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Gamification Framework for Psychological Rehabilitation for Chronic Diseases Patient

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ABSTRACT

The integration of gamification into healthcare has garnered significant attention for its potential to enhance psychological rehabilitation, particularly among patients managing chronic diseases. Such patients often face long-term treatment challenges, including reduced motivation, anxiety and social isolation. Despite the promise of gamified interventions, existing frameworks often lack standardization and fail to address the diverse needs of patients. This research focuses on enhancing the Wheel of Sukr framework to better support psychological rehabilitation for chronic disease patients. Using the Octalysis model as a foundation, the study evaluated the Wheel of Sukr, identifying gaps and introducing new elements such as "Reminder" and "Unpredictability" to bolster patient engagement and motivation. The enhanced framework was validated through expert review involving psychiatrists, psychologists and developers, ensuring its applicability in clinical settings. Key findings highlight the framework's improved capacity to sustain motivation and foster self-management by leveraging both intrinsic and extrinsic motivational strategies. However, the importance of balancing user engagement with the psychological well-being of patients was emphasized, particularly in refining features like reminders to avoid overwhelming users. This study contributes a refined gamification framework tailored to psychological rehabilitation in chronic disease management, emphasizing personalization, engagement and long-term sustainability. The findings underscore the potential of gamified healthcare interventions to empower patients, improve therapy adherence and promote overall well-being. Future work will focus on integrating therapeutic techniques, expanding healthcare system compatibility and validating the framework with broader patient populations.

1. Introduction

The integration of gamification into healthcare has gained significant attention in recent years, particularly in psychological rehabilitation for patients with chronic diseases. Gamification, which involves game-like elements such as rewards, challenges and competition to engage individuals,

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offers a unique approach to motivating patients to manage their conditions. For chronic disease patients, who often face long-term treatment regimens and the psychological burden of living with ongoing health challenges, gamification provides an innovative way to improve adherence to therapy, enhance mental well-being, and foster a sense of empowerment. Interactive and engaging rehabilitation experiences have shown promise in improving patient motivation and therapy adherence. Studies have demonstrated that patients prefer game-based rehabilitation systems over traditional exercises, spending significantly more time engaged in therapy and reporting higher enjoyment levels [1].

A gamification framework tailored to psychological rehabilitation for chronic disease patients has the potential to address key psychological barriers such as anxiety, depression and social isolation, which are common among this population. Recent studies have shown that game-based interventions, including exergames, virtual reality and cognitive training games, enhance patient motivation, improve self-efficacy and reduce stress and negative emotions by promoting engagement and providing rewarding feedback, although further research is needed to conclusively establish their effectiveness compared to non-game-based interventions [2-5]. Additionally, this approach can support the management of chronic conditions by creating a more personalized and dynamic treatment experience. As healthcare systems increasingly turn to digital health tools, gamification presents an emerging avenue for enhancing patient engagement and overall well-being in the rehabilitation process for chronic disease management.

The application of gamification in psychological rehabilitation, particularly for patients with chronic conditions, has shown promising results, particularly in improving patient engagement and adherence to therapeutic protocols. However, key research gaps remain in optimizing its full potential. A primary gap is the lack of standardized frameworks for integrating gamification into psychological rehabilitation, with few comprehensive, evidence-based guidelines outlining best practices for incorporating game elements such as rewards, feedback and social interaction in clinical settings. Researchers have emphasized the need for a more systematic approach to gamification in psychological interventions, as current models often lack clear definitions, standards and comprehensive structure, which complicates the assessment of their long-term efficacy across various conditions [6-8]. Additionally, there is insufficient research on the long-term sustainability and psychological impact of gamified interventions, particularly concerning how these interventions affect patients' mental health outcomes over extended periods. Much existing research has focused on younger, tech-savvy populations, leaving a gap in understanding how gamification can be effectively applied to older adults or individuals with limited digital literacy. Addressing these gaps is essential to refine gamified frameworks and ensure they are inclusive, effective and sustainable for a broader range of patients.

Mobile health (mHealth) applications have recently become widely used for chronic disease self-management, improving patient engagement and treatment adherence [9,10]. However, many patients struggle with long-term engagement, often due to a lack of motivation or dissatisfaction with the technology. To combat this, gamification has emerged as a promising solution, applying game design elements to enhance user motivation and long-term adherence [11,12]. Despite its potential, the use of gamification in healthcare, especially in psychological rehabilitation, remains under-researched. Existing gamified applications often lack standardized frameworks, leading to inconsistent applications and low user satisfaction [13,14]. This gap has resulted in many gamification projects in healthcare failing due to an inadequate understanding of how to design and implement these elements properly [15].

The main objective is to enhance the existing gamification framework, the Wheel of Sukr framework [16-18], for psychological rehabilitation in chronic illness patients, with experts reviewing

the proposed enhanced framework. The findings will benefit various stakeholders, as researchers and developers can use the enhanced framework for future mHealth applications targeting psychological rehabilitation, medical practitioners can utilize the prototype to support rehabilitation and patients may gain improved psychological support and self-management tools. Ultimately, this study contributes to the growing body of research on gamification in healthcare by offering a framework that integrates psychological rehabilitation with gamified design for chronic disease management.

1.1 Overview of Gamification in Healthcare

Gamification in healthcare involves the application of game elements to health-related contexts to enhance outcomes and engage users [19]. This approach has been utilized across various domains, including wellness, chronic disease management and mental health [20]. Common gaming elements such as points, leaderboards, levels, feedback and challenges provide a dynamic and interactive way to motivate and sustain user engagement [21]. Gamification in healthcare is characterized by two main attributes: attraction and achievement, which encompass strategies for synchronization, enjoyable engagement, visual rewards and goal-reinforcing frames [19].

While gamification has demonstrated promise in improving health behaviours, it is not without its challenges. Issues such as cheating, privacy concerns and loss of user interest persist, which can undermine the effectiveness of gamified interventions [21]. Recent trends in gamification indicate a shift towards mobile platforms, virtual reality and the integration of machine learning to create more personalized and effective health interventions [22]. Research gaps remain a significant barrier to the full potential of gamification in healthcare, including a lack of standardization in frameworks and guidelines, limited understanding of the underlying mechanisms that drive behaviour change and insufficient knowledge about the long-term effects and scalability of gamified interventions [22]. To effectively implement gamification in health interventions, healthcare providers must consider the concept's attributes and influencing factors to ensure the appropriate and effective use of game elements [19]. Overall, addressing these research gaps and challenges will be crucial for maximizing the benefits of gamification in healthcare and ensuring its widespread adoption and success.

1.1.1 Core components and elements of gamification in healthcare

Gamification in healthcare leverages game-like elements to engage and motivate individuals in non-game contexts, such as improving health behaviours and outcomes. Key game elements include points, leaderboards, levels, feedback, challenges, badges, and avatars, which are strategically integrated into healthcare applications to promote user participation. These elements are commonly used in areas such as physical fitness, chronic disease management, rehabilitation, and medical education. For instance, fitness applications may use leaderboards to foster friendly competition, while chronic disease management platforms employ feedback mechanisms to encourage adherence to treatment plans. As a result, gamification has become a powerful tool to enhance motivation and improve patient compliance with health interventions [21,23].

The effectiveness of gamification in healthcare can be analysed through seven key attributes: users, psychology, behaviour, activities, health field, technology and gamification elements [24]. These attributes interconnect to create holistic gamified experiences. For example, understanding user psychology is crucial in designing challenges that are engaging yet achievable, fostering a sense of accomplishment. Behaviour-focused strategies aim to instil long-term habits, such as consistent exercise or medication adherence. Additionally, technology plays a pivotal role in enabling these

gamified experiences, with wearable devices, mobile apps, and virtual reality enhancing accessibility and interactivity. The study emphasizes understanding the specific characteristics of patients and professionals to identify the most effective gamification elements in various contexts [24]. Executing the proposed research agenda is expected to enhance resource efficiency in health systems, improve the quality of healthcare management, and increase satisfaction among both health professionals and patients [24].

The field of gamification in healthcare continues to evolve, with emerging research focusing on chronic diseases, preventive medicine and health education. Applications targeting chronic disease management, for instance, increasingly employ personalized gamification strategies to cater to individual needs, enhancing their effectiveness. Similarly, health education programs integrate gamified content to make learning more interactive and memorable for students and patients alike. However, to achieve sustainable engagement, future research must optimize game designs that balance challenge and reward while ensuring inclusivity and ethical considerations. By addressing these challenges and leveraging advancements in technology, gamification holds the potential to transform healthcare by empowering users to take an active role in managing their health [21,24].

1.2 Existing Gamification Framework

Gamification has emerged as a promising strategy within mobile health (mHealth) applications, aiming to enhance user engagement and improve health outcomes by integrating game-like mechanics such as rewards, challenges, and progress tracking. Meanwhile, mHealth applications can support patient involvement and self-management by enabling users to monitor and track their health conditions actively, which may encourage lifestyle changes through ongoing engagement [25]. The incorporation of gamification into mHealth platforms is particularly valuable in the context of chronic disease management, where long-term adherence to treatment plans is a major challenge. Gamified interventions in mHealth apps have increased patient motivation, facilitated behaviour change and improved users' overall experience by making health management more interactive and enjoyable. Gamification in healthcare, including the use of tangible rewards such as points and badges for completing health-related tasks or achieving specific milestones, provides real-time feedback that enhances patient engagement, motivation, and commitment to health goals [26-28]. This framework is especially effective for managing chronic conditions that require continuous monitoring and behavioural adjustments, such as diabetes, cardiovascular diseases or obesity.

A range of studies have explored the impact of gamified mHealth interventions on chronic disease patients, with promising results. For example, research has shown that these interventions can lead to positive effects such as weight loss, blood glucose reduction, and improved behavioural changes, although the evidence base is still developing [29,30]. Gamified mHealth applications, which integrate elements like badges, points and social engagement, have shown promise in enhancing chronic disease management by improving self-management, increasing motivation and boosting health outcomes, while also potentially reducing stress and frustration commonly experienced by patients, though further rigorous evaluations are needed to confirm these benefits [30,31]. Such results emphasize the potential of gamified mHealth apps to create sustainable behavioural change and foster a sense of ownership and self-efficacy among users.

Despite the promising evidence supporting gamification in mHealth, challenges remain in optimizing these frameworks for diverse patient populations. One of the main concerns is ensuring that gamified elements are tailored to individual preferences, health conditions, and levels of digital literacy. The success of gamified mHealth interventions depends on the balance between entertainment and the effectiveness of health outcomes, which requires careful design to avoid

oversimplification or frustration. Researchers have highlighted the importance of integrating social and community aspects into gamified health frameworks to enhance motivation and adherence, noting that current models often involve multiple stakeholders and user-centred approaches to improve engagement and efficacy [32-34]. By leveraging social sharing, peer support, and competitive elements, gamified mHealth platforms can create a more interactive and supportive environment for users. As mHealth continues to evolve, further refinement of gamification strategies—ensuring accessibility, personalization, and scalability—will be crucial in enhancing their effectiveness for diverse patient populations and improving long-term health outcomes.

1.2.1 The Wheel of Sukr

The Wheel of Sukr is a culturally tailored framework that uses gamification to enhance diabetes self-management among individuals in Saudi Arabia. Diabetes is a prevalent health issue in Saudi Arabia, with a high rate of type 2 diabetes linked to lifestyle factors and cultural practices [35]. The framework leverages culturally relevant motivational elements—such as levels, rewards, and community support—to encourage healthier lifestyle choices and foster sustained engagement in diabetes care. By integrating gamification with self-monitoring and educational tools, the Wheel of Sukr aims to make diabetes management both accessible and engaging, aligning with local values and promoting long-term behavioural change in Saudi patients.

The Wheel of Sukr framework, introduced in 2015, was among the first to incorporate gamification elements, such as points and challenges, to enhance diabetes self-management for young adults in Saudi Arabia. In 2016, a Mixed-Methods Study on Gamifying Self-Management of Chronic Illnesses expanded on these principles by examining gamification strategies for improving patient engagement and adherence across chronic illnesses. Building on this, the 2017 Guidelines for the Gamification of Self-Management of Chronic Illnesses provided evidence-based guidance for developers, supporting the creation of culturally sensitive and motivational self-care tools for chronic disease management. The diagrams (Figure 1) below provide a detailed overview of the Wheel of Sukr framework's evolution, including sections on its summary, methodology, and main findings.

Fig. 1. Wheel of Sukr framework evolution overview

1.2.2 The Octalysis

Octalysis, developed by Yu-kai Chou, is a gamification framework designed to understand and enhance user motivation through eight core drives: Epic Meaning & Calling, Development & Accomplishment, Empowerment of Creativity & Feedback, Ownership & Possession, Social Influence & Relatedness, Scarcity & Impatience, Unpredictability & Curiosity and Loss & Avoidance [36]. These drives are used to create engaging experiences by leveraging both intrinsic and extrinsic motivators. Octalysis has been widely applied across various fields, including business, health and education, to optimize user engagement and foster long-term behaviour change [36].

To use the Octalysis framework, designers must first identify the specific core drives that align with their goals and target audience. By understanding which drives are most relevant, they can craft experiences that tap into intrinsic and extrinsic motivations. For instance, incorporating elements of Development & Accomplishment through achievements or Epic Meaning & Calling by tying actions to a higher purpose can increase user engagement. The benefit of Octalysis lies in its ability to design gamified experiences that not only engage users but also encourage lasting behaviour change by balancing various motivational factors. This makes it highly effective in areas like health, education and business, where long-term user commitment is essential [36].

2. Methodology

The methodology begins with a comprehensive literature review aimed at identifying gaps in existing research on gamification and chronic disease management. This step helps uncover areas

where current frameworks, such as the Wheel of Sukr, may fall short, particularly in relation to psychological rehabilitation for chronic disease patients. The findings from this review inform the decision to enhance the Wheel of Sukr, initially designed for diabetes management, to a more generalized framework suitable for psychological rehabilitation across a range of chronic diseases.

Building upon the insights gathered from the literature review, the study proceeds to analyse the Wheel of Sukr in the context of the OCTALYSIS framework. This analysis evaluates how the eight core drives of OCTALYSIS align with the key components of the Wheel of Sukr, which includes both gamification elements and self-management practices. By applying OCTALYSIS, which focuses on intrinsic and extrinsic motivation, the study identifies ways to enhance the framework's effectiveness in supporting psychological rehabilitation for chronic disease patients [36]. The results from this analysis inform the development of a refined version of the Wheel of Sukr.

An enhanced version of the framework is then created, incorporating the insights derived from the analysis of OCTALYSIS. To validate and refine the framework further, a panel of experts—including psychiatrists, psychologists, and developers—reviews the revised model. The experts were chosen based on their deep knowledge and experience in the relevant field, their track record of published work or contributions, and their strong analytical and communication skills that enable effective collaboration and dissemination of research findings. Their feedback ensures that the enhanced framework is scientifically sound, practical, and suitable for psychological rehabilitation in chronic disease management [37].

Future work in this study includes adopting a mixed-methods approach to comprehensively validate the long-term sustainability and psychological impact of gamified healthcare interventions. This approach will combine quantitative and qualitative methods to provide a thorough evaluation of the interventions' effectiveness. Quantitative assessments will involve the use of standardized psychological tests and surveys to measure adherence, engagement, and mental health outcomes across multiple time points, such as baseline, six months, and one year. In contrast, qualitative assessments will focus on collecting detailed participant insights through in-depth interviews or focus groups, exploring their experiences, perceptions, and challenges with the gamified interventions. This combination of methodologies ensures a nuanced understanding of both measurable outcomes and subjective experiences [38].

By integrating data from both quantitative and qualitative sources, future studies aim to develop a holistic perspective on the long-term impacts of gamified interventions. This integration allows researchers to identify common themes, trends and user-specific challenges that may emerge over time. Analysing this data will provide valuable insights into optimizing the design and implementation of gamification frameworks. For example, understanding how users perceive rewards or challenges can inform refinements that sustain engagement and improve adherence in diverse patient populations [38].

3. Result

In this research, the Octalysis framework is used to evaluate and enhance The Wheel of Sukr by analysing each element within the Wheel according to the eight core drives of Octalysis, such as Epic Meaning, Accomplishment, and Social Influence. By scoring each element based on its effectiveness in motivating behaviour, the research identifies strengths, weaknesses, and potential areas for improvement. This evaluation provides a structured approach to refining The Wheel of Sukr, ensuring that the framework aligns more effectively with motivational principles and creates a more engaging, well-rounded experience for its users. The results of the evaluation are shown in the diagram (Figure 2 and Figure 3) below.

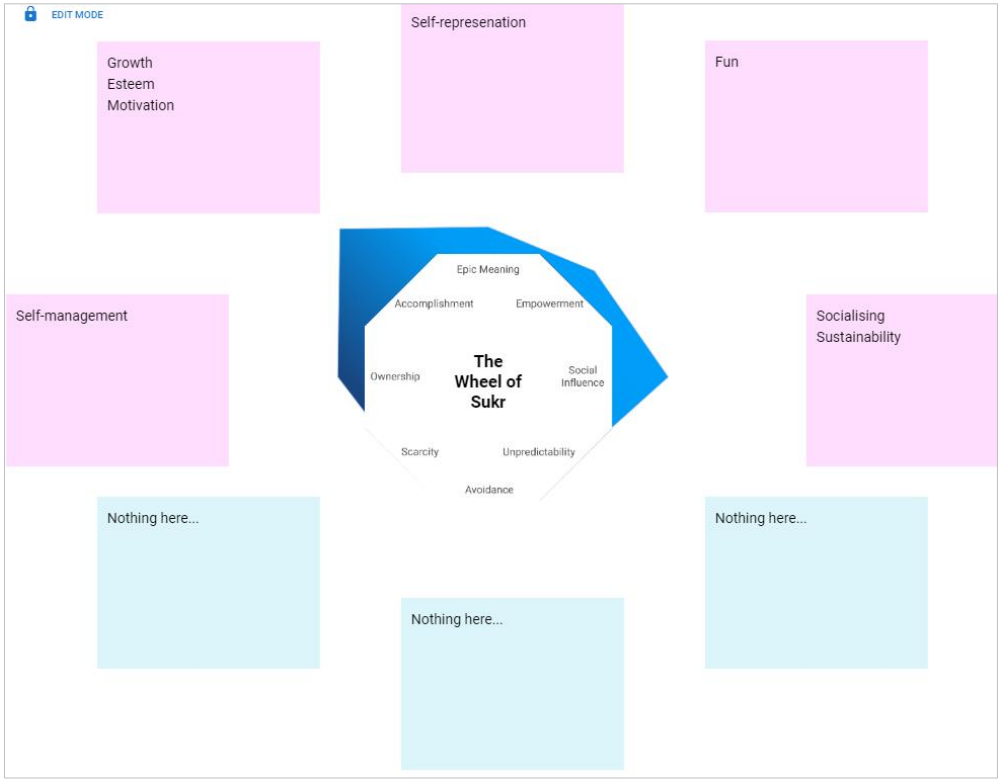

Fig. 2. Octalysis tools evaluation

Result Score: 144

White Hat and Good Motivation

Your experience is heavily focused on White Hat Core Drives, which means users feel great and empowered. The drawback is that users do not have a sense of urgency to commit the desired actions. Consider implementing light Black Hat Techniques to add more thrill to the experience. Also, you seem to have a great balance between Left Brain and Right Brain Core Drives, which means you likely have a good balance between Intrinsic and Extrinsic Motivation. Just be very careful because Extrinsic Motivation designed badly may kill Intrinsic Motivation.

Fig. 3. Octalysis score

3.1 Enhanced Framework

White Hat techniques refer to positive and motivating elements that engage users by making them feel empowered, excited, and in control [36]. Black Hat techniques, on the other hand, are manipulative strategies that create pressure or discomfort, often by using fear or urgency to drive behaviour [36]. Adding subtle Black Hat techniques could increase urgency within the framework without disrupting the balance between intrinsic and extrinsic motivation. This may involve introducing elements of scarcity or unpredictability, encouraging users to take timely actions while still feeling empowered and motivated. In the enhanced framework, two new themes were added and one theme was removed from the original.

In the original framework, the motivation theme consisted of intrinsic and extrinsic motivation. Intrinsic motivation refers to engaging in an activity because it is personally rewarding and driven by

internal satisfaction rather than external rewards. Extrinsic motivation, on the other hand, involves performing a task to earn a reward or avoid punishment from an external source [39]. Implementing gamification elements can blend extrinsic and intrinsic motivation by offering external rewards, such as points or badges, that encourage initial engagement. As users continue, these gamified elements may foster intrinsic motivation by making the activity more enjoyable or meaningful [40]. This combination can create sustained motivation by appealing to both reward-seeking and personal satisfaction, so the motivation element was removed from the original framework.

The two new themes added are "Reminder" and "Unpredictability," based on feedback from the Octalysis evaluation. The goal of the Reminder theme is to emphasize the importance of consistent rehabilitation for patients, using gamification elements like push notifications, in-app reminders, and customized alerts. By delivering timely reminders, this theme keeps patients on track, reinforcing the habit of regular participation in their rehabilitation process. The effectiveness of the 'Unpredictability' theme aligns with findings that gamified interventions fostering curiosity and intrinsic motivation lead to higher engagement, as seen in stress management applications [41]. This theme creates an element of excitement and anticipation, making the rehabilitation journey feel fresh and encouraging patients to stay involved as they look forward to new experiences and rewards. Table 1 below presents the enhanced framework, outlining each theme along with its gamification elements and objectives.

Table 1
Framework themes with gamification elements and goal

Theme	Gamification Element	Goal
Fun	Badge, points, challenges and competition	Create a rewarding and engaging experience
Esteem	Leaderboards, levels, progress bars and reputation	Enable users to respect and admire their achievements and the achievements of others
Growth	Feedback, achieving goals and baby steps	Empower patients to take good care of their health by learning about their illness and learning to manage it
Sustainability	Trigger, flow, storyline and theme and nudge	Ensure the longevity of the gamified effect and encourage consistent and better self-management habits
Self-Representation	Avatars, autonomy, ability and purpose	Enhance the gamification experience and efficiency of the self-management
Socializing	Community, social media, peer support and sharing	Provide users with a community that creates a base for the gamification features and offers emotional and social support for the patient
Self-management	Logbook, visualization of data and trend alerts	Assist user in self-managing their illness in efficient ways
Reminder	Push notifications, In-app reminders, Customized reminders	Remind the patient the importance of consistent rehabilitation
Unpredictability	Unexpected encouragement, Surprise event	To enhance senses of curiosity, motivation and engagement.

3.2 Expert Review

Expert review is crucial as it provides informed, objective feedback based on the reviewer's specialized knowledge, which helps enhance the quality and credibility of the work [42]. It also aids in identifying potential issues or areas for improvement that may not be apparent to non-experts, ensuring a more thorough evaluation. An expert review of the framework, involving a psychiatrist, a psychologist and an application developer, brings a range of valuable insights. The psychiatrist and psychologist ensure the framework supports mental health and user engagement, while the

developers evaluate its technical feasibility. The table below presents insights from the experts' feedback on the framework.

Table 2
Experts' feedback

Expert	Feedback
Expert 1	The addition of the Reminder and Unpredictability elements are valuable improvements to the original TWOS framework, which emphasizes intrinsic self-empowerment by enhancing self-presentation, self-management and social skills. The Unpredictability element effectively boosts motivation, curiosity and user engagement, while the Reminder element encourages consistent rehabilitation through timely notifications. However, while reminders can help users stay on track, excessive or poorly timed notifications may negatively impact users' mental well-being and motivation. Overall, these additions strengthen the framework, though adjusting the Reminder element to a simpler, user-friendly approach—possibly under a theme like "Self-Motivation"—could enhance its effectiveness.
Expert 2	The framework is a good start, but some areas need more explanation. It would be helpful to clarify what the result score of 144 means in the Wheel of Sukr assessment and to provide more details on how the two new themes were added and why the motivation theme was excluded. The definitions of "chronic disease patients" and "psychological rehabilitation" should be clearer, especially in terms of whether the framework applies only to mental health or also to physical conditions like hypertension. Additionally, more explanation is needed on why the framework designed for diabetes is being adapted for other chronic diseases.
Expert 3	The Enhanced Wheel of Sukr (TWOS) framework is a comprehensive tool for chronic disease rehabilitation, combining gamification and psychological support to promote long-term patient engagement and self-management. It integrates motivation, self-monitoring, social support and rewards, but could be further enhanced by incorporating therapeutic techniques like mindfulness and CBT, improving accessibility and adding advanced health analytics. Additionally, integrating with existing healthcare systems and electronic health records (EHRs) would streamline data flow and provide a more comprehensive view of patient health. It's also important to address the patient's ability to adapt to the system by outlining the learning curve and managing cognitive load during onboarding, ensuring the system is user-friendly and accessible for all users. Expanding evaluation metrics to include psychological impact and quality of life would offer a more holistic approach to patient care.

The Enhanced Wheel of Sukr (TWOS) framework represents a significant evolution in chronic disease rehabilitation, blending gamification with psychological support to foster long-term engagement and self-management. Experts have noted that adding the Reminder and Unpredictability elements enhances user motivation and consistency in rehabilitation. The Unpredictability element, which introduces variability in notifications, increases curiosity and engagement, while the Reminder element ensures patients stay on track with their rehabilitation goals through timely prompts. However, as Expert 1 cautioned, while reminders are valuable, an overabundance of notifications or poorly timed alerts could lead to user frustration or burnout, thus diminishing their overall effectiveness. A more nuanced approach to reminders, perhaps framed under a "Self-Motivation" theme, could strike a better balance, making them both helpful and motivating without overwhelming the user.

Despite its potential, the TWOS framework still requires further clarification in several areas, as pointed out by Expert 2. For instance, the meaning of the result score of 144 in the Wheel of Sukr assessment remains unclear. Greater transparency about how this score is derived and what it signifies in the context of a patient's rehabilitation progress would help users and clinicians better understand the tool's outputs. Additionally, while the inclusion of new themes like motivation and unpredictability strengthens the framework, it is important to explain why the motivation theme was excluded in its initial iteration, especially given the crucial role motivation plays in chronic disease management. Furthermore, clarifying the scope of the framework—whether it is designed for mental

health rehabilitation-only or applicable to a broader range of chronic conditions like hypertension—would help ensure that the tool's utility is properly communicated to a diverse user base.

Finally, while the integration of social support, self-monitoring and rewards into the TWOS framework represents a holistic approach to chronic disease management, there is room for further enhancement. Expert 3 emphasizes the potential value of integrating therapeutic techniques such as mindfulness and Cognitive Behavioural Therapy (CBT) to address the psychological well-being of patients. Incorporating these techniques could provide a more comprehensive solution to managing not just the physical symptoms of chronic diseases but also the emotional and psychological challenges that often accompany them. Additionally, integrating the framework with existing healthcare systems and Electronic Health Records (EHRs) would provide a more seamless flow of data, offering clinicians a more comprehensive view of patient health. To ensure that patients can effectively navigate and benefit from the system, a focus on user-friendly design, particularly during onboarding, is essential. This would minimize the cognitive load on patients and make the system more accessible, especially for those who may be less familiar with digital health tools.

4. Conclusions and Future Work

This paper presented a study that enhanced the Wheel of Sukr framework to tailor for psychological rehabilitation in chronic disease management. By leveraging the Octalysis model, the framework was refined to improve user engagement through new themes such as Reminder and Unpredictability and it was validated with expert feedback. Despite these improvements, a key limitation remains the subjective nature of the Octalysis assessment, which could introduce bias. Future work will focus on mitigating these limitations by incorporating broader expert reviews and conducting rigorous testing with target participants to evaluate the framework's practical application and effectiveness. Future iterations of the framework should also consider the insights from gamified mHealth applications, which emphasize lightweight gamification to sustain motivation without overwhelming users. Additionally, insights from gamified mHealth applications, which emphasize lightweight gamification to sustain motivation without overwhelming users, should be considered [43]. Expanding the framework's integration with existing healthcare systems, incorporating therapeutic techniques and addressing user accessibility will further enhance its utility and impact.

While mobile health applications and gamification have shown significant potential in enhancing psychological rehabilitation, it is essential to recognize the crucial role of healthcare providers and the therapeutic relationship in this process. The quality of interaction between patients and healthcare providers, as well as the therapeutic alliance formed, heavily influence the effectiveness of psychological rehabilitation. Integrating human elements with technological interventions can lead to a more robust and holistic framework. For instance, regular interactions with healthcare providers can be incorporated into gamified programs, providing personalized support and guidance. Training modules for healthcare providers to effectively use gamification tools can also enhance the therapeutic experience.

Incorporating insights from psychology and behavioural science into the framework is vital for addressing the psychological needs and behavioural patterns of patients. Designing interventions that leverage technological tools while prioritizing human-centred care ensures comprehensive support for patients. By adopting a holistic approach that combines technology with human factors, the framework can better address the diverse needs of patients, promoting long-term engagement and well-being. This comprehensive approach not only meets immediate health objectives but also ensures the sustainability and effectiveness of psychological rehabilitation interventions over the long term.

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