



Review

Gamification of Medication Adherence in Epilepsy


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ABSTRACT

Adherence to medication regimens is a crucial factor in seizure-freedom and well-being for people with epilepsy. In contrast, taking medication inconsistently increases the risk of not only seizures and their adverse effects, but drug side-effects and unnecessary modifications to treatment plans. Epilepsy is prevalent across all age groups and we have been slow to utilise both the technologies and psychologies derived from computer gaming. Gaming has broken through to the mainstream and is no longer the preserve of younger males, mirroring the adoption of smart-phones. 'Gamification' motivates users into engaging in an activity with a higher intensity and duration. Introducing gaming elements into a non-gaming context has the potential to transform routine tasks into more enjoyable and motivating experiences. This has been exploited by marketing executives, but also has clear uses in a healthcare setting too. We discuss how previously published frameworks could be employed to help people with epilepsy adhere to medication regimens to create a patient-focussed, modifiable and fun experience.

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1. The concept

'Gamification' is a neologism coined in 2002 by Nick Pelling, the British born computer programmer and game developer (Marczewski, 2012) [1]. It is still a nascent concept, and hence a universally agreed definition is pending. Deterding et al. [2] explain the two main definitions of the term 'gamification'. The first is how video games are increasingly widespread throughout today's society, influencing everyday life and interactions; the target group for video games used to be younger males. The same couldn't be said for today, as video games are targeted and played by males and females across all age groups. The Entertainment Software Association (ESA) in the United States release annual reports on video games sales, demographics [3]. 2016 usage data shows that: 59% of gamers are male; 27% of gamers are under the age of 18, 29% between 18 and 35, 18% between 36 and 49, and 26% of the age 50 and above. Interestingly, it was shown that there is a significantly higher number of female players over the age of 18 (31%) compared to males below the age of 18 (17%). With the growth of technology, platforms for gaming have also expanded from consoles to computers as well as smartphones, making video games more accessible and affordable than before. The second definition –

which this paper will focus on – is the use of video games or gaming elements to motivate users into engaging in an activity with a higher intensity and duration. The introduction of gaming elements into a non-gaming context has the potential to transform mundane and routine tasks into a more enjoyable and motivating experience.

2. The problem

Incomplete patient adherence to medication regimens has been, and still is, a problem in effectively administering evidence-based treatments. Adherence is actively following a medication schedule, in contrast to compliance or concordance which are passive [4]. Adherence to long-term treatment for chronic diseases in developed countries can be as low as 50% [5]. (Sabaté E, 2003). Kardas et al. [6] described 771 individual factors that affect patient adherence. The review highlights lack of support, lack of motivation, and forgetfulness as key factors that lead to poor adherence. Adherence to anti-epileptic medication specifically can be poor. A recent poll by Epilepsy Research UK showed that half of respondents forget to take their epilepsy medication at least once a month [7]. Davis et al. [8] conducted a retrospective study on the prevalence and cost of non-adherence with antiepileptic drugs using the PharMetrics database in the United States. They used the medication possession ratio (MPR) to calculate adherence to anti-epileptic medication. This is the total number of days where the

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medication is supplied divided by the number of days in the observation period; they considered anything below 0.8 to be non-adherent. Of 10,892 patients, 39% of patients scored below 0.8 MPR. The mean MPR for individual drugs was also looked at, the highest being lamotrigine (0.83) and lowest being gabapentin (0.70). The difference in adherence between drugs can be attributed to multiple factors, and the varied efficacy and tolerability of each drug will directly affect this. The paper also showed that non-adherence was associated with increased use of healthcare services, and thus an increase in cost. Furthermore, although multiple factors, from genetic to environmental, are thought to contribute to sudden unexpected death in epilepsy (SUDEP) to date, antiepileptic treatment is the only preventative measure proven to be effective [9]. Therefore, an increase in patient adherence, no matter how small, could help reduce mortality in epilepsy. This paper will look at the possibility for the use of gamification in a mobile application to improve patient adherence for epileptic patients.

Current strategies to improve patient adherence target better communication between clinician and patient. Atreja et al. [10] groups the strategies with the mnemonic 'SIMPLE':

- Simplifying regimen characteristics
- Imparting knowledge;
- Modifying patient beliefs;
- Patient communication;
- Leaving the bias; and
- Evaluating adherence.

These strategies, while useful, are confined only to points of contact between the healthcare professional and the patient. They do not represent ongoing strategies for the times when patients are left to their own devices. If the benefits of gamification that are currently employed elsewhere could be transferred with similar efficacy to healthcare, it would be an important aid in ensuring patient adherence to treatment.

3. Past applications of gamification

Gamification revolves around the core idea that people have a natural drive to seek achievement, status, and competition [11]. Video games are fun to play because they give a sense of achievement when one successfully completes a level, usually while being entertained by either the story or the game mechanics itself. Gamification seeks to replicate this by using gaming elements in a non-gaming setting. This could be done via virtual rewards for completing tasks rather than punishment for non-adherence. To keep people engaged, the experience could be further expanded by increasing difficulty over time as well as adding a compelling narrative, just as in video games. While gamification has been applied to many industries successfully – mainly in marketing and advertising – healthcare providers have yet to fully take this concept on board. In recent history, some successful examples of gamification within marketing include M&M's 'Eye Spy Pretzel' and Starbucks' 'Rewards'. In 2010, M&M's devised a simple game to promote their new pretzel-flavoured sweets. This involved a Facebook picture full of M&M's with a small hidden pretzel in. The task – much like Where's Wally (or Where's Waldo) – was to locate the pretzel. It was simple and inexpensive, but the result was obvious. There was an increase of 25,000 likes on their Facebook page, demonstrating engagement with their customers and spreading their brand via social media. Starbucks is also known for gamifying their loyalty card programme by introducing levels to their card. Higher levels could be unlocked by

more loyal customers, revealing more material rewards such as food and drinks.

Chore Wars (ChoreWars.com) is a different example of gamification, where people can create an adventuring fantasy character online that gains Experience Points based on the completion of everyday tasks in real life, such as household chores and office work. For example, a party of adventurers could be formed by office colleagues. The more work is completed in the office, the higher level the characters become and hence more useful to the fantasy quest they are undertaking. This is a perfect example of using a narrative to encourage engagement with mundane tasks.

A hospital in Portugal trialled the use of gamification to increase the compliance of hand hygiene in nurses [12]. This is done via an indoor location system that tracks the nurses' personal smart tags. Beacons are placed at sinks and alcohol gel dispensers to indicate whether the nurse approaches them first before approaching a bed. This then sends data anonymously to the system to measure compliance. A web application can then be accessed by the nurses at any time to view their results. Compliance was rewarded with badges and virtual goods. There was also a leaderboard which showed their performance compared to the other nurses anonymously. This trial showed that the nurses were highly engaged with the programme and compliance to hand hygiene was increased. However, this could be due to being engaged in something new, or the feeling of being scrutinised. While evidence is still lacking in the ongoing efficacy of this method, as well as the motivations of the participants, it remains a promising way to improve compliance.

The provision of information and knowledge to patients is also an important part in maintaining good adherence. A study by McLeod et al. [13] assesses whether gamification could increase participants' engagement in learning a new skill, and whether they were driven more by intrinsic or extrinsic motivation. They found that gamification of the process of learning helped the participants to engage with the activity, more so through extrinsic motivation such as badges, scoreboards, and other reward systems. Even in the healthcare professional setting, Lamb et al. [14] showed that a more gamified approach encouraged resident surgeons to engage in academic reading. They used Twitter as a platform where questions were posted daily, and participants would gain points based on their speed and accuracy. The moderator of the Twitter account would engage with the participants and fuel academic discussions based on the questions. 6 months into the programme, participants took the ABSITE (American Board of Surgeons In-Training Examination) and had an increase in examination percentile rank compared to their counterparts who were not involved in the gamified programme.

All the above have a common theme: Increase in engagement via an increase in motivation. Social interactions via online social media also helps motivate participants. Allam et al. [15] ran a trial of a web-based rheumatoid arthritis self-management programme with social support as well as gamification. The participants were randomly allocated into 1 of 5 groups, each with different levels of accessibility to the website. The groups were the information group (only access to informational sections of the website), support group (online support and information), gaming group (gamification and information), full access group, and control group (no access). The study showed that gamification and online social support decreased healthcare utilisation and increased patient empowerment. Furthermore, patients who were offered the gamified experience were shown to use the website more than the other groups. These findings can be extrapolated to a gamified application to empower patients to take healthcare into their own hands, leading to an increased adherence to medication.

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