Chronic disease self-management

Chronic disease self-management programs such as those guided by the Stanford (e.g., Long & Holman, 2003) and Flinders (e.g., Ragan-Smith et al., 2006) models are now commonplace across healthcare settings. Traditional face-to-face and group-based delivery of these programs poses challenges to scalability, access and attrition. Web-based and mobile technologies

The advent of web-based and mobile technologies presents possible solutions to overcome these challenges. There is a growing literature that demonstrates the effectiveness of web-based and mobile technologies in supporting patients living with chronic conditions to engage in the behaviors necessary for optimal self-management (Fleming et al., 2016; Smith et al., 2006). It can include serious games as well as programs that contain gaming elements, such as the scoring of points or engaging in quests (Fleming et al., 2017). It has been postulated that gamification influences engagement through five key motivation orientations of achievement, exploration, sociability, domination and immersion (Hamari & Tuunanen, 2014). Empirical support for the use of gamification in health behavior change is starting to emerge.

Gamification

Gamification is a broad umbrella term used to describe the process of applying gaming elements to engage and motivate people in non-game contexts (Deterding et al., 2011). It can include serious games as well as programs that contain gaming elements, such as the scoring of points or engaging in quests (Fleming et al., 2017). It has been postulated that gamification influences engagement through five key motivation orientations of achievement, exploration, sociability, domination and immersion (Hamari & Tuunanen, 2014). Empirical support for the use of gamification in health behavior change is starting to emerge.

Objective

This review seeks to understand the characteristics of gamification applications as they relate to supporting self-management behaviors in adults living with chronic physical health conditions. It is proposed that this understanding will help to guide further research and development in this area.

Search process

The Medline PubMed database was searched using the following search terms: “gamification” or “serious games” AND “health behavior” OR “chronic illness” OR “chronic disease” OR “self-management behavior” OR “health behavior change.” This search generated a total of 131 records for consideration. Two investigators (KP and LM) independently reviewed records according to the following inclusion criteria: (1) article reports on the evaluation of a gamification application used to change self-management behavior in adults living with a chronic physical health condition; and (2) article reports on the evaluation of a gamification application used to change self-management behavior in adults living with a chronic physical health condition. In addition to the database searching, reference lists of the articles that met the inclusion criteria were hand searched to retrieve additional articles.

The search process is depicted in Figure 1.

Figure 1. Flow diagram representing the search process.

Introduction

Methodology

Table 1. Characteristics of the included studies.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Study design</th>
<th>Sample patient</th>
<th>Self-management behavior</th>
<th>Technology platform</th>
<th>Gaming elements</th>
<th>Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen et al. (2005)</td>
<td>Randomized controlled trial (RCT)</td>
<td>165 patients with rheumatoid arthritis</td>
<td>Physical activity</td>
<td>Internet-based intervention accessed via a website</td>
<td></td>
<td>Gamification is a form of functional interactivity increases motivation and supports empowerment</td>
</tr>
<tr>
<td>Cloehey et al. (2015)</td>
<td>Development: Participatory design approach</td>
<td>Chronic disease with specific mention of diabetes and hypertension</td>
<td>Communication with healthcare professionals</td>
<td>Serious game delivered via a computer kiosk</td>
<td></td>
<td>Knowledge and empowerment are predictors of behavior change</td>
</tr>
<tr>
<td>Hickman et al. (2016)</td>
<td>Randomized controlled trial (RCT)</td>
<td>186 patients with hypertension</td>
<td>Communication with healthcare professionals</td>
<td>Serious game delivered via a computer kiosk situated in a health care clinic</td>
<td>3D avatar to support behavior health and provide customized real-time feedback</td>
<td></td>
</tr>
<tr>
<td>Hillard et al. (2014)</td>
<td>Development: Mixed methods</td>
<td>36 patients with chronic hip</td>
<td>Treatment adherence</td>
<td>Smartphone app</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riva et al. (2014)</td>
<td>Randomized controlled trial (RCT)</td>
<td>31 patients with chronic back pain</td>
<td>Physical activity</td>
<td>Internet-based intervention accessed via a website</td>
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</table>


Discussion

Chronic conditions, behaviors and technology

- Consistent with the broader self-management literature, a range of chronic conditions, behaviors and technologies were described.

Gaming elements

- Rewards were the most commonly used tactic taking the form of prizes, points, on-screen visuals or badges and medals.
- Other tactics included social comparison via leaderboard boards and competition, 3D avatars to promote behavior rehearsal and provide customized feedback, and the notion of a personal pledge whereby patients commit to a goal.

Behavior theory

- Articles cited a range of concepts or processes to support application design and/or evaluation, including interactivity, experiential learning, self-efficacy, health literacy, education, immersion experience and supports mechanisms of change was lacking.

Article findings

- Articles reporting on development suggest that gamification may not be a suitable approach for all individuals, and that gaming elements be provided as optional or tailored to patient need.
- Articles reporting on effectiveness demonstrated mixed results that warrant further exploration. Significant increases in physical activity, and reductions in medication misuse and healthcare utilization were reported between intervention and control groups.
- The Allam et al. (2015) and Riva et al. (2014) articles suggested behavior change was achieved through increased empowerment.

- Six articles were eligible for inclusion in this review. The limited sample may reflect the strict inclusion criteria applied, and the fact that gamification in health is a relatively new area of research inquiry.
- Health psychology can be leveraged to ensure gamification applications are grounded in behavior theory, and that theory is explicitly linked to the design and evaluation of applications. The use of theory will enable the development of more effective approaches to behavior change but will likely also provide patients with a more coherent gaming experience.
- Given the commonalities with the behavior change literature, future research could support more explicit linking of gaming elements to behavior change techniques (BCTs; Michie et al., 2013). This would support a common nomenclature and make future study comparisons and applications possible. Future research could focus on isolating the gaming elements and BCT combinations that are effective in driving behavior change. Future research could further explore the role of empowerment in behavior change, and could look to assess change over the long term, beyond what could be perceived as short-term novelty effects.