# Older adults' perceived benefits of digital gameplay: Associations with demographics and game use patterns

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*D. Kaufman, T. Gayowsky, L. Sauvé, L. Renaud, E. Duplàa. Older adults' perceived benefits of digital gameplay: Associations with demographics and game use patterns. Gerontechonology 2018;17(1):56-67;* https://doi.org/10.4017/gt.2018.17.1.006.00 **Introduction** Rapid growth in the older adult population is expanding the need for resources to mitigate the effects of aging. Leisure activities such as digital games have been shown to help with aspects of social and cognitive wellbeing in older adults. **Purpose** To identify associations of demographic characteristics and game use patterns with the socioemotional and cognitive benefits of digital gameplay perceived by older adults. **Method** A survey was administered to 590 adults aged over 55 years, asking about their demographic backgrounds, game use patterns, and perceived gameplay benefits. Descriptive statistics and nonparametric comparison of means were used to identify demographic characteristics and game use patterns associated with players' perceptions of socioemotional and cognitive benefits from playing digital games. **Results** Perceived socioemotional benefits of digital games were greater for males, not living in a couple, living in an assisted living facility, and having a lower education level. Perceived socioemotional benefits were greater for five of the game use pattern variables: playing more than six hours per week, playing RPGs, playing social games online, meeting new people while playing social games online, and playing with others. Perceived cognitive benefits were associated with having a higher gameplay skill level, playing social games online, meeting new people playing online, and playing with others. **Conclusion** These findings provide two insights. The first is that variables associated with older adults' perceptions of digital gameplay benefits are not homogenous and are rather complex. The second insight is that older adults do find digital games to be a source of socioemotional and cognitive benefits. This study provides a more nuanced understanding of the variables that may be influential in older adults' perceptions of benefits from digital gameplay.

**Keywords: digital games, benefits, older adults, seniors, game use patterns**

## INTRODUCTION

Older adults are the world's fastest growing population segment, with the number of those over 60 years old expected to grow to more than two billion by 2050[1]. Maintaining social support and cognitive stimulation have consistently been identified by older adults as important concerns as they age[2-6]. In addition, research has found social connectedness and cognitive functioning to be associated with one another, although a clear directional influence has not been established[7,8]. Because of the interrelated nature of social and cognitive functioning, solutions to support and enrich older adults' lives may be more successful if they address both of these dimensions of healthy aging.

Older adults have reported that using the Internet has a positive impact on their feelings of social connectedness and self-esteem[9,10], and their engagement with new technology extends beyond the Internet. More than one third of older adults are digital game players; in 2014, 34% of Canadian adults aged 55+ years had

played a video game in the past four weeks[11]. As those who grew up with digital games grow older, this number appears to be stable or increasing; US statistics show that in 2007, 24% of gamers were aged 50 years or older[12], increasing to 26% in 2016[13]. With the popularity of digital games among older adults, it is useful to investigate how this form of leisure activity may be benefiting the older generation.

A growing body of research is investigating the contributions of older adults' digital gameplay to their daily lives. In one approach, researchers have begun asking older adults about the benefits that they perceive from playing digital games. Older adults have reported cognitive benefits such as improved memory and feeling sharper[14], along with social and emotional benefits such as feeling connected[15,16] and increased self-esteem[17,18].

Identifying factors that are associated with older adults' perceived benefits of digital gameplay could help in the development of successful interventions in different situations. A few studies have begun to explore demographic and game use characteristics of the older adults who report benefits. Whitbourne et al. noted that older players were more likely to report being challenged as a reason for playing casual video games and that gameplay helped them to see patterns and perform timed tasks more quickly[14]. In their study, a higher percentage of older adults were "heavy" players, compared to younger age groups, and older adults were more likely to play to beat friends and teammates and to enjoy game graphics and effects. (Note, however, that other studies have found that older adults do not enjoy Internet-mediated co-play[19] and that competition becomes less important as players' ages increase[20]). Allaire et al. reported that scores on a number of domains of successful aging were significantly higher for older adults who reported playing digital games than for those who did not play[15]. Delwiche & Henderson found that older game players were more likely than younger players to be motivated by perceptions that self-growth and learning could come from digital games[16]. However, these studies generally compared older to younger players and did not study differences in demographics or game use patterns within their "older adult" age groups.

To address this gap, the current study investigated associations of demographic characteristics and game use patterns with the socioemotional and cognitive benefits of digital gameplay perceived by older adults. We defined "game use patterns" to include where, when, how often, and with whom games are played, as well as whether players played social games or met new people while playing. We also examined their self-rated skill level as digital game players. Patterns of game use have been found to be associated with gameplay benefits; in particular, some studies have found greater perceived or measured benefits accruing to regular players or experienced "gamers" compared to those who play less frequently[15,21,22].

## BACKGROUND

### Demographic characteristics and game use patterns

Although most demographic research about digital gameplay centers on younger players, some recent surveys have included older players and their game use patterns. A recent Pew Research Center study found that 25% of Americans aged 65 years or older played digital games, although only 4% of those over 50 years old described themselves as "gamers"[23]. In contrast, 77% of men aged 18-29 years were game players, with 33% identifying as gamers, while corresponding figures for women were 57% and 9% respectively. An online survey by AARP found that nearly 40% of adults aged 50+ years (38% of women and 35% of men) were gamers (defined as owning a game device and playing at least once per month), pointing to higher game use frequencies among younger "older adults"[21]. This survey also reported that older gamers tended to have less education, with 35% of gamers among high-school educated participants but only 26% of gamers among those with a bachelor's degree. In a study related to this project, Duplàa, Kaufman, Sauvé, and Renaud noted that language, education, and life situation are factors associated with digital game use[24]. Respondents in that survey tended to play more if they were Anglophones, educated, or did not live alone.

### Perceived socioemotional benefits of digital game use

Although social isolation (lack of social relationships) and loneliness (a feeling that one's social relationships are insufficient) can be issues at any age[25], older adults are often at increased risk of both, due to causes such as smaller social networks, mobility difficulties, and the death of spouses. Both social isolation and loneliness are associated with increased health and mortality risk[26-28]. Digital games can support and encourage social interaction. Socializing is an important reason that older adults play digital games[29,30], and older adults have reported that playing games socially has led them to make new friends and strengthen connections with current friends and family[31-33].

Allaire et al. compared older adult gamers and non-gamers on measures of wellbeing, negative affect, and loneliness[15]. They found that older

adults who played digital games occasionally (once a month) and regularly (once a week or more) had higher scores on wellbeing and lower scores for negative affect than their non-gamer counterparts. In addition, regular gamers reported lower levels of depression than non-gamers.

De Schutter and Malliet found that older adults identified a number of social and emotional benefits as reasons for playing digital games[34]. Their respondents thought that digital games helped them to fulfill affective needs, for example by allowing them to experience emotions like excitement, suspense, or nostalgia. These older adults also reported that digital games allowed them to feel a sense of connectedness, particularly within family relationships. In a study by De Schutter and Brown, older adults valued their digital gameplay because it distracted them from feelings of loneliness and helped them to connect with younger generations[35].

Based on observation and interviews, McLaughlin et al. reported that playing digital games together led older adults to experience social and emotional benefits including social interaction, increased self-esteem, positive emotions, and wellbeing[18]. Nap, de Kort, and IJsselsteijn used focus groups and contextual inquiries with ten older adult gamers to investigate their game use habits and opinions on digital games[36]. Their participants experienced social and emotional benefits from playing digital games that included opportunities to engage in social connections online and to relieve stress. They had mixed opinions about playing digital games with others; some preferred to engage in games alone, while others reported using them as a source of entertainment with their significant other or family members. However, preferences for playing digital games alone did not take away from other positive benefits they felt they received from playing digital games.

**Perceived cognitive benefits of digital game use**

As with social and emotional capacities, some older adults experience changes in cognitive abilities such as pattern recognition, memory, reasoning, verbal ability, and processing speed[37]. These can lead to difficulties in managing and enjoying daily life. While the evidence in not conclusive, clinical studies have reported improvements in specific cognitive abilities after digital game use interventions[38,39].

Older adults have identified a number of general and specific cognitive benefits from playing digital games. For example, in a sample of older adults who played the digital game Bejeweled, 43% reported that the game made them feel "sharper," 10.5% indicated that it improved their memory, 18.6% thought that it improved their visuospatial skills, and 23.4% felt that it improved their reaction time[14]. Other studies have found that older adults identified cognitive needs as reasons for playing digital games, including basic cognitive exercise (e.g., improving memory while playing a puzzle game) and being able to imagine complex situations (e.g., developing a business plan while playing a simulation game)[34,35].

Older adults' perceptions of digital gameplay benefits may influence how likely they are to invest time in playing a game[18,40]. If older adults do not see value in investing time in digital gameplay, they may be less likely to do so in their daily routines.

## METHODS

### Research questions

This paper reports on two primary research questions:

1. What are the associations between older adults' demographic characteristics and their perceived benefits of playing digital games?
2. What are the associations between older adults' game use patterns and their perceived benefits of playing digital games?

### Research instrument

A questionnaire was developed and refined using an iterative process. The questions were developed from existing surveys found on the Internet, research standards, and team discussions; *Table 1* summarizes the sources used to develop the survey.

A set of questions was first created by the study investigators to address the study objectives. Each draft of the survey was sent to members of the research team that included gerontologists, educators, and computer scientists, as well as four graduate students in Education. Feedback received on each draft was integrated into a re-

*Table 1. Questionnaire development sources*

| Variable category | References |
|---|---|
| Game use patterns | Lenhart, Jones, and MacGill[41] |
| Playing with others | McLaughlin et al.[18] |
| Social/psychological benefits | De Schutter; Gamberini et al.; Jung, Li, Janissa, Gladys, and Lee; Khoo, Cheok, Nguyen, and Pan; Wollersheim et al.[29,42,43,44,45] |
| Cognitive benefits | Buiza et al.; Gamberini et al., Wollersheim et al.[42,45,46,47] |
| Educational/skills benefits | Gamberini et al., Wollersheim et al.[45,47] |

vised version of the survey that was sent out for additional feedback. This process continued for six iterations until no further changes were suggested. The final version was then reviewed by approximately 10 older adults and finalized.

The questionnaire was print-based and the majority of questions were close-ended "multiple choice" or "select all that apply," with a few partially open-ended questions. The final version of the survey consisted of 36 questions, including 26 content questions about respondents' main leisure activities and digital and non-digital game playing patterns. For non-digital gamers, this included questions about games played, frequency, people with whom the respondents played, reasons for playing, and perceived benefits. For digital games, this included questions about games played, frequency of playing, digital game skill level, computer skill level, devices used for playing digital games, people with whom the respondents played, perceived benefits, difficulties playing games, and perceived outcomes of digital game playing. Eight demographic questions collected information about respondents' age, sex, primary language, ethnicity, education, place of residence (i.e., private dwelling, assisted living, nursing home), living arrangement (i.e., alone, in a couple, with family, with others,...) employment, and retirement status.

The final questionnaire was written in both English and French to allow for delivery to both English-speaking and French-speaking Canadians.

**Procedures**

The survey was given to older adults in Greater Vancouver, Quebec City, and Montreal. Participants were recruited from older adults' independent and assisted living centres, local community centres, seniors' centres, and shopping centres. Permission to publically solicit participants was obtained from these organizations' management by email. As compensation for their participation, each respondent was given a $5 gift card.

**Data analysis**

The data were collected and coded into separate data sets for the English-language and French questionnaires. Both data sets were coded into an SPSS format, and IBM SPSS Statistics v.21 was used to carry out all the statistical work. Descriptive statistics were run on the demographics between the groups to ensure that the two samples were homogeneous. Once it was determined that the samples collected were similar in demographic characteristics, the data sets were combined. This involved cross-referencing coding schemes between the individual files and ensuring that there were no errors. Only respondents who indicated that they had played digital games in the past year (n=590) were included in subsequent data analyses.

The final data set contained over 150 variables. All variables associated with the first seven questions on the questionnaire were eliminated because these questions addressed older adults' general leisure activities and non-digital gameplay, which are outside of the scope of the present research and are reported elsewhere[48,49]. Frequencies were run on all of the remaining variables for questions 8-36. This allowed for the identification of data errors, variables irrelevant to the research questions, unequal group sizes, and the need for new variables to be created. Some questions were eliminated from the analyses because of a very low response rate or lack of relevance to the research questions.

Variables that contained response categories with highly unequal group sizes were recoded to contain fewer categories than originally stated on the questionnaire. In addition, three new variables were created: two were the total measures of digital games' cognitive and socioemotional perceived benefits, while the third variable aggregated the data from question 11 (during the past month, how many days per week on average have you played digital games?) and question 12 (during the past month, when you played digital games, how many hours per day on average did you play?) to create a variable measuring the average hours per week spent playing digital games.

Once the final set of variables was established, cross-tabulations and nonparametric comparison of means were conducted to answer the research questions. Chi-squared, Mann-Whitney, and Kruskal-Wallace tests were calculated for statistical significance. The criterion for significance was set at p=.05.

Most of the independent variables were demographic characteristics. The questionnaire asked about the participant's age, first language, country of birth, city of residence, ethnicity, living situation, educational level, retirement status, and current working/volunteering status.

**Development of dependent variables**

Data on perceived gameplay benefits of playing digital games were collected for socioemotional and cognitive categories. For these, questions asked "In your opinion, has playing digital games increased or decreased the following:" followed by a list of items to which respondents could indicate Increased, No Difference, or Decreased. Only a few respondents selected Decreased in any of the categories. All of the measures were recoded into Increased and No Difference/Decreased, giving

*Table 2. Frequencies of recoded responses for perceived socioemotional benefits of playing digital games*

| | Increased (%) | Decreased/ no change (%) | Total |
|---|---|---|---|
| Developing new friendships | 128 (23%) | 417 (77%) | 545 |
| Connecting with current friends | 134 (25%) | 394 (75%) | 528 |
| Connecting with family | 163 (31%) | 366 (69%) | 529 |
| Connecting with various age groups | 129 (25%) | 387 (75%) | 516 |
| Developing self-confidence | 237 (44%) | 301 (56%) | 538 |
| Dealing with loneliness | 150 (29%) | 376 (71%) | 526 |
| Dealing with depression | 107 (21%) | 402 (79%) | 509 |

binary measures for each response. Responses were coded as either a 1 or 0 in each of the categories: 1 for Increase and 0 for Decrease or No Change. The sum of the scores in each benefit category provided ratio measures (e.g., those who reported an increase on two of the socioemotional measures could be viewed as having reported half the number of benefits as someone who reported an increase on four of these measures). These two variables were used as the dependent measures of (1) perceived socioemotional benefits from playing digital games, and (2) perceived cognitive benefits from playing digital games.

*Socioemotional dependent variables*

*Table 2* shows the frequency of responses for each of the items in the perceived socioemotional benefits category. The sum of these seven scores was used as an aggregate measure of perceived socioemotional benefits.

*Cognitive dependent variables*

*Table 3* shows the frequency of responses for each of the items in the perceived cognitive benefits category. The sum of these five scores was used as an aggregate measure of perceived cognitive benefits.

## RESULTS

### Respondents

A total of 1,211 adults aged 55 years or older completed the survey. Only those who indicated that they had played digital games in the past year were included in the analyses (n=590). This included 218 males (36.9%), 363 females (61.5%), and nine respondents (1.5%) who chose not to disclose their sex. Ages ranged from 55 to 75+ years, with 234 (39.7%) between the ages of 55 and 64 years, 223 (37.8%) aged 65–74 years, and 112 (19%) aged 75 years and older. Twenty-one respondents (3.6%) chose not to disclose their age. In terms of language, 397 respondents (67.9%) had English as their first language, 123 (21%) had French, and 65 (11.1%) had another language as their first language.

**Research Question 1: What is the association between older adults' demographic characteristics and their perceived benefits of playing digital games?**

The perceived socioemotional benefits score had a range of 0-7 with a mean of 1.86 (n=483, SD=2.05). The perceived cognitive benefits score had a range of 0-5 with a mean of 3.16 (n=515, SD=1.80). A Pearson product-moment correlation coefficient was computed to assess the correlation between perceived socioemotional benefits and perceived cognitive benefits. There was a moderate and significant correlation between the two variables (r=0.41, n=483, p<.000).

*Associations between demographics and perceived socioemotional benefits of playing digital games.*

Nonparametric independent tests of means were conducted using either a Kruskal-Wallis or Mann-Whitney U test. *Table 4* shows the significant associations found between demographic characteristics of the older adult respondents and perceived socioemotional benefits of playing digital games.

An independent samples Mann-Whitney U test was conducted to compare the association of sex with the perceived socioemotional benefits of digital gameplay. There was a significant difference (U=30.43, p=.006) between males (M=2.23, SD=2.21) and females (M=1.67, SD=1.92), with males reporting a higher number of benefits than females.

An independent samples Kruskal-Wallis test was conducted to compare the association of

*Table 3. Frequencies of recoded responses for perceived cognitive benefits of playing digital games*

| | Increased (%) | Decreased/no change (%) | Total |
|---|---|---|---|
| Focusing attention | 397 (71%) | 165 (29%) | 562 |
| Memory | 389 (69%) | 175 (31%) | 564 |
| Reasoning | 313 (58%) | 230 (42%) | 543 |
| Problem solving | 320 (58%) | 229 (42%) | 549 |
| Speed in reacting/responding | 352 (64%) | 198 (36%) | 550 |

*Table 4. Significant associations between demographic variables and perceived benefits from playing digital games*

| | | Descriptive statistics | | Test statistics | |
|---|---|---|---|---|---|
| **Demographic characteristic** | **Category** | **M (n)** | **SD** | **Test statistic** | **p** |
| **Socioemotional benefits** | | | | | |
| Sex | Female | 1.67 (307) | 1.92 | U=30,426.50 | .006 |
| | Male | 2.23 (173) | 2.21 | | |
| Living arrangement | Alone | 1.96 (178) | 1.91 | H=21.29 | <.000 |
| | In a couple | 1.41 (180) | 1.89 | | |
| | With family/others | 2.45 (119) | 2.33 | | |
| Living situation | Home | 1.76 (398) | 2.04 | U=18,338.50 | .001 |
| | Assisted living/other | 2.48 (75) | 2.06 | | |
| Education | High school or less | 2.26 (133) | 2.21 | H=6.86 | .032 |
| | Post-secondary | 1.73 (251) | 1.96 | | |
| | Post-graduate+ | 1.69 (91) | 2.04 | | |
| **Cognitive benefits** | | | | | |
| Sex | Female | 3.03 (307) | 1.67 | U=33,543.00 | .034 |
| | Male | 3.42 (173) | 1.86 | | |

living arrangement with perceived socioemotional benefits of playing digital games. There was a significant association at the p<.05 level for the three groups (H(2, 475)=21.29, p<.000). Pairwise comparisons indicated that the mean socioemotional benefit score for respondents living alone (M=1.96, SD=1.91) was significantly higher than for respondents living in a couple (M=1.41, SD=1.89). A significant difference was also found between respondents living with family/others (M=2.45, SD=2.33) and those living in a couple (M=1.41, SD=1.89). There was no significant difference between those living alone and those living with family/others. Those living with family/others reported the highest level of socioemotional benefits, followed by those living alone and those living in a couple.

An independent samples Mann-Whitney U test was conducted to compare the association of living situation with the perceived socioemotional benefit of playing digital games. Respondents who indicated that they lived at home (M=1.76, SD=2.04) reported significantly fewer socioemotional benefits than those who lived in assisted living/other arrangements (M=2.48, SD=2.06), (U=18,338.50, p=.001).

An independent samples Kruskal-Wallis test was conducted to compare the association of education with perceived socioemotional benefits of playing digital games. There was a significant association at the p<.05 level for the three groups (H(2, 473)=6.86, p=.032). Pairwise comparisons did not reveal any significant differences among the three education groups postgraduate and postsecondary (p=1.0), post graduate and high school (p=.078), and post-secondary and high school (p=.06). However, the global test of independence suggested that education was associated with perceived socioemotional benefits of playing digital games, with socioemotional benefits decreasing as the level of education increased (p=.034).

Demographic characteristics that were not found to be significantly associated with the perceived socioemotional benefits of digital games were age, retirement status, and current working/volunteering status.

*Associations between demographics and perceived cognitive benefits of playing digital games*

Sex was the only demographic characteristic found to be significantly associated with perceived cognitive benefits of playing digital games. An independent samples Mann-Whitney U test was conducted to compare the association of sex with perceived cognitive benefits of playing digital games. Males (M=3.42, SD=1.86) reported perceiving more cognitive benefits than did females from digital gameplay (M=3.03, SD=1.67); U=33,543.00, p=.034 (*Table 4*).

Demographic characteristics that were not found to be significantly associated with the perceived cognitive benefits of digital games were age, living arrangement, living situation, education, retirement status, and current working/volunteering status.

*Summary of findings for Research Question 1*

Four significant associations were found between demographic characteristics and perceived socioemotional benefits of playing digital games. Males reported significantly more socioemotional benefits compared to females, those who lived alone or with family or others reported significantly more compared to those who lived in a couple, those who lived in assisted living or another situation reported significantly more compared to those who lived at home, and those with a lower education level reported significantly more than those with a higher education level. For cognitive benefits, the only significant

association was that males reported significantly more benefits than did females.

**Research Question 2: What is the association between older adults' game use patterns and their perceived benefits of playing digital games?**

*Associations between game use patterns and perceived socioemotional benefits of playing digital games*

Nonparametric independent tests of means were conducted using a Kruskal-Wallis or Mann-Whitney U test to identify associations between participants' game use patterns and perceived socioemotional benefits of digital gameplay. *Table 5* shows significant associations found in these comparisons.

An independent-samples Kruskal-Wallis test was conducted to compare the association of time spent playing digital games (hours per week) with perceived socio-emotional benefits of playing digital games. There was a significant association at the p<.05 level for the three groups (H(2, 476)=8.64, p=.013). Pairwise comparisons indicated that the mean socioemotional benefit score for respondents who play between two and six hours per week (M=1.62, SD=1.85) was significantly lower than respondents who play more than six hours per week (M=2.27, SD=2.18). Respondents who play digital games less than two hours per week (M=1.75, SD=2.08) had significantly lower perceived socioemotional benefits scores than those who play more than six hours per week. There was no significant difference between those who play less than two hours per week and those who play between two and six hours per week.

Independent samples Mann-Whitney U tests showed significant associations with perceived socioemotional benefits of digital gameplay for playing role-playing games (RPGs) (U(1, 540)=9,461.50, p=<.000), playing social games online (U(1, 478)=26,575.50, p<.000), meeting new people while playing social games online (U(1, 470)=18,581.50, p<.000), and playing alone or with others (U(1, 482)=34,032.00, p=<.000). Respondents who reported playing RPGs (M=3.73, SD=2.20) and social games online (M=2.54, SD=2.18), and those who meet people online while playing social games (M=3.45, SD=2.25), reported significantly higher mean scores of perceived socioemotional benefits from digital gameplay than their counterparts who do not play RPGs (M=1.76, SD=2.01), do not play online social games (M=1.65, SD=1.92), or have not met new people online while playing digital games (M=1.65, SD=1.92). Those who play alone (M=1.51, SD=1.97) reported significantly fewer socioemotional benefits of digital gameplay than those who play with others (M=2.33, SD=2.08).

Game use patterns that were not significantly associated with perceived socioemotional benefits of digital gameplay were self-reported skill in playing digital games and self-reported skill using computer technology and the Internet.

*Associations between game use patterns and perceived cognitive benefits of playing digital games*

Non-parametric independent tests of means were conducted using a Kruskal-Wallis or Mann-Whitney U test to test the associations between participants' game use patterns and perceived cognitive benefits of digital gameplay. *Table 5* shows the significant associations for these comparisons.

An independent-samples Kruskal-Wallis test was conducted to compare the association of time spent playing digital games (hours per week) with perceived cognitive benefits of digital gameplay. There was a significant association at the p<.05 level for the three groups (H(2, 507) = 7.47, p=.024). Pairwise comparisons indicated that the mean perceived cognitive benefit score for respondents who play less than two hours

*Table 5. Significant associations between game use patterns and perceived socioemotional and cognitive benefits of playing digital games*

| | | Perceived socioemotional benefits | | | Perceived cognitive benefits | | |
|---|---|---|---|---|---|---|---|
| **Game use pattern** | **Category** | **M (n)** | **SD** | **p** | **M (n)** | **SD** | **p** |
| Time playing digital games | Less than 2 hours/week | 1.75 (176) | 2.08 | .013 | 2.94 (188) | 1.79 | .024 |
| | 2–6 hours/week | 1.62 (159) | 1.85 | | 3.23 (169) | 1.83 | |
| | More than 6 hours/week | 2.27 (141) | 2.18 | | 3.43 (150) | 1.73 | |
| Play RPGs | Yes | 3.73 (30) | 2.20 | <.000 | 2.75 (196) | 1.81 | <.000 |
| | No | 1.76 (421) | 2.01 | | 3.46 (312) | 1.73 | |
| Play social games online | Yes | 2.54 (117) | 2.18 | <.000 | 3.59 (130) | 1.67 | .001 |
| | No | 1.65 (361) | 1.96 | | 3.02 (378) | 1.83 | |
| Met new people while playing games online | Yes | 3.45 (62) | 2.25 | <.000 | 3.71 (70) | 1.68 | .003 |
| | No | 1.65 (408) | 1.92 | | 3.11 (430) | 1.79 | |
| Play alone or with others | Alone | 1.57 (298) | 1.97 | <.000 | 3.05 (318) | 1.81 | .040 |
| | With others | 2.33 (184) | 2.08 | | 3.36 (195) | 1.76 | |

per week (M=2.94, SD=1.79) was significantly lower than for respondents who play more than six hours per week (M=3.43, SD=1.73). There were no significant differences between respondents who play digital games between two and six hours per week (M=3.23, SD=1.83) and those who play less than two hours per week or those who play more than six hours per week.

Independent samples Mann-Whitney U tests showed significant associations of perceived cognitive benefits with self-reported digital gameplaying skill (U(1, 508)=37,711.50), playing social games online (U(1, 508)=29,192.50, p=.001), meeting new people while playing social games online (U(1, 500)=18,277.00, p=.003), and playing alone or with others (U(1, 513)=34,252.50, p=.040). Older adults who rated themselves as intermediate-to-advanced in their digital gameplaying skill (M=3.46, SD=1.73) reported significantly higher scores of perceived cognitive benefits from playing digital games than did those who rated themselves as beginners (M=2.75, SD=1.81).

Respondents who indicated that they played social games online (M=3.59, SD=1.67), met new people online while playing social games (M=3.71, SD=1.68), and played digital games with others (M=3.36, SD=1.76) reported significantly higher mean scores of perceived cognitive benefits from digital gameplay than did their non-engaged counterparts.

*Summary of findings for Research Question 2*
Five significant associations were found between game use patterns and perceived socioemotional benefits of playing digital games. Five significant associations were also found between game use patterns and perceived cognitive benefits. Three game use patterns showed significant associations with both socioemotional and cognitive benefits: significantly more of both of these were reported by those who played social games online, met new people while playing online, and played with other rather than playing alone. Significantly more socioemotional benefits were reported by those who played more than six hours per week and played RPGs, while significantly more cognitive benefits were reported by respondents with self-reported intermediate skills compared to those who reported themselves as beginners.

## DISCUSSION

Older adults' motivations for engaging in digital games revolve largely around the improvement of their social and emotional wellbeing and cognitive functioning. The current study aimed to gain a better understanding of the demographic factors and game use patterns associated with perceived benefits of digital gameplay by older adults living in Canada.

There were a number of both demographic and game use patterns associated with perceived socioemotional and cognitive benefits of digital gameplay for older adults in this study. More time playing digital games was associated with greater perceived socioemotional and cognitive benefits. Results showed that older adults who played digital games for more than six hours per week perceived significantly more socioemotional and cognitive benefits from their digital gameplay than those who played for fewer than six hours per week. These findings suggest that there may be a minimum threshold for time spent in order for older adults to perceive the benefits from playing digital games. On the other hand, it is possible that the benefits people perceive, e.g., developing improved reasoning, might lead people to play more.

Age was not found to be significantly associated with perceived socioemotional benefits or cognitive benefits from digital gameplay. This contradicts the findings of Whitbourne et al. that adults between the ages of 50 and 59 years differed in perceptions of cognitive benefits of playing the digital game Bejeweled[14]. This may be due to the much wider age distribution in our study. We could find no other studies that explicitly discussed the differences between older adults' perceptions of digital games within the overall age group.

**Perceived socioemotional benefits of playing digital games**

Respondents who perceived the most socioemotional benefits from playing digital games were male; lived alone, in a family, or at home; and had less than a high school education. Game use patterns associated with the highest number of perceived socioemotional benefits were playing more than six hours per week, playing role-playing games or online social games, meeting new people while playing games online, and playing with others.

With respect to previous research in this area, education is a complex factor. Our results are consistent with those of Anderson and of De Schutter and Vanden Abeele, showing that more education is associated with less time spent playing, while less time spent playing is associated with fewer benefits[21,30]. We can hypothesize that older adults with more education are likely to have better access to digital games but that they perceive fewer socioemotional benefits and prefer other activities.

With respect to players' social situations, our results suggest that playing digital games may particularly help older adults who live in seniors' facilities, since participants who lived in assisted living or nursing homes perceived more socioemotional benefits from playing digital games than did those who lived at home. Older adults

who live in assisted living or nursing homes have been found to be at greater risk for feelings of depression and loneliness, and this study suggests that digital games may provide an opportunity to help mitigate their increased risk for social isolation, since games are portable and accessible[50]. Digital game-based interventions have been shown to successfully increase older adults' social interactions in nursing homes and assisted living facilities[31,32,51,52]. The current study confirms these findings from the perspective of naturally occurring gameplay, compared to an intentional intervention.

Although socioemotional benefits were positively associated with the social game use patterns noted above, fewer than half of our respondents reported engaging in these types of games. Only 30 respondents reported playing RPGs at all, although 154 respondents reported playing social games (e.g., games on Facebook, Bridge online). This might be because RPGs and their required gameplay methods are more complex. Previous literature has identified as deterrents to adoption both lack of support for older adults in learning new technology and inability to access resources to help them learn a new tool[16,36]. Older adults might not be gaining as much as they could from digital games because they are limited to interacting with games that are simplistic or adaptions of what they already know, for example playing traditional card games in a digital setting.

It is promising to see that older adults who play social games online do perceive social benefits from engaging with the games. Those who might be limited in their social interactions due to disabilities that prevent them from being mobile, or who might not have access to in-person social activities, can potentially increase their social wellbeing through online interactions with others. Digital games provide an activity for multiple people to collaborate in a fun environment to solve puzzles, learn new strategies, and become more comfortable using technology in general.

### Perceived cognitive benefits of playing digital games

Respondents who perceived the greatest cognitive benefits from digital gameplay were male. Game use patterns with the highest number of perceived cognitive benefits were playing digital games more than six hours per week, rating oneself as an intermediate or advanced digital game player, playing online social games, meeting new people while playing games online, and playing with others.

Respondents reported a greater number of cognitive benefits than socioemotional benefits from digital gameplay, perceiving an average of 3.16 cognitive benefits out of a possible total of seven (45.1%) from playing digital games, compared to an average of 1.86 socioemotional benefits out of a possible total of five (37.2%). This difference may be explained by the types of games that these older adults reported playing. Fewer than one third of participants reported that they engaged in any social gameplay activities (playing RPG online with others, playing social games online, meeting new people while playing digital games online, and playing with others). Cognitive benefits may have been more strongly perceived by the entire population because there are cognitive training aspects to all types of digital games, whether or not individuals are engaging in the game socially. However, social and emotional wellbeing have been found to be correlated with cognitive functioning, and this pattern was seen here in results showing that older adults who engaged in the social gameplay also perceived significantly more cognitive benefits than did nonsocial gamers.

As previously discussed, social wellbeing and cognitive function in old age are found to be closely associated with one another. Research has not been able to identify a causal relationship between these two areas, probably in part due to the broad definition of both of these constructs[52-54]. In this study, increases in perceived socioemotional benefits and perceived cognitive benefits were found to be significantly associated with one another, which is consistent with findings from previously mentioned research about older adults' social wellbeing and cognitive benefits.

## LIMITATIONS OF THE STUDY

There were limitations to this study in both design and data analysis. Sampling was conducted in in-person settings such as shopping centres, senior centres, and retirement communities and therefore did not reach people who do not frequent these types of locations. Also, we have only examined self-reported perceptions of cognitive and socioemotional benefits rather than objectively measuring benefits. Measurement of some variables could also be improved in future surveys. Studies vary widely in how they measure the amount of time playing digital games, with some using the number of days per week or hours per day played and others documenting a range. Having participants record their number of hours played in a given timeframe such as a week would allow more accurate data analyses for evaluating the association of time with perceived benefits. Retaining time played as a continuous variable might be more fruitful for identifying correlations and studying factors related to increases in time played.

Finally, the survey included only residents of three Canadian metropolitan areas, one predominantly Anglophone and two Francophone. We have reported separately on differences within and between these groups[24], but because our re-

sults may be dependent on culture, they cannot be generalized to populations outside Canada.

## CONCLUSION

Older adults are increasing their leisure time spent playing digital games. How they play digital games is diverse, varying in the types of games they play and with whom they play. This study has found significant associations between older adults' demographic characteristics, their game use patterns, and perceived socioemotional and cognitive benefits. The two key findings were:

1. Perceived socioemotional benefits of digital games were greater for males, not living in a couple, living in an assisted living facility, and lower level of education, whereas perceived cognitive benefits were only greater for males.
2. Perceived socioemotional benefits were greater for five game use pattern variables: playing more than six hours, playing RPGs, playing social games online, meeting new people while playing social games online, and playing with others. Perceived cognitive benefits were associated with having a higher gameplay skill level, playing social games online, meeting new people playing online, and playing with others.

These findings provide two insights. The first is that variables associated with older adults' perceptions of digital gameplay benefits are not homogenous and are rather complex. While previous research has focused on only a few demographic characteristics such as sex and education, and a few game use patterns, such as type and amount of time spent playing, no other study has investigated this wide range of associations.

The second insight is that older adults do find digital games to be a source of socioemotional and cognitive benefits. The results of this study suggest that games should be designed to appeal more to female gamers, and older women should be encouraged to get involved in this type of activity. Also, games should be created for older adults to play online with other players, as this appears to provide both cognitive and socioemotional benefits. These insights can help guide professionals who are developing new digital games for older adults as well as organizations building social programs to promote digital gaming in specific communities. These findings can also help future researchers to develop better data collection methods and provide direction about factors to investigate in similar areas of study.

Providing opportunities for older adults to remain socially and cognitively active throughout their lives is a necessary component of a model for aging well[55,56]. Most of the older adults in the present study were able to identify at least one socioemotional and one cognitive benefit from digital gameplay. Digital games provided these older adults with the opportunity to interact with others, learn new skills, improve their memory, and have fun. In a world where technology is becoming more present, older adults who did not grow up with these tools are adapting to their environments. Gaining a better understanding of which older adults are playing digital games as a form of leisure activity, as well as how and why they play, provides us with knowledge about how to successfully develop new programs and tools to assist in the aging process.

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