

# Gamification and older adults: Opportunities for gamification to support health promotion initiatives for older adults in the context of COVID-19

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## Summary

The COVID-19 pandemic has increased reliance on digital service delivery, including the delivery of health promotion initiatives. Health promotion interventions need to carefully consider user engagement. Gamification is a strategy used to engage and motivate people, and evidence shows overall cautious positive results in the use of gamification for older people across a range of health areas although more evidence is needed. Gamification has been used as a strategy in COVID-19 related initiatives and there is potential to build on the evidence to further develop gamification initiatives for those living in the Western Pacific region to impact positively on healthy behaviours and health outcomes.

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## Background

The global population of older people is increasing and there is a need to focus on healthy ageing strategies both for older people of the present, and healthy ageing across the life course for older people of the future. The United Nation's World Population Ageing Report recorded 727 million people aged 65 years or over in 2020, with the population of older people expected to double globally in the next 30 years to 1.5 billion in 2050.<sup>1</sup> The Western Pacific Region (WPR) is home to more than 240 million people aged over 65 years and this is the region's fastest growing age group.<sup>2</sup> As the population ages, healthy ageing has become a global and regional priority. In response, the World Health Organization Western Pacific Regional Office has produced a 'Regional Action Plan on Healthy Ageing in the Western Pacific'.<sup>2</sup> The report outlines five objectives to support this vision of healthy ageing, with one of these aiming to 'foster technological and social innovation to promote healthy ageing'.

The COVID-19 pandemic has impacted health and wellbeing around the globe. Alongside morbidity and mortality, COVID-19 has increased social isolation and

loneliness among older people.<sup>3</sup> A review of the effects of COVID-19 found that older adults were reporting greater loneliness, social isolation and worsening psychological symptoms during the pandemic, but experiencing this to a lesser extent than younger people.<sup>3</sup> Recommendations from the literature include using technology to ensure social connection, incorporating daily structure and encouraging outdoor activities.<sup>3</sup>

The focus on technological and social innovation has been especially relevant since the start of the COVID-19 pandemic. The pandemic has changed service delivery models and seen a shift to digital delivery of services, including health promotion interventions. The shift to reliance on digital delivery has increased interest in how to motivate and engage users in health interventions. Gamification and serious games have been used in a range of health promoting contexts to engage and motivate users. Older adults are using technology in their daily lives for a wide variety of tasks and are increasing digital savvy. This viewpoint paper describes the evidence and potential of gamification for health promotion initiatives among older people, including opportunities in the context of COVID-19.

## Gamification

Gamification is the practice of using game-like elements to motivate and encourage people in non-game contexts. Common gamification elements include mechanics such as points, levels, leaderboards, badges,

*Abbreviations:* WPR, Western Pacific Region

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challenges and quests, customisation, and feedback and reinforcement.<sup>4</sup> Serious games is a term used to describe a game designed for purposes other than pure entertainment.<sup>5</sup> The difference between gamified interventions and serious games can be blurry and subjective.<sup>6</sup> As many systematic reviews include both gamified and game-based initiatives, both are described here and gamification is used as a common term. Gamification can be a complex integration of different design elements, all balanced together to create a user experience that aims to motivate and engage users. While gamification initiatives are not all digital in nature, the majority of the literature focusses on those that are, and this is the focus of this paper.

## Digital technology and older adults

Older adults are using digital technology in their everyday lives for a wide variety of tasks and are increasingly digitally savvy.<sup>7</sup> In some countries, early adopters of digital and online technology were primarily younger people, and began their use many years ago, meaning that now older adults are the fastest growing group of Internet users.<sup>8</sup> Internet and technology use varies both globally, and within countries. Data from Australia shows a steep recent rise with 93% of older people having Internet access in their home in 2020, compared with 68% in 2017.<sup>9</sup> The most common device used to access the Internet in Australia is a mobile phone. In China, approximately 50% of those aged 60 years and over use a smartphone to access the Internet,<sup>10</sup> and in late 2020, China's Ministry of Industry and Information Technology announced a special campaign to improve Internet access for this group.<sup>11</sup> In Japan Internet use declines with age, with 82.7% of 60-69 year olds having access, 59.6% of 70-79 year olds and only 25.6% of those aged 80 and over.<sup>12</sup>

Digital inclusion describes factors that impact on digital participation. The Australian Digital Inclusion Alliance measures digital inclusion across three areas of access (network reach and connection), affordability (relative expenditure), and ability (attitudes, skills and activities).<sup>13</sup> In 2021 the Decade of Healthy Ageing initiative was established by the United Nations.<sup>14</sup> The focus for the first year of global collaboration was on digital equity for all ages and the initiative aims to increase awareness on digital inclusion of the ageing population.<sup>14</sup> Digital inclusion can vary within demographic groups (including age) and within countries. Considering the range of factors impacting on digital inclusion it is an important consideration in understanding the potential of any digital initiatives.

## Evidence of gamification for older adults

Most gamification research has been carried out with younger people, with older adults being given limited

attention.<sup>15</sup> Nonetheless, the body of research on gamification is wide and varied. Recent cohorts of older people may have been exposed to digital technologies and gamified solutions throughout their adult lives.<sup>15</sup> Gamification is being used as a technique in initiatives for older people. A review of mobile apps for older adults on the European App store and Google Play identified 83 apps, 30% of which included gamification elements.<sup>16</sup> Older people in the coming decades will be increasingly comfortable and confident with digital solutions.

There is however evidence that older adults may experience lower digital self-efficacy and computer anxiety than younger people and that usability is very important.<sup>15</sup> Learning new skills and systems may take longer for older people. One study found that age does not have a significant impact on the social, hedonic and utilitarian benefits users receive from gamification, however the age range of their sample ended at 59 years.<sup>17</sup> Developing interventions with older people will be a key factor in acceptability.

Overall, a systematic review of gamification initiatives for older people found weak indications of positive effects.<sup>15</sup> Future research on older adults and gamification is needed and should be based on appropriate theoretical frameworks, use large sample sizes and robust empirical methods including randomisation and controls, and use validated tools to evaluate.<sup>15</sup> Evidence related to specific health issues is stronger in some areas than others and a brief review of the evidence is outlined below. In summarising the literature concerning the use of gamification with older people, the focus was on first attempting to source and include reviews, such as systematic reviews, scoping reviews or meta-reviews. Where these were not available, individual high-quality studies, such as randomised control trials, were included.

## Psychological wellbeing

Initiatives that seek to improve mental health may directly target mental wellbeing or may incorporate other mental health moderators such as physical activity. A number of studies have used "exergames" (i.e. exercise games) or gamification to increase physical activity levels or movement, in an effort to improve mental health and wellbeing. A systematic review of the social effects of exergames on older adults found an overall positive effect on social wellbeing including reduction of loneliness, increased social connection and positive attitude towards others.<sup>18</sup> Most of the studies included in the review used the Nintendo Wii platform (8/10), with the remainder using Microsoft Kinect devices (2/10).

Systematic reviews for both exergames, and game-based digital interventions for depression have reported positive effects on depression but concluded that further research and increased research rigor is needed.<sup>19,20</sup>

The call for further research is a common refrain with multiple reviews calling for increased research, and increased study rigor to advance the field. Gamification may impact positively on mental health in a range of ways. The inclusion of gamification can increase the impact of mental health initiatives by increasing reach, by improving engagement and retention, and by utilising behavior change elements.<sup>21</sup> The use of levels or progress feedback, points or scoring, rewards or prizes, narrative or theme, personalisation, and customisation were the most popular features reported in a systematic review of gamified apps for mental health and wellbeing.<sup>22</sup>

### Cognitive capacity

A systematic review and meta-analysis of the effects of gamification on computerised cognitive training found that gamified tasks were more engaging as well as more difficult than non-gamified tasks.<sup>23</sup> The interventions described used between 2-9 elements different gamification elements. The most commonly used game elements were rewards (such as points and badges), feedback loops, stories or themes, and difficulty adjustment (dynamic and or manual). Although results suggested significant positive effects of gamification on motivation, no difference in cognitive outcomes were found. There were no differences reported in either motivation or outcomes when looking by age.

Looking specifically at the use of cognitive games in older adults, a meta-analysis of 16 studies reported overall positive outcomes.<sup>24</sup> Significant improvements were reported in processing speed, working memory, executive function and verbal memory, with the largest observed effect being in processing speed. Another systematic review looked at reasons for the inclusion of gamification in cognitive training and assessment.<sup>25</sup> There were seven broad categories identified from across the 33 included studies: motivating participants; increasing usability; increasing long-term engagement; investigating feasibility of gamified tasks; improving brain simulation; increasing ecological validity; and increasing suitability for the target disorder.

### Physical activity

A systematic review and meta-analysis of gamified physical activity initiatives found a small to medium positive effect.<sup>26</sup> The effect of gamification was better with step counts than it was on moderate-to-vigorous physical activity. There was no difference observed between older and younger age groups, between genders or related to BMI.<sup>26</sup> The longer-term effect was weaker and the authors suggested more longer-term research was needed to demonstrate sustainability.

A systematic review looked at the impact interactive computer games had on physical and cognitive outcomes in older adults.<sup>27</sup> The interventions included interactive dance mats, Wii fit games and virtual reality

gameplay. The review found preliminary evidence that the use of game-based intervention was safe and effective, but findings were limited by the low number of high-quality studies. This review recommended interactive computer games should be tailored to older people and that more rigorous study methodology was needed.

Behaviour change techniques that are effective with physical activity are commonly used in gamified solutions.<sup>28</sup> A UK-based systematic review of behavior change techniques in health promotion mobile apps identified 64 apps, the majority of which were focused on physical activity.<sup>29</sup> The review found that behaviour change techniques such as feedback and monitoring (94%), comparison of behaviour (81%), and rewards and threat (81%) were commonly used.

### Injury prevention and functional capacity

Injury prevention refers to initiatives designed to decrease the incidence of injury. In older people, this would include strength-based interventions designed to reduce the risk of falls. A systematic review and meta-analysis of the use of mixed reality technologies for falls prevention for older adults, many of which used gamification or exergames, found a positive effect on physical functions and potential to reach older people to improve their health.<sup>30</sup> Of the 21 included studies, eight used the Xbox Kinect platform, and five used Nintendo Wii. The authors did however find that more attention needs to be given to usability and acceptability and that end-users should be included in intervention design.<sup>30</sup>

A systematic review of the effect of game-based interventions on the functional capacity of acutely hospitalised older people included four RCTs.<sup>31</sup> All interventions used Nintendo Wii programs and no differences were seen in health outcomes. They concluded that there is limited available evidence, more research is needed, and that gamification strategies should be considered as complementary to usual care. A recent three-armed, non-randomised controlled trial aimed to assess the impact of gamified interventions on functional capacity in older adults in hospital.<sup>32</sup> The study found that guided technology-based gamified intervention improved muscle strength and physical function and reduced functional decline.

### Nutrition

Systematic reviews of the use of gamification for nutrition or healthy eating are more common in initiatives targeting younger people. There were no systematic, scoping or meta reviews found that focused specifically on gamification, nutrition and older adults. A 2019 scoping review looked at nutrition education and dietary behaviour change games more broadly.<sup>33</sup> The review focused on video games, mini-games in a larger multimedia experience, or a game as part of a human-delivered intervention. The authors identified 22 studies, with all but one reporting positive outcomes. However,

of the included studies, all but two targeted children and the majority were from the United States (13/22).

Digital technology may have potential to improve diet in older adults which may improve COVID-19 risk factors and outcomes.<sup>34</sup> While there are positive outcomes reported with the use of games and gamification for healthy eating and nutrition, most of the research is with children and there is a clear need for more research involving older adults, and for adults in general.

### COVID-19 opportunities

The COVID-19 pandemic has had a significant impact on global health and wellbeing.<sup>35</sup> Alongside morbidity and mortality, COVID-19 has increased social isolation, loneliness and psychological symptoms amongst older people as public health and safety measures have called for social distancing.<sup>3</sup> A US study on physical activity showed the potential for mobile apps to buffer the pandemic-related decline in physical activity, with gamification features found to be particularly helpful.<sup>36</sup> Research from Canada shows older adults changed their technology use during the pandemic, using technology more for activities such as shopping, entertainment and staying socially connected.<sup>37</sup> Over half of respondents in another survey aged 65 years and over had adopted new technology since the start of the pandemic and had used technology differently to connect with others.<sup>38</sup> A significant opportunity has been identified to use digital games and gamification to develop social connectedness interventions for older adults during COVID-19.<sup>39</sup> Digital games have become more common in households during the pandemic. As COVID-19 restrictions have decreased the ability to meet face-to-face, these initiatives have a role to play in helping people stay connected through a playful and engaging modality,<sup>39</sup> as well as using technology to ensure social connection, incorporating daily structure and encouraging outdoor activities.<sup>3</sup>

The COVID-19 pandemic may have exacerbated ageist attitudes as decisions about pandemic policies have been made to protect vulnerable older people.<sup>40</sup> This increased ageism has been linked to health worries and anxiety in older people.<sup>41</sup> Negative stereotypes about older people can be detrimental to the health and wellbeing of those people.<sup>42</sup> Confronting ageism can be an important factor in promoting healthy ageing. For many, bias about age is unconscious and people may not recognise that they are biased, or will not see ageism the same as other biases such as racism or sexism.<sup>42</sup> Myth busting, education, increasing awareness of unconscious bias and increased social support are all ways that the impact ageism can be mitigated.

While there is little in the literature with regard to gamified solutions for ageism, there are examples where gamification has been applied to other biases that offer relevant learning. Fair Play is a US digital

game with a focus on reducing subtle racial bias.<sup>43</sup> Users take on the role of a Black male graduate student and navigate the discrimination he experiences in his PhD program. The game aims to increase awareness of racial bias and increase empathy to reduce implicit and unconscious racial bias. Feedback from participants was positive with most stating they could take the character's perspective and understand how he felt in the situations described. More research is needed to understand the impact this has on bias and actions over a longer period of time.<sup>43</sup>

Another challenging aspect of the pandemic has been the infodemic - the spread of misinformation and disinformation, as well as an overwhelming overabundance of information.<sup>44</sup> Often people may overestimate their own ability to identify misinformation online and gamified solutions have sought to increase their awareness of their own limitations and increase skills in identifying and responding to misinformation. Gamification has been a strategy used in addressing this.

The 'Bad News' game is a psychological intervention that aims to increase people's ability to identify and resist misinformation.<sup>45</sup> The game involves users taking on the persona of someone spreading disinformation, challenging them to use all the techniques people may use to spread malicious content, thus exposing them to such tricks and increasing their ability to identify them. Users earn points and badges as they move through the game. After playing the game, people's ability to identify and resist misinformation was shown to have improved.<sup>45</sup> Building on research findings from the 'Bad News' game, 'Go Viral' is an online game that follows similar principles but with a focus specifically on COVID-19.<sup>46</sup> It aims to expose players to the techniques and motivations behind the spread of misinformation with a view to inoculating them against the influence.

### Western Pacific regional context

COVID-19 has highlighted the role digital technology can play in improving health.<sup>47</sup> Gamification has the potential to engage older people in health promotion activities and to impact positively on health outcomes, yet there are wider considerations such as digital inclusion that needs to be taken into account with intervention planning. In the WPR, countries have varying digital capabilities and capacity. Disparities are seen both between countries, and within countries. As COVID-19 has accelerated the use of digital technology, there are inequalities in access, and in some countries, legislation has not kept up. The WPR had the lowest percentage of countries with data protection legislation in regard to electronic health records and personally identifiable information.<sup>47</sup> Digital inclusion and digital equity are key considerations and there is concern that the COVID-19 initiated acceleration of digital products and initiatives has not been implemented equally.<sup>48</sup>

Countries in the WPR are prioritising digital service delivery. In Malaysia, increasing digital inclusion and access is a priority with the government establishing the National Digital Inclusion Council in 2019,<sup>49</sup> and launching the Malaysia Digital Economy Blueprint in 2021 in response to challenges of the COVID-19 pandemic.<sup>50</sup> China has been taking a proactive approach to improving access to digital health care for older people. Their 'Action Plan for the Development of Smart Elderly Care Industry' (2017-2020) aimed to encourage investment by the private sector to support the integration of innovation such as wearables, alert systems and robot butlers.<sup>51</sup> The World Bank published the 'Philippines Digital Economy Report' in 2020<sup>52</sup> to draw attention to the urgent need to improve digital technologies in the Philippines. In Fiji, the government has launched a digital transformation programme called 'digitalFIJI' aiming to build and develop digital capacity in government services.<sup>53</sup>

Some Chinese jurisdictions have implemented gamification approaches in their COVID-19 response. Officials in the province of Shandong have implemented gamification into the existing health code app to encourage vaccine uptake.<sup>54</sup> The existing app shows a green code to show the user hasn't been in contact with anyone who has COVID-19, and the app now adds a badge-like golden border with a small needle and shield icon when people are fully vaccinated.<sup>55</sup> This low-cost initiative makes use of existing technology and infrastructure and has reportedly been well received. Although this is targeting younger people, the learnings may well be transferable.

## Opportunities and challenges

As health services and initiatives are increasingly being delivered digitally, looking for ways to encourage older adults to try digital interventions, and to keep using them, is an important consideration in promoting health. There are both opportunities and challenges in this space and the use of gamification as a motivator may help to reach and engage older adults in health promotion interventions. Evidence about the impact of gamification on health outcomes with older adults is encouraging, but more research is needed to better understand the mechanisms and potential.

Digital inclusion factors such as digital access, digital ability and affordability, can be a challenge to gamification implementation, both on an individual level, and a national level. While many countries in the WPR are prioritising digital development and strategies, countries are at different stages of implementation and sophistication of both infrastructure and skills. In addition, there are differences in digital inclusion factors within countries, and within population groups. Examples provided in this paper include interventions delivered in a range of settings such as in the community, home and hospital. More research is needed into how

gamification solutions for older adults function in different settings.

The COVID-19 pandemic has accelerated digital adoption and digital service delivery around the world. Older people have adopted new technological behaviours during COVID-19,<sup>38</sup> creating new opportunities for health promotion initiatives to be tailored to older people. Reports on the impact of the pandemic are mixed. The digital divide between older and younger people in China has reduced during the pandemic with the number of people aged 60 years and over using the internet doubling in the first year of the pandemic, creating an opportunity to impact positively on health.<sup>56</sup> Another paper noted that the rapid escalation of digital adoption, including technologies connected to mobility such as the Health Code app, have led to a widening of the digital divide in China.<sup>57</sup> The pandemic has provided an opportunity for older Malaysians to embrace using digital technology to shop, participate in healthy active activities or stay in touch with friends.<sup>58</sup> Others have reportedly found the switch difficult which has highlighted the need for user-centred design practices.<sup>59</sup>

Although countries are increasingly looking to address the digital divide, these issues can remain a barrier and designing solutions with end-users will be an important part of acceptance and sustainability. While there are many examples of changes in technology use for older adults during the pandemic which have brought new opportunities to improve the health of older adults,<sup>56</sup> ongoing efforts to address the digital divide and digital inclusion factors are needed.

User-centered design (UCD) is a framework process of involving end-users and stakeholders throughout the process of developing, implementing and evaluating a system.<sup>60</sup> UCD can benefit a project as the continuing input and consultation can shape an intervention as it progresses, with iterations happening as required. UCD methods include usability testing, participatory design, and evaluation and this iterative process has been used in the development of gamification initiatives for older adults in a number of initiatives.<sup>32,61-63</sup> There are opportunities to adapt common UCD methods to the older population, such as simplifying measures like the system usability scale, incorporating more breaks and offering support for vision and motor impairment.<sup>62</sup>

Recommendations for developing digital gamification solutions for older people include creating adaptable games that account for potential impairments or reduced abilities, providing clear instructions, tutorials and onboarding and focus on usability – creating systems that are easy to understand, easy to set up and easy to engage with are key considerations.<sup>64</sup>

## Conclusion

There is a need for more research on digital health promotion interventions for older adults in the Western

Pacific, including the impact of gamification. Overall the literature shows cautiously positive results in the use of gamification for older people across a range of health areas, yet the evidence needs more structured measures, standardised reporting and focus on interventions specifically targeting older people. Studies from the United States and Europe are over-represented and there is a need for more research in other areas, including the WPR.

As the pandemic enters its third year, engaging people in digital health promotion initiatives has never been more vital. We need to understand how to engage and motivate people in the absence of face-to-face service delivery. Gamification offers an opportunity to strengthen intervention design and reach older populations with health initiatives. While there are challenges with digital inclusion, regional efforts to strengthen capacity and skills will increase the opportunity for these tools to be used effectively by more and more people.

#### Contributors

B.W. conducted the literature review and wrote the initial draft. A.M. and J.W. provided input on evidence, critically reviewed and edited the draft manuscripts. All authors reviewed the paper and provided final approval.

#### Declaration of interests

All authors have completed the ICMJE disclosure form at [www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf). The authors are employees of Reach Health Promotion Innovations that provides public health digital development and consultancy services. This work was funded by the WHO Western Pacific Regional Office and does not include reference to any products, services or competitors of Reach HPI.

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