# Sustained Gamification in Medication Adherence: Strategies and Conceptual Framework

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## ABSTRACT
This paper examines the current body of literature on medication adherence using sustained gaming strategies and approaches. The objective is to investigate the concepts of sustained gaming, gaming strategies, and gaming approaches in relation to medication adherence. The goal is to identify the elements that contribute to a conceptual framework for understanding medication adherence behavior in patients, as part of a broader study. A comprehensive literature review was performed on four scholarly databases: MEDLINE, BMC, Global health, and Embase. The study examined the strategies and methodologies employed by the Pokémon Go game as a location-based game (LBG), and its impact on patients' adherence to medication. The study has identified several components, namely physical activities, social connections, exploration, enhanced emotional expression, and individual/self-treatment. The study conducted a qualitative examination on Pokemon Go players to understand their experiences and what kept them playing the games for a longer period. Therefore, the findings from the study and data analysis helped in the development of conceptual framework for promoting medication adherence using sustained gaming strategies and approaches is hereby presented. The results of this study have the potential to contribute to a shared comprehension among practitioners, professionals, and academics in the field of digital health and serious games. Additionally, these findings can serve as a foundation for future research on the long-term viability of digital health through gaming.

## Keywords
Medication adherence, sustained gaming, strategies, AR games, behavior and lifestyle changes.

## 1. INTRODUCTION
Many scholars argue that sustained gaming can be considered an intervention or a source of long-term benefits. Many researchers have emphasized the intervention's ability to be sustained without the need for additional resources, either implicitly or explicitly Harris [1], [2]. This is conveyed in Harris [1:2] frequently cited definition of sustainability as "the ability of an intervention to persist after the implementing agency has left." Thus, sustained gaming can be defined as an ongoing intervention that consistently evolves to maintain the long-term engagement of voluntary gamers who desire an active community and an immersive experience [3, 4]. Engaging in sustained gaming activities leads to enhanced behavioral modification and performance in individuals [5, 6].

Sanner and Sæbø [7] has outlined various strategies to enhance the success of an IS project, such as implementing a daily wage system for project participants. This approach can lead to a decrease in project complexity and promote long-term viability [8, 9]. Sustainability in Information Communication Technology for Development (ICT4D) viewpoints should encompass various aspects, including economic, ecological, educational in nature, political, cultural, and technological dimensions [10-12]. The concept of sustainability has gained significant attention in the field of Information Systems [8, 13] while the concept of long-term gaming strategies and approaches is seldom addressed and has yet to be thoroughly examined in scholarly literature. Furthermore, there is a lack of theoretical research that specifically examines the use of strategies and approaches for sustained gaming in relation to medication adherence. This article aims to identify the strategies, approaches, and gaming experiences that promote sustained gaming in order to develop a conceptual framework for medication adherence in patients focusing on Pokémon Go as a game. This study adds to the growing body of knowledge in the field of digital health, gaming and medication adherence.

## 2. RESEARCH APPROACH
A systematic literature review is a type of literature review that follows a rigorous set of scientific methods with the explicit goal of minimizing systematic error (bias). It involves identifying, evaluating, and synthesizing all relevant studies, regardless of their design, in order to address a specific question or set of questions [14, 15]. Not only that, Okoli [16] stated that investigations aiming to advance knowledge rather than corroborate existing literature should employ a systematic literature review methodology. To investigate the strategies and methods for ensuring consistent medication adherence in gaming, a systematic literature review is required. A systematic search was performed using health-related databases including MEDLINE, BMC, Global Health, and Embase [17, 18] for articles published between January 2015 and December 2023.

The research utilized specific keywords and phrases, including gaming, augmented reality (AR), Internet of Things (IoT), medication adherence, virtual reality, users' participation, users' behavior patterns, and users' motivation, during its data search. The study design incorporated the following search terms: questionnaire, qualitative, focus group, research, observation, and interview. Research conducted in this field is scarce due to its novelty, with only a few studies identified that contribute to technological advancements, particularly in developing nations. The research primarily encompasses literature on virtual reality, digital gaming, and augmented reality. There is a limited amount of literature available on the impact of gaming on medication adherence. All recently published English articles related to the search criteria, including AR in gaming, the effects of AR on medication adherence, user motivation and participation, and behavioral patterns, were included. The search terms were categorized as follows: artificial intelligence and augmented reality in healthcare, behavioral and changes in lifestyle in gaming, economic and political implications of gaming strategies, medication adherence, innovations in technology, and augmented reality gaming.

Excluded selection criteria include: (1) articles pertaining to non-interventional clinical, biological, and epidemiologic research; (2) policy/strategic papers, periodicals, and bulletin items; and (3) articles that are not related to gaming and medication adherence. The scope of the exploration was broadened to include research conducted in South Africa as well as other developed nations.

# 3. THEORETICAL FRAMEWORKS

This paper examines the diverse theoretical frameworks utilized by scholars in their research. This method enables analysis of how these frameworks affect scholars' contributions to essential themes across various disciplines. It also illuminates emerging issues that certain researchers have examined. Consequently, the study discerned three distinct theoretical perspectives which are: 1) Self-Determination Theory, 2) Social Cognitive Theory, 3) Goal Setting Theory.

**Self-Determination Theory (SDT)** emphasizes the importance of intrinsic motivation and the satisfaction of three fundamental psychological needs: autonomy, competence, and relatedness [19]. Applying these principles in gamification strategies for medication adherence can significantly improve user engagement [20]. Enabling users to personalize their experiences such as selecting reminders or rewards—can cultivate a sense of autonomy and empowerment. Incorporating features like progress tracking and achievement badges can enhance perceptions of competence. Moreover, incorporating social features, such as community support and shared achievements, fulfils the need for connection and fosters a collaborative environment for users [21]. To execute an effective gamified strategy, it is crucial to emphasize personalization, ongoing feedback, social engagement, and significant rewards [22]. Adapting experiences to personal preferences can greatly enhance motivation, while prompt feedback fosters positive adherence behaviours. Establishing social connections among users fosters a sense of belonging, thereby enhancing their commitment [22]. Although rewards can enhance engagement, it is crucial that they correspond with intrinsic motivations to foster enduring commitment [23]. With the integration of these strategies using the principles of Self-Determination Theory can effectively promote sustained medication adherence through gamification, resulting in improved health outcomes.

**Social Cognitive Theory (SCT)** examines the interplay of individual factors, behavior, and external factors in shaping actions [24]. SCT provides essential insights for promoting and supporting users in sustaining gamification for medication adherence [25]. Essential components encompass observational learning, wherein individuals derive motivation from the achievements of others, and self-efficacy, denoting the conviction in one's capacity to succeed [26]. Including testimonials and peer accomplishments into a gamified platform enables users to observe effective medication management techniques. Moreover, establishing attainable objectives and monitoring advancement can bolster users' confidence, motivating them to consistently follow their medication regimens [25].

To successfully execute gamification strategies, it is essential to incorporate elements such as social interaction, goal setting up, and contextual prompts [24]. Researchers argued that promoting interaction through elements such as leaderboards or team challenges cultivates community support and incentivizes users to motivate each other. Well-defined, achievable objectives coupled with consistent feedback can bolster users' self-efficacy, while reminders and notifications act as beneficial cues for behavioral modification [27]. A well-structured reward system can promote compliance if it aligns with users' intrinsic motivations to maintain continuous engagement [28]. Using the concepts from SCT, gamification can assist individuals in effectively managing their medication regimens within a supportive and engaging context.

**Goal Setting Theory** proposes that the establishment of particular and difficult objectives, coupled with prompt feedback, can substantially enhance motivation as well as performance [29]. This theory provides a valuable framework for promoting sustained engagement with health behaviours via gamification in medication adherence [30]. With the Development of explicit and precise objectives, such as adhering to prescribed medications, aids users in recognizing their responsibilities [31]. Additionally, introducing successively demanding tasks—such as enhancing adherence streaks or engaging in vital educational activities—sustains user motivation [32]. By providing regular feedback through notifications or visual progress indicators, users can track their compliance, which in turn strengthens their commitment to health routines.

Gamified systems can also use the SMART criteria (Specific, Measurable, Achievable, Relevant, Time-bound) to ensure that goals are clearly defined and actionable [33]. Visual tracking attributes, such as graphs or accomplishment badges, can increase motivation by highlighting users' achievements. Including social elements, such as group challenges or opportunities to share accomplishments, increases accountability and community support [34]. Visual tracking attributes, such as graphs or accomplishment badges, can increase motivation by highlighting users' achievements. Including social elements, such as group challenges or opportunities to share accomplishments, increases accountability and community support [34]. Moreover, providing rewards for achieving specific goals can boost engagement, especially when those incentives are relevant to users' interests.

# 4. DISCUSSION OF FINDINGS

Given the limited research in this emerging field, only 50 publications were considered relevant for the current review. Only those publications with complete texts accessible were exploited. Figure 1 depicts the PRISMA diagram, which provides a clear overview of the paper selection process. The study results pertaining to the chosen area of interest are outlined below:

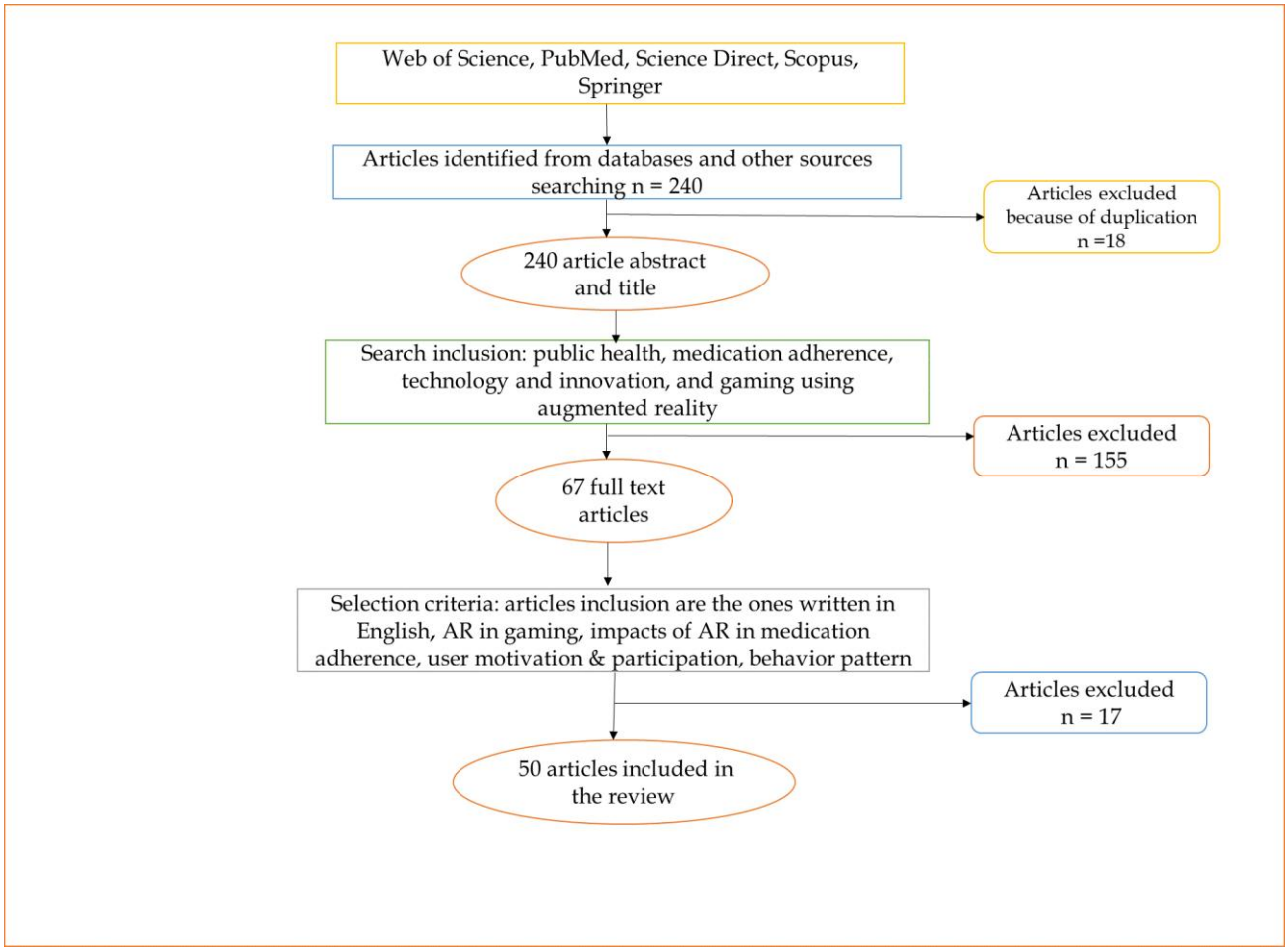


**Figure 1: PRISMA diagram for literature review**

## 4.1 Strategies and Approaches of Gaming.

**Strategy** is the process of creating a unique and valuable position through a range of activities. Strategy becomes unnecessary when there exists only a singular optimal position. A strategy encompasses the actions and activities involved in executing procedures in a distinct manner. The fundamental concept of strategic positioning is to select activities that set one apart from competitors [35]. An effective strategy typically consists of elements such as objectives, scope, and advantages [36, 37]. A strategy, according to the Oxford dictionary, is a deliberate plan designed to accomplish a specific objective. The game designs encompass the strategic elements that distinguish it from its competitors. The game designers integrate the strategies into the game during the game design process.

The "**approaches**" in gaming refer to the methods or strategies used to accomplish tasks or objectives. This study uses the methodology employed in the Pokémon Go game to assist TB patients in their treatment process. The designers are responsible for devising the strategies implemented in the game. In order to achieve success in playing the game, the players must adhere to the rules without any complications. The gaming experience is quantified by the emotional responses of the players following their gameplay. Experiences are derived from the acquisition of skills and the learning of new things by the game player. The factors that serve as incentives for players to remain engaged in the game encompass points, levels, and rewards [15].

Gaming strategies refer to the methodologies or tactics employed by gamers to enhance their performance, proficiency, or enjoyment while engaging in video games. This study focuses on the gaming strategies and approaches employed in the Pokémon Go game. Wang [38], explained further that Pokémon Go is an augmented reality game that employ geolocation technology to overlay virtual creatures from the Pokémon universe onto the real world through the player's mobile device. The game enables players to assume the role of a Pokémon trainer, capturing virtual Pokémon by exploring the physical world, and participating in battles with other players at Gyms. The game uses the GPS functionality of the smartphone to display a map of the nearby area, with the player's image superimposed on their current geographical position. The avatars materialize unpredictably in various locations, necessitating the player's proximity in order to capture them. During a period of up to 30 minutes, all players have the opportunity to visually perceive the Pokémon that manifest [39, 40]. Pokémon Go capitalizes on a preexisting fanbase of Pokémon enthusiasts, which is one of its distinctive features. Hence, this study acknowledges the prolonged engagement of a specific group of individuals in playing Pokémon and aims to address this factor in order to mitigate any potential biases in the subsequent analyses. Game strategies and approaches encompass the various techniques and methods employed to achieve victory in a game [41, 42].

## 4.2 Components of AR Games that Impacts Medication Adherence.

The identified literature has outlined the various components that make up AR gaming. The components of AR games presented in Table 1 were deemed pertinent to this study for two reasons:

• The authors either explicitly mentioned that the components were related to AR games, or

• The descriptions or purposes of the components were consistent with the definition of gaming used in this study. Moreover, these elements can be utilized in the healthcare setting as cited by [15] . Table 1 provides a description of the elements comprising AR games.

**Table 1: Components of AR games**

| Components | Description |
|---|---|
| Feedback and rewards | Providing prompt feedback and rewards, such as points, badges, and ranks. |
| Progress paths | Players are compelled to achieve a higher level, which acts as a source of motivation. Progressing from a lower level of difficulty to a higher one. |
| User interface and user experience | The quality of game-based techniques is enhanced by technological innovations and their interconnectivity. |
| Social connection | It fosters pleasurable interaction and dialogue among users. |

## 4.3 Behaviours and Lifestyle changes in Gamification

Researchers emphasized that gaming employs numerous strategies that facilitate its status as a long-lasting game with the potential to impact medication adherence. The researcher discovered through analysis that Table 2 below showcases the behavioral and health lifestyle change strategies and approaches employed in gaming. The players of Pokémon Go (AR Game) experience various behavioral and health lifestyle changes, including engaging in physical activities, forming social connections, exploring new places, expressing emotions more intensely, practicing self-care, participating in community activities, and contributing to community development.

**Exercises/Physical Activities** - Pokémon Go is an innovative technology that motivates diverse individuals from around the globe to engage in a game that fosters enhancements in lifestyle. A recent study found that Pokémon Go motivates gamers to increase their physical activity by an average of 1437 steps, resulting in a 25% rise compared to their previous level of activity [43]. Engaging in Pokémon Go frequently enhances physical activity levels, potentially resulting in an estimated accumulation of 144 billion steps among the population of the United States. This widespread participation in the game has the potential to yield significant health advantages for players [43, 44]. The presence of active players leads to an increase in the number of steps taken, as well as an increase in the time spent on physical activities and the distance covered while engaging in the gameplay of a location-based video game [45-49]. According to these studies, additional beneficial physical activities include weight loss, increased outdoor time, and improved sleep quality [50].

**Social bond/connections** - The social dimension of a game refers to the manner in which users engage and communicate with each other. The presence of teamwork, negotiation, and relationship-building is evident. The tabletop role-playing game is a widely recognized instance of a social game, however, numerous massive multiplayer online games also possess a significant social component [51]. Computers facilitate social games through various means. These platforms enable remote communication among participants through networking and facilitate games with significantly larger player counts than those feasible in a conventional setting. Additionally, these games offer a persistent virtual environment where players can establish their status and accumulate resources, allowing them to cultivate alternative identities distinct from their real-life challenges. The interplay between politics and economics in such a world fosters a dynamic and engaging setting for social interaction [52]. The exhilaration of capturing an elusive Pokémon not only elicits happiness in players but also engenders joy in their companions; when one successfully captures a rare Pokémon, it also bestows delight upon their friends. The majority of the game participants expressed their shared interest in the Pokémon matter, that boosted their sense of being part of something [53-56]. Pokémon Go not only enhances public social interaction, but it also serves as a catalyst for initiating conversations with family members, friends, and strangers [46, 56-58].

**Explorations** - Previous research has demonstrated that Pokémon has incentivized players to actively explore their immediate environment. Players are motivated to deliberately move around in order to search for specific Pokéstops. Research studies have indicated that players opt to navigate unfamiliar paths to familiar locations as a result of the game, thereby increasing their awareness of their surroundings [44, 59]. Furthermore, a study provided evidence of how the game prompted individuals to actively investigate their environment, unintentionally seeking out Pokémon [60]. Pokémon Go facilitates the formation of teams, allowing players to collaboratively explore virtual and physical locations through augmented reality and GPS navigation, resulting in a series of progressive events [38, 61, 62].

**Enhanced emotional expression** – Pokémon Go game enhances emotional expression for players. Research indicates

that players exhibited positive emotions, such as happiness during gameplay, often expressing laughter, smiles, and occasionally silly expressions. Emotions stem from the shared joy and happiness experienced while playing with unfamiliar individuals [62, 63]. This is due to the beneficial interaction where individuals educate each other on game strategies and analyze game features like winning battles, capturing Pokémon, and advancing to higher levels [38, 47, 58, 64-66].

**Individual self-treatment** - Engaging in the game can aid in weight loss, enhance physical fitness, and boost mood. It also helps in discovering strategies to address symptoms of depression and anxiety [67-69]. While not all gamers utilized Pokémon for therapeutic purposes, some employed it for general health maintenance [70]. Furthermore, the game's connection to real-life scenarios and the act of capturing new Pokémon, the behavior modification feature that facilitated self-improvement was the hatching of eggs. This pertains to achieving goals that are associated with physical activity. The societal and economic effects of gaming on the community are analysed within the context of community engagement and community development.

**Community Engagement** - Community engagement is now a common term used by various health and human rights organizations as well as government agencies [71]. It serves as the central hub for extra resources, capacity building, and training activities. Due to the growing popularity of this term, there is confusion regarding the meaning of community engagement [72]. The growing focus on communities is crucial for the future of healthcare and global health, requiring a precise comprehension of the concept of 'community engagement'. Local communities are the primary beneficiaries of community engagement. Empowering communities to establish local health and social systems will enhance local conditions through community-led decision-making, leading to the development of community-driven data, solutions, and policies, ultimately resulting in community transformations and improved well-being. Community engagement is a vital field that aims to empower communities to achieve behavioral and social goals for improved health or development outcomes. It encompasses public health, healthcare, communication, and international/community development [71]. It involves actively engaging and strengthening communities, rather than simply informing, surveying, or seeking feedback on programs that are developed and managed externally [73]. It involves promoting and honoring the community's ownership of therapies, research design, implementation, and evaluation, while building trust, lasting relationships, and a willingness among communities and their leaders to engage. This "bottom-up approach" requires substantial modifications in existing power and privilege structures [73].

**Community development** - Governments worldwide have responsibilities to their citizens, including security, safeguarding lives and assets, and market price control. Enhancing citizens' living standards is crucial and is achieved through policies promoting social development, well-being, welfare, and sustainability. Despite efforts by successive governments in developing nations, especially in Sub-Saharan Africa and notably in South Africa, optimal results have not been achieved [74, 75]. The community-based development strategy is recognized as one method for reducing poverty. This may be because the Community Based Development Approach (CBDA) is usually focused on people and communities [76]. Moreover, it has significant consequences on socioeconomic growth. As stated by Eftekhari, Falahat [77], The CBDA has a notable advantage in fostering community empowerment, especially in low-and middle-income nations. Fostering socioeconomic development relies on community members participating and collaborating to make collective decisions and address communal challenges [74, 78]. Table 2 below gives the relationships between the gaming approaches, behavioral changes and Pokémon strategies.

**Table 2: The relationship between healthy behavior, gaming approaches and Pokémon strategies**

| Heathy Behaviours | Gaming Approaches | Pokémon strategies | Sources |
|---|---|---|---|
| Physical Exercise | - increase in physical activity by spending more time moving, reducing sedentary behaviour, being more active outdoors, losing weight, improving sleep quality, and walking the dog. | Exploring Pokéstops, game locations linked to physical places, themed around Pokémon, capturing new Pokémon | [38, 43, 46, 50, 53, 54, 79-81] |
| Social connections/bonds | Facilitate in-person interactions and support individuals experiencing severe social isolation. - alleviate social anxiety - enhance social interaction - enhance social connections - While playing the game, users establish new friendships. - Foster interaction and connections within families. - Encourage social gameplay by | Locating particular Pokémon, utilising items, capturing new Pokémon, battling in gyms, linking the game's environment to a geographical region, and the Pokémon motif | [38, 43, 46, 51-54, 57, 80, 82-84] |

| | | | |
|---|---|---|---|
| | gathering people at Gyms and Pokéstops. Encourage players to exchange their expertise and insights. | | |
| Exploration | - decreases inactive behaviour - takes extended walks with the dog - explores new geographical areas - enjoys entertaining and engaging gameplay | Discovering new Pokémon and exploring Pokéstops. The game's geographical area is associated with its physical position. | [38, 44, 59-62] |
| Enhanced emotional expression | - heightened cheerfulness and emotions - increased motivation for outdoor activities, socialising, and physical exercise - reduced mental anguish - improved cognitive function - enjoy engaging and entertaining gameplay | Hatching eggs, locating specific Pokémon, and visiting Pokéstops are key activities in the Pokémon game that are influenced by the game's geographic theme. | [38, 63, 66, 85-90] |
| Individual /self - treatment | - Shows increased activity outdoors, reduced weight, and improved sleep patterns. - offers engaging and absorbing gameplay - enhances physical fitness and state of mind - used for health management | Capturing new Pokémon, finding specific Pokémon, and the game's location are tied to a physical location, as well as hatching eggs. | [65, 67-70] |
| Community involvement | - boosts inspiration for outdoor activities and social interaction while being practically active - provides engaging and immersive gameplay - enhances fitness levels and mood - decreases sedentary habits - fosters social interaction through gatherings at Gyms and Pokéstops - motivates players to exchange information and experiences | Capturing new Pokémon and visiting Pokéstops, The game's location is linked to a physical location. Finding specific Pokémon, utilising items, and capturing new Pokémon. Engaging in physical combat within fitness centres or gaming venues associated with a specific location, Pokémon theme song | [71-73, 91-94] |
| Community Development | - Property rights refer to the legal ownership of resources, allowing individuals to have economic freedom and independence. Agriculture, empowerment of communities, community- | Capturing new Pokémon and discovering Pokéstops, The game location is linked to a physical location. Finding specific Pokémon, | [95-100] |

| | | | |
|---|---|---|---|
| | based development approaches<br>- Land administration - Social enterprise - Transport infrastructural investment | utilising items, and catching new Pokémon. Engaging in physical combat within fitness centres or gaming venues associated with a specific physical location, Pokémon theme song | |

A conceptual framework for medication adherence using the strategies and approaches of sustained gaming presented in Figure 4, showing the underlying relationships of the different components identified in selected literature.

# 5. METHODOLOGY

This study adopted the Design Science Research (DSR) approach to design a framework for medication adherence in TB patients through strategies, approaches and experiences of sustained gaming. DSR is a problem-solving methodology aimed at enhancing knowledge by developing innovative artifacts to address existing challenges. It also establishes connections between problems and solutions within a given environment by defining the relationships between goals and means of achieving them. DSR has been widely applied in research focusing on ICT-based solutions in developing economies, particularly within the ICT4D (Information and Communication Technology for Development) domain. However, for a solution to be effective, it must align with user requirements.

To achieve this, the study integrated the DSR framework—which consists of problem identification, requirements definition, design and development, demonstration, and evaluation—with the DSR four-cycle model—which includes change and impact, relevance, design, and rigor. The research was carried out in three phases. Phase 1 was the literature review on strategies and approaches of sustained gaming and Phase 2 of the study was the pilot study, this resulted in a conceptual framework. These phases work iteratively, refining each framework through a continuous iterative process until a comprehensive framework (MATBGSA) is achieved.

The DSR cycles were particularly suitable for this study as they establish a connection between identified challenges and possible solutions through a structured design process. The relevance cycle helped the researcher in learning from each iteration to inform the following iteration towards the finalization of the MATBGSA framework as depicted in Figure 4. These requirements define the core problem, essential artifact features, and quality indicators. The DSR methodology follows a logical progression—from identifying key issues to designing innovative solutions in addressing the identified problems.

## 5.1 Data Collection

This study employs purposive sampling techniques. It utilizes participants who have played Pokemon Go for at least five years and can share insights into what keeps them going while playing the game for over a long time. The researcher contacted the community of Pokemon Go players in Gauteng, and some players were nominated from the community randomly by the community President. These were the participants in this research. The actual number of participants was not determined prior to the interviews. The number of participants that showed up for the teams online meeting were six. Data capturing and data analysis were repeated until saturation was achieved, that is, until no new themes emerged. This occurred after six participants were interviewed by the researcher for two hours. Interviews were conducted virtually in an online environment due to the restrictions posed by the Covid-19 pandemic. Qualitative research allowed the researcher to explore participants' strategies, approaches, and experiences of sustained gaming. During the open-ended interview, the researcher recorded the session and cautiously informed the interviewee of what is expected from them, mentioning to the participants that the process should not be too rigid, to enable them to express their views.

## 5.2 Data Analysis

An inductive qualitative study using NVIVO software is used for data analysis. The software package NVivo enables qualitative data analysis [101, 102], and allows analysis of documents involving images, plain text, audio, and video [102]. NVivo likewise can query, search, visualize, store, and distribute results [101]. The software package remained predominantly suitable for working with the raw data provided in the interview. Data preparation involves organizing the data and conducting preliminary reading through the document [101]. The data collected in this study were formatted in a Microsoft Word document by the researcher and uploaded to the NVivo software for analysis. Qualitative thematic analysis was conducted to capture participants' views and categorize them into themes aligned to the framework's constructs for sustained gaming strategies for medication adherence. The gaming strategies (themes) used are social connection, community involvement, health benefits, physical activities, and mental and emotional stability. The views of the six participants were described using Participant 1, 2, 3, 4, 5 and 6, in order to maintain anonymity, and for ethical reasons.

## 5.3 Research Ethics

Throughout the research process, the present study adhered to ethical standards [103]. Research permits were obtained from the University of South Africa's College of Science, Engineering and Technology. The researcher told the subjects of the aim of the study. The participants filled out and signed consent forms, and we advised them of their right to refuse to take part in the study as they so want. Not revealing participant identities helped to preserve confidentiality.

## 5.4 Research Result

The data analysis indicates that the participants predominantly held favorable views regarding the gaming strategies; the

analysis substantiated the themes. The individual experience recounted in the interviews provided additional relevant insights into the implementation of gaming strategies for sustained medication adherence. Figure 2 illustrates the matrix coding query regarding participants' contributions to themes related to gaming strategies for medication adherence. The respondent characteristics are shown in Table 1 below:

**Table 2: Respondents Characteristics**

| Participant ID | Employment status | Gender | Experience in Pokemon Go | Age | Marital Status |
|---|---|---|---|---|---|
| 1 | Student | Male | 6years | 21-25 | Single |
| 2 | Employed | Female | 6years | 41-45 | Married |
| 3 | Employed | Male | 6years | 35-40 | Married |
| 4 | Student | Female | 6years | 26-30 | Single |
| 5 | Student | Female | 6years | 21-25 | Single |
| 6 | Student | Male | 3years | 26-30 | Single |

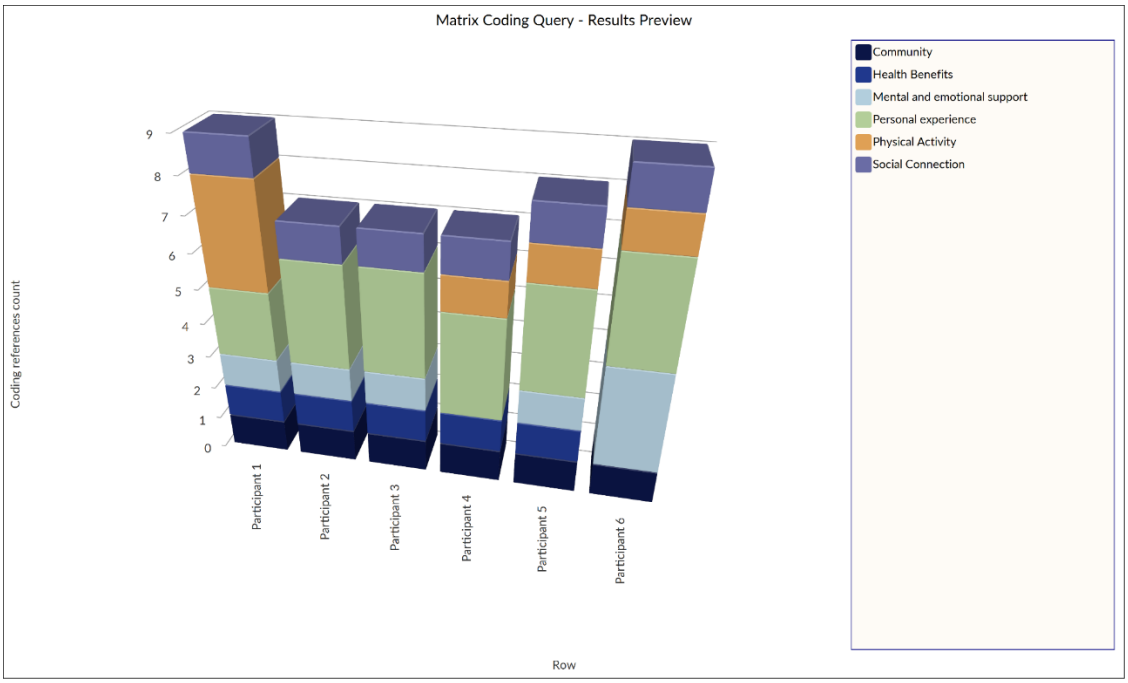


**Figure 2: Coding query Matrix of participants**

Figure 2 displays the matrix coding query that illustrates participants' perspectives on the themes derived from the analysis. All six participants concurred that the Pokémon Go game facilitated the development of social connections among friends and family. The game requires team members to convene at any hour to participate. Four participants supported the notion that Pokémon Go games facilitate the initiation of physical activities. The game features individuals traversing to locate Pokémon, commonly known as a raid. Players frequently congregate at PokéStops to engage in discussions. They stated that the game facilitates their walks with their dogs, ultimately resulting in the exploration of their surrounding environment. Players traverse various locations to discover new regions. Figure 3 provides a summary of the data analysis concerning the codes associated with the participants.

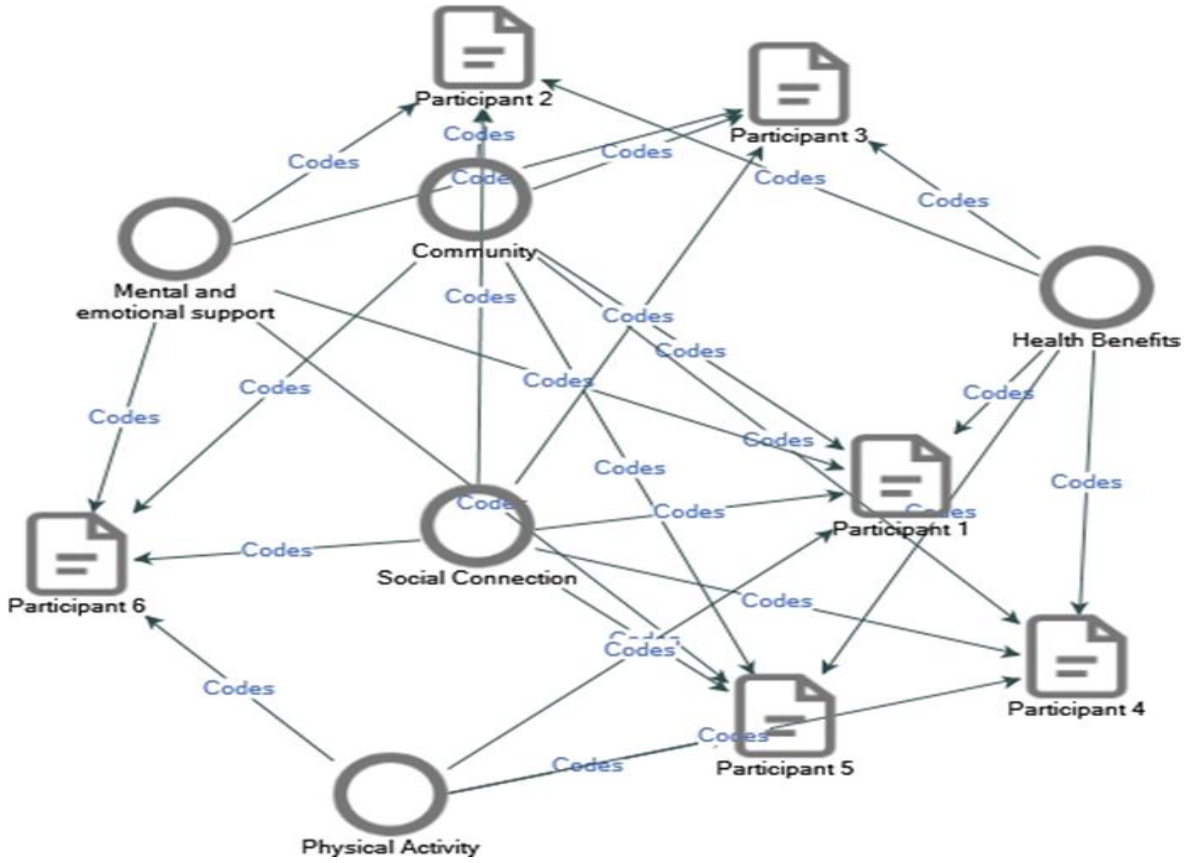


**Figure 3: The diverse relationship of responses in terms of different variables**.

As demonstrated above, distinct experiences of individual participants were conveyed during the interview session. The diversity of players' experiences contributes to their prolonged engagement with the game. Five participants concurred that engaging in the Pokémon Go game enhances individuals' mental and emotional well-being, with the exception of Participant 4. Two participants indicated that playing Pokémon Go alleviates their academic stress. They engaged in the game primarily when it was necessary to alleviate studies, work, and stress. All participants, with the exception of Participant 6, concurred that engaging in the Pokémon Go game offers health advantages. Ultimately, all participants concurred that fostering a community retains players in the game. The presence of friends and family during gameplay significantly enhances one's lifestyle, particularly through interactions with individuals otherwise unrelatable.

## 5.5 Participants Perspectives on Gaming Strategies

The researcher presented the following questions to the participants during the interview:

*What about the game that keeps you playing?*
*Is the game (Pokémon Go) good for health benefits?*
*Does the game help you in any way to connect to the community? What are the impacts?*
*Describe how Pokémon Go is good for physical and mental activities?*
*Describe the social connections of Pokémon Go for health benefits?*
*To what extent would you say the game has changed your life?*

The responses show that playing Pokémon Go has a positive impact on health. Participant 5, who is a student, aged between 21 and 25 and with 6 years of experience in playing Pokémon Go indicated that:

**"***Yes, ultimately Pokémon requires you to walk around, so you get exercise, and you get outside more than you would have otherwise"*

The participant's response points to the fact that Pokémon Go players would benefit from the walk around and relating with people in their community.

Second**,** respondents' personal experience is another strategy that keeps players playing the game. The six participants reported similar experiences, as stated below:

***Participant 1- "****I have made some friends".*

***Participant 2 – "****I have gotten to know some incredible people through the shared interest in this game".*

***Participant 3 – "****It has not had such a big overall impact on my life".*

***Participant 4 – "****I've met many different people in many different places and discovered parts of South Africa I didn't know existed".*

***Participant 5 – "****The game is something that I always do in my spare time and provides a distraction. I tend to walk more when I play, and I have met and communicated with people I would otherwise never have interacted with. The game also sometimes influences trivial things like my route to class or where I park so I can reach Pokéstops, gym, and Pokémon hotspots".*

***Participant 6 – "****It was really great during the stress of varsity to have friends to connect with, to distract you from the current struggles of the day. A brief break to unwind is important. It has taught me to take a step back when stressed".*

From the study findings, participants make friends through the game, know incredible people, visited unusual places. The game influences routes to take and helps in reducing stress. This shows that individual experiences were positive, and that playing Pokémon Go can have a positive impact by influencing TB patients in medication adherence. The individual experiences from the participants' view align with the theoretical findings that gaming experiences could be part of strategies for supporting TB patients in their journey.

Furthermore, the Pokémon Go game involves moving from place to place in search of Pokémon, this is a fantastic way of changing players' sedentary lifestyles. Players are encouraged to exercise by moving around in their environment in search of Pokémons. All the respondents were positive that Pokémon Go is good for physical activities. The study findings about physical activities are strategies that could enhance medication adherence in TB patients. Routine activities are altered and there will always be a form of exercise to improve the physical, mental, and emotional wellbeing of players.

Participant 6, a friendly and humorous person with only 3 years of experience, stated that "*it is good to walk around and improve physical health, especially cardiovascular health"*. It can be inferred from the responses that the Pokémon Go game is good for physical and mental activities. Participants' positive responses show that they agree with the gaming strategy to support the TB patient journey over a long time.

Moreso, the social connection theoretical study showed that social support, including support from friends, close relatives, the general community, healthcare workers, and neighbors, was recognized as extremely critical for adherence to TB treatment. The data analysis findings also show that the social connection derived from playing the game could bring about health benefits to players. The responses from the data findings are presented below:

***Participant 1 "****Raid trains for walking from one raid to the next during raid hour".*

***Participant 2 "****Gives you something mundane to focus on to escape your current reality".*

***Participant 3 "****It allows one to meet new people in a safe space which most people need, but all people benefit from".*

***Participant 4 "****Having friends who play Pokémon Go with you is a fantastic way to spend time. It also serves as an ice breaker when meeting other players. Positive social interactions are good for body and mind".*

***Participant 5*** *"The game has enabled me to meet different people in person at raids and online and allows us to keep in touch and share a mutual interest which has had a positive influence on mental well-being".*

***Participant 6*** *"This goes again to the mental health issues and having community with you to overcome these issues".*

The participant responses indicate that there are numerous benefits that players derive from social connections while playing the game. It makes one escape one's current reality; meet new people in a safe place; have people to spend time with; have positive social interactions that are good for body and mind; and meet people with mutual interests– having positive mental well-being helps in overcoming stress. The findings show that with Pokémon Go, the social connection strategy could be supportive for TB medication adherence purposes.

Lastly, community engagement is to reach out to different communities and build relationships with people of similar interests. Players of the Pokémon Go game are people with mutual interests who share knowledge about the game. The respondents in this study facilitate the team-building ability in players that play the game.

Participant 6, with only 3 years of experience in playing the game, specified that: "*it is great to build community. This helps with mental health and learning people skills for future work".*

Participant 4 also stated that "*…have people willing and able to answer any questions you might have*".

Participant 5 responded that "*Pokémon raids sometimes require you to team up with other people, which requires you to organize a get-together or*

*collaborate through online communication to organize a collective effort for remote playing. The groups used to facilitate organizing raids have also become a place to share general Pokémon information, to share noteworthy Pokémon caught, to share memes, and to comment on the game or developments*".

The MATBGSA framework developed from the study is presented below:

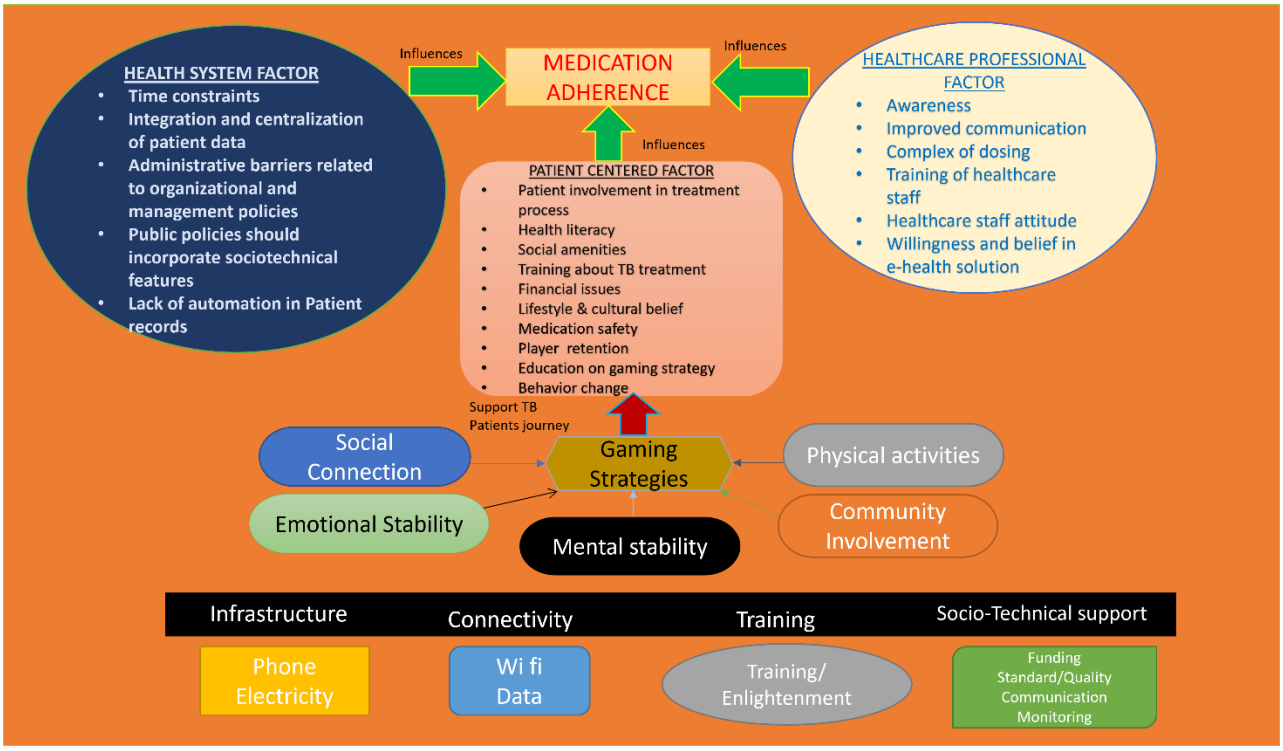


**Figure 4: The MATBGSA framework**

The data derived from the application of socio-technical systems theory in conjunction with design and action corroborated the constructions identified in the conceptual framework. This demonstrates that an organizational process and structure, effective design and implementation, and a conducive environment are necessary for the framework to operate effectively. These findings did not modify the MATBGSA framework but improved its interrelations and efficacy.

## 6. INNOVATIONS IN GAMING STRATEGIES

This paper introduces a novel approach by incorporating sustained gaming concepts, including gamification, serious games, and digital interactions, into the domain of medication adherence. This paper synthesizes gaming strategies from multiple studies to emphasize innovative methods for consistently engaging patients over time, which is essential for enhancing adherence rates. Methodological Approach to Systematic Literature Review: An exhaustive understanding of the current landscape can be obtained by conducting a systematic literature review to collect and analyze existing research on gaming strategies and medication adherence. This methodology facilitates the identification of deficiencies and possibilities for novel interventions, so assuring that the suggested conceptual framework is firmly based on empirical evidence and recognized best practices.

A significant advancement is the creation of a conceptual framework that integrates effective gaming strategies within a structured model designed to enhance medication adherence. This framework offers a methodical approach for the design and implementation of gaming-based interventions, providing explicit guidance for future research and practical applications. The study emphasizes the importance of continuous engagement, specifically the requirement for prolonged patient participation in medication adherence. This framework prioritizes sustained engagement and motivation to address a significant challenge in chronic disease management, in contrast to conventional approaches that typically emphasize short-term compliance.

A thorough examination of gaming dynamics, including social features, progress tracking, and reward systems, offers insightful information about how to combine these components to make successful adherence interventions. This comprehensive approach fosters the creation of more intricate and captivating solutions. This work's primary contributions encompass the utilization of continuous gaming methodologies to improve medication adherence, a comprehensive review of pertinent literature, the development of a novel conceptual framework, and a significant focus on sustained patient engagement. These advancements provide a basis for enhancing adherence strategies and optimizing health outcomes in chronic disease management.

## 7. LIMITATIONS AND FUTURE RESEARCH

Future research should focus on several critical areas to enhance the efficacy and enduring influence of sustained gaming on medication adherence. The customization and personalization of gamified interventions are crucial; comprehending how diverse patient demographics react to distinct game mechanics can result in more tailored and engaging solutions.

Moreover, the difficulty of sustaining long-term engagement endures. This study identifies Pokémon Go as a significant example; however, additional research could explore other AR games or gaming strategies within healthcare settings for a more comprehensive understanding. For instance, investigating games such as FITXR may prove advantageous. Consequently, subsequent research should concentrate on creating adaptive game components and novel motivational strategies to maintain patients' consistent engagement in their adherence programs.

A study by Wagner-Greene, Wotring [104] and another one by Lindqvist, Castelli [105] stated that Pokémon Go game could pose potential harm to game players. Players could trespass or place themselves in dangerous environments or situations so they can catch more Pokémon. The findings corroborate the research by demonstrating the proportion of players who engage in such behaviours. Over 25% of players indicated a likelihood of engaging with the game while driving (27%), biking (43%), walking inattentively (32%), and compromising sleep to increase gameplay (38%). Notable variations in risky behaviours were observed based on gender and age. Men exhibited a higher propensity to engage in gameplay while operating vehicles or bicycles, participate in activities in unsafe environments, and trespass on private property to capture Pokémon. Individuals aged 24 years or younger exhibited a higher propensity for engaging in these risky behaviours compared to their older counterparts, which needs further investigation so that the harm can be reduced.

Moreover, guaranteeing interoperability with current healthcare systems and meticulously evaluating behavioral and psychological impacts are essential. Investigating the incorporation of gamified interventions into electronic health records and telemedicine platforms can improve their practicality and efficacy. Comprehending user reactions to game mechanics, including feedback and social interactions, will provide significant insights into their impact on medication adherence. An in-depth analysis of cultural and contextual factors is essential for maintaining the relevance and efficacy of interventions across diverse populations. The researcher additionally advocates further examination of the responses of different age demographics to gaming strategies and methodologies.

Highlighting ethical considerations and assessing the cost-effectiveness of gamified methods are essential for attaining broad acceptance. Furthermore, it is essential to examine the ethical ramifications of gamifying healthcare, encompassing concerns regarding privacy, data security, and the risk of gaming addiction. Subsequent research must prioritize data security and the formulation of explicit ethical guidelines for the implementation of gamification in healthcare. Furthermore, examining the economic ramifications and practical obstacles of implementation will yield critical insights for stakeholders. Collaborative, multidisciplinary efforts will be essential for innovating and refining interventions to enhance medication adherence and improve patient outcomes.

# 8. CONCLUSION

This study contributes to the growing literature and findings on strategies and methods for ensuring consistent medication adherence via gaming. It delineates gaming within an academic framework and specifies strategies for maintaining a consistent gaming regimen while complying with medication protocols. A theoretical framework is suggested to improve medication adherence through the application of gaming techniques. The results may foster a common comprehension among practitioners, professionals, and scholars in the field of sustained gaming. This research may provide a basis for subsequent investigations into the use of gaming to enhance medication adherence. The gaming strategies and methodologies selected in this study were guided by their attributes and objectives noted during gameplay in Pokémon Go, consistent with definitions of digital health, gaming, and medication adherence. The authors considered factors that were either directly associated with gaming or influenced medication adherence. As a result, other pertinent facets of e-health that failed to satisfy the inclusion criteria may have been omitted, potentially impacting the outcomes. Subsequent research may broaden these criteria to include supplementary pertinent factors in e-health, serious games, sustainability, and medication adherence. Additionally, subsequent research should examine the application of the strategies delineated in this conceptual framework, concentrating on the utilization of sustained gaming to enhance medication adherence in both developed and developing nations.

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# 10. AUTHORS CONTRIBUTION

Rose drafted the work, conceptualization, methodology, original draft preparation and writing of the review and editing. Adele contributed to conceptualization and supervision. Marlien contributed to the conceptualization, validation and supervision of the work.

# 11. CONFLICT OF INTEREST STATEMENT

The authors show no conflict of interest.

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