Leveling Up Health: Unlocking the Power of Gaming in Wellness Fusing Digital Therapeutics

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Abstract. The fusion of Gaming in wellness or healthcare with Digital Therapeutics (DTx) is emerging in today's world. The problem statement captures the game-changing potential to merging gaming and DTx to offer or enhance innovative solutions for personal health. DTx is a software-based treatment or intervention designed to treat medical conditions based on the patient's evidence. In scenarios like managing calcium intake to prevent kidney stones, these solutions actively promote patient engagement in monitoring and improving their dietary choices. The creative approach of fusing Gaming with DTx in this tech-driven world uses gaming features to boost the overall patient's well-being. By employing the preceded mentioned method, we gain insights into maintaining a healthy balance of calcium intake, effectively mitigating the risk of developing kidney stones. Through the integration of gaming and healthcare, our goal is to pioneer inventive solutions that facilitate the enjoyment and effectiveness of health management practices. The current technological landscape incorporates educational components infused with gaming elements on platforms, facilitating users' understanding of nutrition and offering tailored guidance on calcium intake. This approach involves crafting user-centric games with individualized health objectives, amplifying patient involvement. The objective is to revolutionize how people perceive healthcare self-management, rendering it captivating, interactive, and accessible to diverse demographics. This innovative amalgamation holds the potential to revolutionize and prioritize health, not solely by enhancing enjoyment but also by fostering tangible health benefits, paving the way for a healthier global populace. Throughout this paper, we utilize our proposed model, the Therapeutic Wellness Gaming Model (TWGM), to delve into the convergence of gaming and healthcare within the realm of Digital Therapeutics.

Keywords: Gaming, DTx, Calcium Intake, Kidney Stones, Wellness, Machine Learning .

1   Introduction

In this world where gaming meets or fuses with healthcare is an innovative step to merge gaming with DTx to improve our health. By utilizing the features of gaming, it aims to turn regular health routines into engaging or fun experiences where people will get involved majorly. The aim is to how people approach wellness by getting involved in the world of gaming for better health outcomes. In search for better health solutions, it comes from a big problem; it's really hard for the people who stick to their healthy habits from time to time. Even trying various ways to promote for improving health through platforms or apps, still people struggle as they lose interest in it. This scope or the type of problem affects all kinds of people, and to fill the gap between the user involvement and health treatments we need some creative ideas for taking the care of their health globally [1]. Currently, the issue or problem is that how the people will stick to their healthy habits. Due to these traditional methods, they struggle to engage users because they are not personalized as per their needs. This problem affects people who are involved in their own health. We need something innovative that will engage users and help to stick to their daily routines and maintain their health. In this aspect "Leveling Up Health" we're also targeting critical health issues like calcium intake and kidney stones. By gamifying or turning health practices into a game, it will make wellness more engaging and personalized which will guide users in managing their consumption of calcium intake and offering them an experience for long-term well-being. In this paper, we will utilize the Therapeutic Wellness Gaming Model (TWGM) as our proposed model. This proposed

model offers a structured approach to integrating gaming into wellness initiatives, aiming to enhance health outcomes. Through this we will aim to explore the potential of TWGM.

2 Literature Survey

In recent years we have observed that by combining or intersecting gaming and wellness has brought more attention throughout academic and industry circles. This literature survey paper aims to explore the emerging field of gaming technology with **DTx** to enhance health and well-being.

A. Integration of Gaming and Health Technology:

Several studies have investigated that adding gaming aspects or elements into health programs can lead to better help in wellness. For example, Zichermann and Cunningham (2011) have discussed about the concept of gamification and its application in the change in behavior [2], while on the other hand, Baranowski et al. (2008) studied that how games that are based on an exercise called exergames, can encourage or promote in physical activity [3].

B. Digital Therapeutics (DTx) in Healthcare:

DTx is like a digital health tool which provides treatments through smartphones or computers based on the evidence. A study or research by Vaghefi et al. (2020) showed that DTx can help people effectively with conditions like diabetes and high blood pressure, making it potential to revolutionize traditional healthcare models [4].

C. Gamification in Wellness and Mental Health:

Gamification methods nowadays are becoming popular for boosting mental health. Hamari et al. (2016) have studied how gamified activities work psychologically [5], while Morschheuser et al. (2018) looked at how gamification can keep people or users engaged during health programs [6].

D. Personalized Health Interventions:

With the advancement in technology with Artificial Intelligence (AI) and Machine Learning, have changed the way healthcare is approached. For example, Abdullah et al. (2018) have looked at how AI can be used to create personalized health plans. They found that customizing or personalizing the treatments to each person's specific needs and preferences can lead to better health outcomes [7].

E. Wearable and Health Monitoring:

Nowadays wearable devices are increasing and becoming popular for tracking health metrics in real time. The research by Patel et al. (2019) and Dunton et al. (2019) showed that these devices are very helpful in encouraging physical activity and also improving overall health habits. Making them a personalized insight for guiding individual health treatments [8].

F. Addressing Specific Health Concerns:

In the context of "Leveling Up Health", by giving special attention to certain health concerns for example calcium intake and kidney stones. The research by Taylor et al. (2012) examined the relationship or link between that how much calcium you eat and the risk of getting kidney stones and its likelihood [9]. On the other hand, the study by Penniston and Nakada (2009) found that by making the changes in your diet and lifestyle can help to lower the risk of getting kidney stones. So that by paying attention to your calcium intake and making some of the changes can lead to an increase in the chance of overall well-being [10].

Table 1. Set of data from the research papers.

Sr. No	Problem Statement	Existing Systems	Limitations	Outline Approach
1.	Motivating behavior change in health interventions through gamification.	Gamification techniques are applied to various domains to encourage desired behaviors.	Limited long-term efficacy of gamified interventions	Integrating gamification principles with evidence-based health interventions for sustained behavior change.
2.	Encouraging physical activity through exergames.	Exergames are designed to promote physical activity and exercise.	Dependency on user access to gaming technology and space.	Developing immersive and accessible exergames personalized to different users.
3.	Revolutionizing healthcare delivery through DTx.	DTx platforms offer evidence-based treatments for chronic conditions.	Challenges in user adoption and adherence to DTx interventions.	Leveraging AI and ML to personalize DTx interventions and improve user engagement.
4.	Understanding the psychological mechanisms underlying gamified treatments.	Gamification elements integrated into wellness and mental health interventions.	Potential for over-reliance on extrinsic rewards, leading to diminished intrinsic motivation.	Designing gamified treatments that balance intrinsic and extrinsic motivators to sustain user engagement and behavior change.
5.	Enhancing use engagement and motivation in mental health treatments through gamification.	Gamified mental health apps offering incentives and rewards for desired behaviors.	Lack of personalization in gamified treatments may limit their effectiveness.	Developing AI-driven gamified treatments that adapt to individual user preferences and needs for enhanced engagement and efficacy.

6.	Exploring the potential of AI-driven personalized treatments in improving health outcomes.	AI algorithms analyze user data to deliver personalized health recommendations.	Privacy concerns and ethical implications associated with AI-driven treatments.	Implementing robust data privacy measures and ethical guidelines to ensure the responsible use of AI in delivering health treatments.
7.	Leveraging wearable technology to promote physical activity and overall behavior change.	Wearable devices provide real-time monitoring of health metrics and activity levels.	Limited accuracy and reliability of some wearable devices in capturing health data.	Integrating wearable technology with AI algorithms to analyze health data and deliver personalized treatments for behavior change.
8.	Investigating the relationship between dietary calcium intake and kidney stone formation.	Dietary modifications and lifestyle changes recommended for reducing the risk of kidney stones.	Variability in individual response to dietary treatments for kidney stone prevention.	Developing personalized dietary and lifestyle treatments based on individual risk factors and preferences for kidney stone prevention.
9.	Evaluating treatments for reducing the risk of kidney stones through dietary modifications.	Dietary recommendations aimed at reducing urinary stone risk factors such as calcium intake.	Lack of standardized guidelines for dietary management of kidney stone formation.	Establishing evidence-based dietary guidelines and treatments personalized to each patient's characteristics for kidney stone prevention.

3 Methodology Applied For Therapeutic Wellness Gaming Model (TWGM)

A. User Assessment and User Profiling:

Research on the user preferences and their health needs through surveys and interviews. Identify that how the gaming can help to improve wellness by data analytics, including the issues like kidney stones related to calcium intake [11].

B. Creating Gaming Platforms:

Collaborate with game developers, health professionals, and software engineers, to design a gaming platform for wellness by utilizing gaming elements, such as rewards, progression systems, and immersive storytelling, to make users more engaged in wellness. By integrating the features for tracking calcium intake and providing real-time feedback on the impact on kidney stone risk [12].

C. Data Integration and Analysis:

By implementing the data to merge gaming activity with health metrics obtained from the user input through the wearables. Utilizing machine learning algorithms to analyze the user data and to generate personal guidance for improving the outcomes for wellness, including the management of calcium intake and lowering the risk of kidney stones [13].

D. Biofeedback Mechanism:

Integrating biofeedback into the gaming and giving the users real-time feedback. By using the biofeedback sensors, it will monitor to adjust the gameplay and to reduce the stress level, through which it can have direct impact on the factors like calcium intake and kidney stone prevention.

E. Behavioral Intervention Design:

Collaborate with Psychologists and behavioral scientists to design strategies related to diet, exercise and stress management. By implementing these interventions and strategies for kidney stone prevention, and leveraging to enhance motivation [14].

F. Evaluation and Iteration:

Conducting the rigorous evaluations to study the user satisfaction of the gaming platform for improving wellness outcomes and gathering data from the user to improve or update the health indicators, and features related to tracking of the calcium intake and kidney stone prevention results [15].

4 Computing for TWGM

A. Calorie Burn Rate Comparison with Gaming and Traditional Treatment:

- Let CBRgame represent the calorie burn rate during the 30-minute gamified exercise session and CBRtraditional denote the calorie burn rate during the 30-minute traditional exercise session.
- If CBRgame = 250 calories and CBRtraditional = 200 calories, then the increase in calorie burn rate due to gamified exercise (ΔCBRgame) can be calculated as ΔCBRgame = CBRgame - CBRtraditional = 250 – 200 = 50 calories. [15]

B. Effectiveness Score Calculation for DTx Interventions:

1. The effectiveness score (ESDTx) of a Digital Therapeutics (DTx) intervention can be calculated using a weighted average of various parameters, such as user engagement (UE), improvement in health metrics (HM), and adherence (AD) [16]:

$$\text{ESDTx} = \frac{UExHMxAD}{Total\ Possible\ Score} \ X\ 100 \qquad (1)$$

2. If UE = 85%, HM = 70%, and AD = 90%, and the total possible score is 300, then ESDTx would be:

$$\text{ESDTx} = \frac{85x70x90}{300} \, X \, 100 \approx 21.17$$

C. Risk Reduction Percentage with Increased Calcium Intake:

1. RRcalcium can be calculated using statistical analysis of the epidemiological data or the clinical trials, relating the increase in calcium intake to the reduction in kidney stone formation risk [17].
2. For example, if a study or research finds that each additional 100 mg/day of calcium intake decreases the risk of kidney stone formation by 5%, the formula for RRcalcium would be:

$$\text{RRcalcium} = \frac{Reduction\ in\ Kidney\ Stone\ Risk}{Increase\ in\ Calcium\ Intake} \, X \, 100 \tag{2}$$

3. If the risk reduction is 5% for every 100 mg/day increase in calcium intake, then RRcalcium = 5%.

D. Mathematical Model for Health Improvement Rate:

Let H (t) denote the health status of an individual at time t. A mathematical model representing health improvements over time t due to gaming and DTx integration can be expressed as [18]:

$$\frac{dH}{dt} = k1 . \ G(t) + k2. D(t) \tag{3}$$

where:

G(t) represents the impact of gaming on health.
D(t) represents the impact of DTx on health.
k1 and k2 are constants representing the effectiveness of gaming and DTx, respectively.

5 Proposed Model For Twgm

A. Personalized Wellness Adventure:

In this the users will embark on personalized wellness journeys which are designed specifically for their health goals. These journeys will cover their various areas like weight management, stress reduction, and chronic disease management. By Using the interactive storytelling, fun challenges, and digital therapy techniques, users will enjoy an engaging experience as they progress toward better health. (ref eq. 1).

B. Progressive Reward Systems:

To keep the users more engaged and more motivated, our model will use a system of rewards based on their health progress. As they reach the milestones and move closer to their goals, they'll unlock rewards like virtual items, new levels, and extra health tools. These rewards will encourage them to stick with healthy habits and feel proud of their achievements, keeping them motivated for the long term. (used in eq. 1)

C. Community Challenges and Social Support:

In this, our model will encourage teamwork and the social support by organizing group challenges and cooperative gameplay. By this, the Users can team up with friends, family, or

online communities to tackle their health goals together, share progress, and motivating each other. This nurtures or cultivates a sense of belonging and accountability, boosting engagement and creating a supportive atmosphere for wellness. (used in eq. 2)

D. Real-World Integration and Data Tracking:

To make DTx interventions or treatments more effective, our model will connect with wearable devices or mobile apps to track users' progress. This real-time monitoring will provide personalized feedback and insights, helping users make better decisions for their health. By using this data, the model shown in fig-1 will offer tailored advice to improve health outcomes. (ref eq. 3).

Fig. 1. Flowchart diagram of Proposed Model (TWGM).

6 Results and Discussions For TWGM

By combining gaming with Digital Therapeutics (DTx) for wellness, along with the focus on calcium intake and kidney stone prevention, shows great promise for boosting health. This approach offers new ways to improve health outcomes effectively. Now to gamifying the health practices means turning them into games, encouraging people to stay involved and stick to their healthy habits, like keeping the track of how much calcium they are getting. Research proves that turning the health into a game keeps people more interested and involved for longer compared to just telling them what to do.

By using the Digital Therapeutics (DTx), the gaming platform can give a personalized treatments to the patients or users based on their needs. It means that with the help of Artificial Intelligence (AI), the platform or app can study that how the users or patients are consuming calcium and give them specific advice to reduce the chances of getting kidney stones. This personalized guidance makes the interventions more effective and helps users feel more in charge of their health.

By using gaming for educational purposes can help people to get understand why calcium intake matters for preventing kidney stones. By adding educational information to games, players or users will or can easily learn about how the calcium in their diet affects their risk of

getting kidney stones. This approach makes learning about kidney stone prevention more engaging and accessible.

As we know that the gaming platforms are easy to access and can reach many users, even those who usually don't use traditional health programs, they can help a lot more people. By doing this, it enhances the overall potential of the platform and can improve the public health. Also, for our research paper, we used dataset from Kaggle to support our findings. Kaggles dataset gave us a wide range of information to analyze. These datasets were crucial for making us. [13]. Here are some graphs fig-2 to fig-7 below which helped us to analyze our findings:

Fig. 2 . Sum of Sl. No. by Feel After
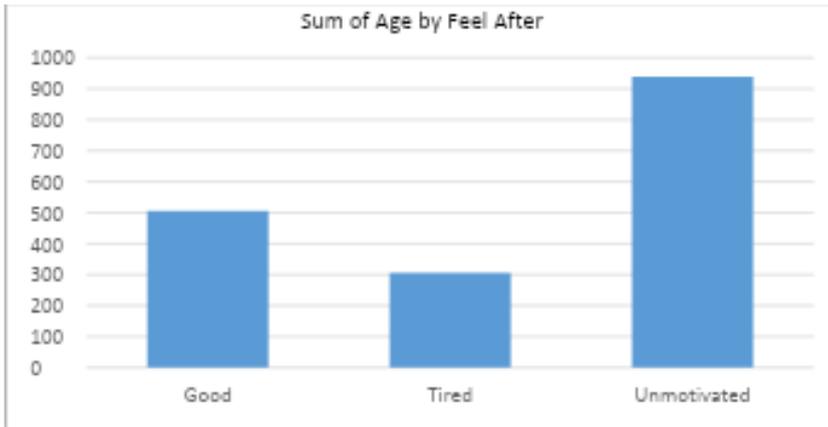

Fig. 3. Count of Sl. No. by Feel After.

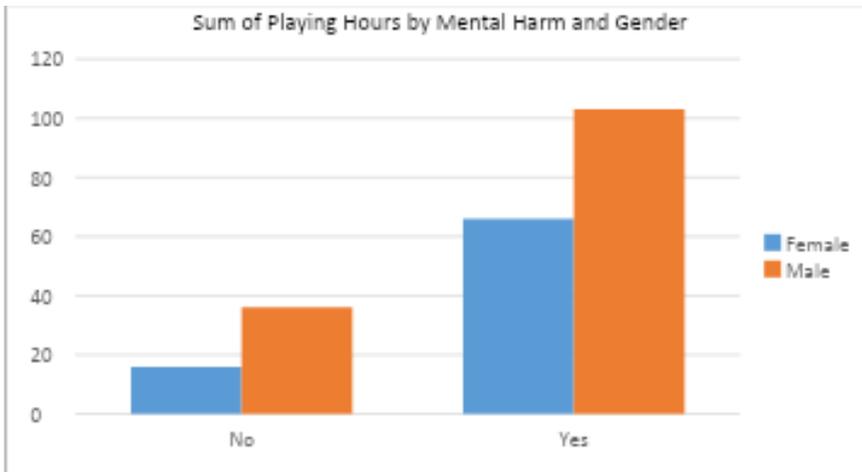**Fig. 4.** Sum of Age by Feel After.

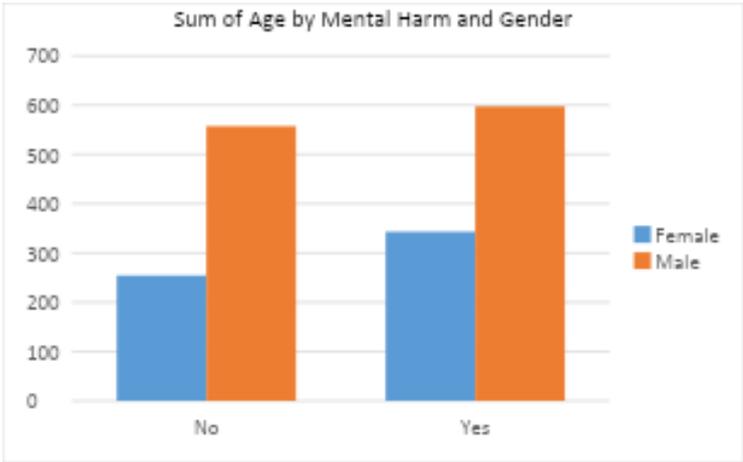**Fig.5** Sum of Playing Hours by Mental Harm and Gender.
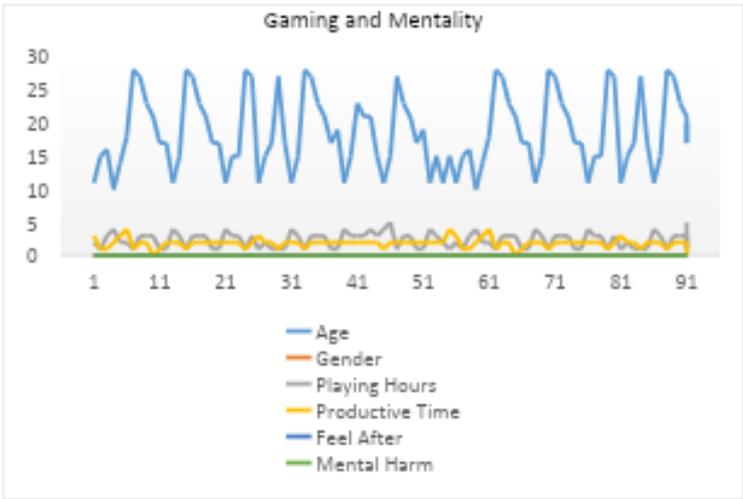
Fig. 6. Sum of Age by Mental Harm and Gender.

Fig. 7. Gaming and Mentality.

Table 2. Dataset taken from Gaming and Mentality (Kaggle).

Age	Gender	Playing Hours	Productive Time	Feel After	Mental Harm
11	Male	2	3	Good	No
15	Male	1	1	Tired	No
16	Male	3	1	Unmotivated	Yes

| 10 | Female | 4 | 2 | Unmotivated | Yes |

The table-2 shows just a small part of the dataset, which holds a lot of information. Although it's just a snapshot, there's a lot more data to explore and analyze in the full dataset.

Table 3. . Dataset on discussed results for TWGM

Sr. No	Result Parameter	Use in Healthcare	Example
1.	Increased engagement and Adherence.	Encourages users to maintain healthy behaviours.	Using a fitness app to track daily steps.
2.	Personalized Interventions or Treatments.	Customizes interventions or treatments to the individuals.	Receiving personalized diet recommendations based on health data.
3.	Education and Awareness.	Raise awareness about health topics.	Learning about the importance of calcium intake through interactive gaming.
4.	Scalability and Accessibility.	Reaches a wide audience, including non-traditional users.	Providing health education through a mobile game accessible to all demographics.

7 Conclusion

In conclusion, the research offers an exciting new way to enhance the well-being by combining gaming and Digital Therapeutics (DTx). This approach is very effective in tackling the health issues like calcium intake and kidney stone prevention. By making health more immersive and interactive, it provides a new and innovative approach to promoting the personal wellness. By this innovative fusion and its potential to make people's lives healthy, it can make positive on the people's lives healthier for the long term.

By turning the health activities into games, people can get more engaged with their well-being in a fun. With the tools like biofeedback and Artificial Intelligence (AI), the system can adapt to each person's needs, making it more helpful. This personalized approach can enhance the whole process leading to work better for everyone.

By focusing on the aspects such as calcium intake and how it effects on the kidney stone formation, this approach shows the understanding of the health issues well and provides better solutions before problems arise. By making the games based on health can be fun and easy to manage the leveling of health, which can attract more people and can inspire them to make their lives long-lasting.

8 Future Scope

The future of "Leveling Up Health: Unlocking the Power of Gaming in Wellness fusing DTx" is exciting, especially in improving the healthcare and wellness, especially for managing the calcium intake and to preventing the kidney stones. In the near future, we can focus on making the platforms or apps even more personalized for the users or the patients. This means the by refining the algorithms to give personalized or customizable health advice based on each person's or user's data and how they interact or play the game. For example, if someone has a low calcium intake or is at the risk of kidney stones, then at the time the game will address the issue and will help the users in the real time.

By integrating the health wearables with gaming platforms has a promising effect on the health. Nowadays these devices are becoming more popular and advanced, so by merging them with the games can give users or patients a complete health monitoring experience. By tracking the issues like calcium levels and hydration, the integration can provide a valuable data for personalized treatments.

With the help of Gamified Education and Awareness, it can make a big difference in the healthcare sector. By adding fun like quizzes and learning games about calcium intake and kidney stone prevention. In this way, the users can learn more enjoyably and interactively way and encouraging them to stay on their daily routines and healthy habits.

Also, the work of research and data analysis is very important for making the platform better. By studying that how the users interact with the games and their health data so that we can learn that what works best for promoting wellness and preventing kidney stones. Through this information, it can help us to improve the platform or apps to learn more about patient's health and giving them gamified health treatments to stay healthy.

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