consumer needs,

these technologies function as a unifying force, offering unprecedented empowerment to both parties. Wearable and digital technologies are fundamentally reshaping the dynamics between health and fitness professionals and consumers within the B2C landscape.

The first set of pillars underscores the personalized nature of health and fitness interventions enabled by these technologies. Leveraging real-time biometric data collected through wearables, professionals can tailor individualized health and fitness plans, ensuring a targeted and responsive approach. Remote health monitoring becomes an integral facet, offering professionals the ability to track and manage consumer well-being in real-time, leading to proactive interventions and a continuous healthcare experience. Engaging consumers through gamification elements within digital platforms fosters adherence to fitness goals and cultivates a sense of community. Telehealth consultations capitalize on wearables and digital platforms to extend healthcare accessibility, allowing professionals to leverage wearable data for informed virtual discussions. The integration of wearables with Electronic Health Record (EHR) systems creates a unified health profile, enhancing the comprehensive understanding of consumer health histories.

The second set of pillars emphasizes the data-driven and behavioral change aspects facilitated by wearable and digital technologies. Data-driven wellness programs leverage aggregated information from wearables to design holistic health programs, incorporating individual preferences and behavioral patterns. Behavioral change interventions, guided by AI-driven insights, enable professionals to identify and address behavior patterns through personalized nudges and coaching strategies. Seamless integration of wearable data with EHR systems contributes to a unified health profile, aiding in informed decision-making. The establishment of health and fitness communities within digital platforms creates a supportive environment, fostering mutual encouragement, motivation, and accountability among users. In summary, these pillars collectively represent the transformative power of wearable and digital technologies, acting as conduits for personalized, data-driven, and socially connected health and fitness experiences.

In conclusion, by leveraging accurate and reliable data from wearables, health and fitness professionals can promote personalized and effective interventions that encourage better adherence to physical activity regimens. However, ethical considerations, including data privacy and the responsible use of personal health information, must be prioritized to ensure trust and protect client confidentiality. Additionally, the use of GAI and CAI can further support professionals by providing insights and facilitating communication, but must also be employed ethically and responsibly. Balancing technological advancements with ethical standards will be crucial in maximizing the benefits of wearables in the fitness industry.

Key takeaways

— *Empowerment via technology*, wearable and digital technologies help consumers through real-time data, personalized insights, and guidance, enabling active management of their health and fitness journeys.
— *Enhanced professional-customer connectivity*, these innovations foster a closer bond between health and fitness professionals and consumers, facilitating personalized, data-driven guidance and support.
— *Optimized industry dynamics*, the integration of these technologies reshapes the B2C landscape, creating more efficient channels for sector practitioners to deliver services and for patients/clients to engage in their wellbeing goals.
— *Potential for continuous evolution*, technological advancements promise ongoing innovation in personalized health and fitness solutions, indicating a continual evolution in how professionals and consumers interact and achieve their objective.

DECLARATION OF CONFLICTING INTERESTS

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