

Challenges in Healthcare Gamification: Insights from Review Articles

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Abstract

Initially prompted by a global shift from infectious diseases to lifestyle-related non-communicable diseases, there's been an increased emphasis on healthier living. Gamification, widely adopted in the late 2010s for its potential to motivate health-related behaviors, has been applied in areas such as physical exercise, rehabilitation, and health behavior change. Despite its popularity, gamification has yet to achieve a consistent result in terms of behavioral outcomes. This study provides a comprehensive overview of current challenges by reviewing a collection of articles across various healthcare domains. By identifying and summarizing the primary barriers to effective healthcare gamification, this paper aims to inform future research directions and improve the implementation and outcomes of gamification strategies in health behavior motivation.

Keyword: Gamification, Healthcare, Review

I. Introduction

With the advancement in technology and our living conditions, major health challenges the world has faced in the past few decades have shifted from deadly infectious diseases to modern lifestyle health risks. In 2020, the WHO reported that 7 out of 10 leading causes of death were non-communicable, lifestyle-related diseases such as heart diseases, stroke, and diabetes [1]. The

alarming risk of living a sedentary, chronically stressing modern life has caused society, healthcare professionals, researchers, and policymakers to advocate and promote more on healthier individual lifestyles [2].

To live a healthier lifestyle requires better health behaviors, and a driving factor for health behaviors is motivation [3]. In the late 2010s, with successful business cases and wide public exposure, gamification quickly rose to fame in both industry and academia as a promising way to motivate behaviors [4]. Expectedly, gamification was quickly adopted and studied in healthcare sub-domains such as physical exercise, rehabilitation, and health behavior change and was seen as a promising new approach to health behavior motivation [5-9].

However, after a decade-long development, gamification has yet to achieve good effectiveness in healthcare in terms of accomplishing behavioral outcomes. Systematic reviews of gamification in healthcare sub-domains commonly report gamification to have mixed results in a significant portion of their included studies. For instance, Johnson et al. reviewed gamification for health and wellbeing, and 41% of the accumulated studies reported mixed results [2]. In Koivisto and Hamari's review of gamification for physical activity, only half of the collected studies showed fully or partially positive results [10].

To provide a comprehensive overview of the current barriers and challenges in healthcare gamification, this study reviewed a collection of review articles across various healthcare domains. By summarizing these barriers and challenges, the study aims to inform and guide future research directions in the field of healthcare gamification.

II. Literature review

A total of eleven systematic reviews covering key healthcare areas that have evaluated the effectiveness of gamification were gathered during the literature review process of this work. The review articles are listed in Table 1.

Table 1. *Summary of reviewed articles.*

Article	Health topic	Type	Samples	Effectiveness	Summary
[11]	Physical exercise	Systematic review	25	Overall positive	The review shows overall positive psychological outcomes as well as behavioral ones. out of the 25 articles, 13 showed positive result, 12 showed partially positive result.
[10]	Physical exercise	Systematic review	16	Mixed	The review concluded positive result for baseline comparison studies, but mixed result for RCT. 16 articles were collected. 4 showed fully positive result, 4 showed partial positive result, 7 showed null or equal result, 1 showed partial negative result.
[13]	Mental health	Systematic review	61	Negative	This review did not find any evidence that use of specific gamification features was associated with higher adherence to the intervention program as measured by adherence to protocol. Furthermore, no evidence was found to suggest that interventions incorporating additional gamification features had any statistically significant influence on adherence.
[2]	Healthcare in general	Systematic review	19	Mixed	In this review, 59% of reported impacts are positive, 41% are mixed. Results were clear for health-related behaviours (13 positive, 6 mixed or neutral) but mixed for cognitive outcomes (8 positive, 9 mixed or neutral).

[14]	Mental health	Systematic review	38	Negative	No significant difference in effectiveness between mental health apps with and without gamification features in prediction. No effect of gamification elements on intervention adherence.
[15]	Diet	Systematic review	23	Mixed	Gamification was a positive influence on dietary behaviour and nutritional knowledge. Results of the meta-analysis showed an increase in the level of nutritional knowledge. No significant effect of gamification for body mass index z-score.
[16]	Cognitive training	Systematic review	49	Mixed	The meta-analyses showed that gamified training tasks were more motivating/engaging and more demanding/difficult than non or less-gamified tasks. Out of 9 RCT analysed. 8 reported positive motivational outcomes. No effects on cognitive outcome were found.
[17]	Diet	Systematic review	7	Overall positive	6 out of 7 articles reported positive outcomes, indicating short-term gamified interventions can improve fruit and vegetable intake in those aged 10 to 24 years old. Gamification also resulted in positive changes in knowledge acquisition.
[18]	Diet	Systematic review	43	Overall positive	Both gamifications and serious games can enhance children's fruit and vegetable intake and promote healthy eating behaviour by improving their nutritional knowledge and

[12]	Vaccination	Scoping review	7	Overall positive	attitudes. All the 7 identified gamified digital tools were highly appreciated for their usability and were effective in increasing awareness of vaccine benefits and motivation for vaccine uptake.
[19]	Healthcare in general	Systematic review	13	Mixed	For the collected 13 healthcare studies, 4 reported fully positive result, 7 reported mixed result with positive tone 2 reported null or equally positive and negative result.

Four studies demonstrated generally positive outcomes from the use of gamification. In a systematic review on effectiveness of exergames, Matallaoui et al. analyzed 25 studies, finding a predominant positive (13 studies) and partially positive (12 studies) trend [11]. Complementing this, Montagni et al., in their scoping review on gamification for enhancing vaccination knowledge, discerned that all 7 evaluated articles supported the effectiveness of gamified tools in increasing vaccine awareness and motivation [12]. Positive findings were also reported in Chow et al. 's examination of 43 studies on gamification's role in children's eating behavior, revealing a generally positive effectiveness in achieving behavioral target [18]. Yoshida-Montezuma et al. focused on adolescent fruit and vegetable intake, where 6 out of 7 studies reported short-term positive results [17].

Five reviews have reported mixed results. Koivisto & Hamari's conducted a systematic review on comparison studies of gamification for physical activity. Of 16 articles analyzed, 4 showed fully positive result, 4 showed partially positive result, 7 showed null or equal result, and one showed partially negative result [10]. This mixed trend was further mirrored in Johnson et al.'s review of 19 articles on gamification for health and well-being [2], and in Suleiman-Martos et al.'s exploration of 23 articles on the effectiveness of gamification in improving diet, nutritional habits and body composition in children and adolescents [15]. Notably, while Johnson et al. reported largely positive behavioral impacts (13 positive, 6 mixed or neutral), cognitive outcomes presented a more balanced spread of positive and neutral results (8 positive, 9 mixed or neutral). Results in Suleiman-Martos et al. highlighted a positive influence on dietary behavior yet found no significant effect on body mass index. Furthermore, in Koivisto & Hamari's overarching review of gamification in general, out of the 13 healthcare related studies, 4 reported fully positive result, 7 reported mixed result with a positive tone, and the remaining 2 reported null or equally positive and negative result [19].

Lastly, conclusions from 2 reviews are on the negative side. Brown et al., conducted a systematic review on gamification for web-based mental health intervention adherence to examine the efficacy of game elements [13]. In their analysis of 61 random control trials (RCT), the increase in user adherence is all statistically insignificant. Similarly, Six et al.'s review of 38 studies found that

gamification did not notably reduce depressive symptoms or boost app adherence [14]. Adding to this narrative, Vermeir et al. analyzed 9 RCTs and, while noting a moderate positive effect on motivation and engagement, found no improvements in cognitive outcomes [16].

III. Current Challenges

Barriers and challenges uncovered in the reviewed articles can be categorized in to the following four aspects:

A. Theoretical challenges

Gamification research is characterized by a lack of uniformity. This is evident in the absence of consensus on theoretical underpinnings, methodology, taxonomies, and game elements [19]. In the healthcare domain, the ambiguity resulted from the lack of foundation has led to the aforementioned situation where the same game element was referred to by different terms across studies (e.g., narrative vs. story, or avatar vs. character). Several systematic reviews have reported that a considerable portion of the collected studies were not theory driven. Game elements were employed without explaining their intention or theoretical basis, which could potentially lead to unreliable findings and prevent the emergence of a cohesive body of knowledge [11, 13, 20]. Diving into gamification without a thorough understanding of its core theories can lead to misconceptions, like the notion that integrating game tactics automatically ensures increased engagement [5]. It can also lead to misuse of game elements like points and leaderboards [13].

Furthermore, the evolution of gamification has been influenced by rapid technological advancements, changing user preferences, and emerging interdisciplinary insights, all of which necessitate a continuous review and adaptation of its theoretical development. As gamification spreads across diverse fields—from education to healthcare to business—each domain calls for a specialized theoretical approach. This diversification adds complexity to its theoretical development.

B. Methodological challenges

Methodology-wise, a predominant concern in gamification research is the absence of unified evaluation framework and a lack of rigor [21]. This has led to several problems: studies often lean on non-validated scales or depend on subjective reporting [10, 11]. Many studies failed to employ robust evaluation methods such as randomized controlled trials (RCT) when assessing gamification [22]. Despite being central to gamification, there is a notable gap in assessing intrinsic motivation and enhanced engagement [2, 23]. Some comparison studies did not provide solid pre-test and post-test evidence [12]. Additionally, some of the studies were designed too short to yield an accurate result or long-term impact certain studies are of inadequate duration, limiting their ability to provide insights into long-term effects or deliver precise results [17, 18, 21].

When it comes to the study design, conflicts even appear among the research regarding the number of game elements that should be studied at a time. Some reviews suggested that game elements should be studied one at a time so that a clear conclusion could be derived on the studied element [2, 10, 18], while others suggested that multiple elements should be used to ensure gamification's effectiveness since one may not be enough [8, 21]. It has also been mentioned that some studies did not involve health professionals in the design process. Excluding such expertise can potentially diminish the efficacy and credibility of the gamified system [21].

C. Design challenges

In terms of design, a frequently mentioned concern is the lack of customization of gamification to cater to the specific needs and preferences of its target users and the intended use case [2, 5, 12, 16, 21]. This oversight often results in gamified interventions being seen as irrelevant or unhelpful [21], or a trivialization of the health situation [24]. It is important to recognize that users have varied preferences when it comes to game elements [13, 20]. Moreover, implementing gamification for individuals who are already intrinsically motivated can be redundant or even annoying [20]. The lack of tailoring can be detrimental for some population or health situation, such as for elderlies, who

faces more difficulty in using, understanding and perceiving the associated benefit of the gamified system [25], or for depressed person, who are generally hyposensitivity to rewards [14] Children also might need more structured and guided experiences [18].

Furthermore, a common pitfall in gamification design is the excessive reliance on positive reinforcement, which is not always a long-term solution for driving behavioral change [2, 20, 26]. There is also a predominant trend towards offering extrinsic rewards, which tend to have short-term impacts term [8, 10, 21]. For sustainable results, designs should pivot more towards nurturing intrinsic motivation and genuine engagement [17, 21].

D. Implementational challenges

From an implementation perspective, attaining a high level of quality in gamification is challenging, and as a result, quality of the gamification often gets [24]. Some attempts at gamification merely tweak the system's aesthetics or input methods, giving it a superficial game-like appearance without integrating the essence of gaming [11]. On the other hand, certain studies push the gaming aspect too hard that the health behavior, which should be the primary focus, gets overshadowed [20].

Special attention needs to be given to specific demographic groups: for instance, elderly users, who may require more intuitive and user-friendly interfaces [25]. An emerging concern in the gamification landscape is dishonest behavior or cheating by players [8, 21]. Such behavior often stems from gaps in design, implementation, or both, underlining the need for thorough consideration in this regard in future gamification studies.

IV. Conclusion

The volume of articles on healthcare gamification is extensive. While the articles referenced here were not gathered systematically and this analysis is not a meta-review, the clear distinctions in reported effectiveness suggest they can sufficiently represent the diverse range of outcomes observed in healthcare gamification research. The actual efficacy of gamification in healthcare may be more

questionable than what researchers initially hoped for. From its theoretical foundations to its practical implementation, the field is marked by a lack of consensus, varied methodologies, and misaligned designs. Researchers and practitioners alike navigate through a landscape where the same game elements bear different names across studies, leading to theoretical ambiguities. Methodologically, there is an evident absence of consistent evaluation metrics and frameworks, making cross-study comparisons a complex endeavor. This is compounded by design challenges, where a one-size-fits-all approach often fails to address the unique needs of diverse user groups, from the elderly to children. Furthermore, while the aim is to seamlessly integrate gamified elements, many implementations either overemphasize the gaming aspect or provide superficial game-like features, weakening the intended health outcomes. As gamification continues to develop, addressing these multifaceted challenges is important for future studies.

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