

Original Paper

Video Games as a Potential Modality for Behavioral Health Services for Young Adult Veterans: Exploratory Analysis

Sean Grant, DPhil; Asya Spears, MS; Eric R Pedersen, PhD

RAND Corporation, Santa Monica, CA, United States

Corresponding Author:

Sean Grant, DPhil
RAND Corporation
1776 Main Street
Santa Monica, CA,
United States
Phone: 1 310 393 0411 ext 6438
Email: sgrant@rand.org

Abstract

Background: Improving the reach of behavioral health services to young adult veterans is a policy priority.

Objective: The objective of our study was to explore differences in video game playing by behavioral health need for young adult veterans to identify potential conditions for which video games could be used as a modality for behavioral health services.

Methods: We replicated analyses from two cross-sectional, community-based surveys of young adult veterans in the United States and examined the differences in time spent playing video games by whether participants screened positive for behavioral health issues and received the required behavioral health services.

Results: Pooling data across studies, participants with a positive mental health screen for depression or posttraumatic stress disorder (PTSD) spent 4.74 more hours per week (95% CI 2.54-6.94) playing video games. Among participants with a positive screen for a substance use disorder, those who had received substance use services since discharge spent 0.75 more days per week (95% CI 0.28-1.21) playing video games than participants who had not received any substance use services since discharge.

Conclusions: We identified the strongest evidence that participants with a positive PTSD or depression screen and participants with a positive screen for a substance use disorder who also received substance use services since their discharge from active duty spent more time playing video games. Future development and evaluation of video games as modalities for enhancing and increasing access to behavioral health services should be explored for this population.

(*JMIR Serious Games* 2018;6(3):e15) doi:[10.2196/games.9327](https://doi.org/10.2196/games.9327)

KEYWORDS

behavioral health; replication; veterans; video games

Introduction

Behavioral health issues such as posttraumatic stress disorder (PTSD), depressive disorders, and substance use disorders (SUDs) are common diagnoses among veterans from recent conflicts in Iraq and Afghanistan [1,2]. However, at best, only half of the veterans with a documented behavioral health need actually receive behavioral health services [3,4]. Moreover, nearly 40% of the veterans from recent conflicts in Iraq and Afghanistan have never sought services through the Veterans Health Administration (VHA) for any reason since separation from active military duty [5,6]. Young adult veterans are particularly at risk for unmet behavioral health needs, as they are less likely to seek behavioral health services than older veterans [7,8], have higher rates of behavioral health issues than

older veterans [1], and report poorer behavioral health than young adult civilians [9]. Improving the reach of behavioral health services to young adult veterans is consequently a policy priority.

Young adult veterans report multiple barriers to seeking and receiving behavioral health services in traditional settings and formats. These include inconvenience of appointments, concerns about high costs, perceived stigma from peers, beliefs that they can handle symptoms on their own, and living in rural settings that are far from care settings [3,4,10-14]. Expanding beyond traditional care settings and developing innovative means of engagement can help address unmet behavioral health needs.

Video games have the potential to improve the reach of behavioral health services [15], including those who have

currently unmet behavioral health needs or face difficulty accessing treatment [16]. Given their increasing popularity [17], research on video game use is increasingly shifting from a focus on its potential negative impacts (eg, exposure to violence) to its potential cognitive, emotional, social, and health benefits [18,19]. Specifically, video games are increasingly used for health-related interventions, given their engaging and entertaining format [20,21] and their versatility across different platforms or environments such as consoles, computers, and mobile phone apps [15]. Recently, these apps have been extended to serve as an alternative or additional form of treatment for behavioral health [22,23]. For example, a computer video game that incorporates evidence-based cognitive behavioral therapy was found in a randomized trial to be both an appealing and efficacious treatment for adolescent depression [16,24].

In this exploratory study, we replicated analyses from two cross-sectional, community-based surveys to explore the plausibility of video games as a modality for behavioral health services for young adult US veterans. The lack of data on veteran video game playing precluded us from making clear a priori hypotheses regarding the prevalence of video game playing in the sample. As video game-based interventions appeal more to those who play video games generally [16], the lack of familiarity with and available leisure time to play video games can serve as key barriers to their use for behavioral health services [17]. We therefore used the time spent playing video games as a proxy for familiarity with and time available for video games. We specifically examined differences in time spent playing video games by whether participants screened positive for a behavioral health issue (ie, alcohol misuse, depression, and PTSD) and received the required behavioral health services.

Methods

Study Procedures

Data presented in this manuscript are from two surveys conducted as part of a larger randomized controlled trial (RCT) of a Web-based normative feedback intervention for heavy drinking young adult veterans [25,26]. We collected data on the video game behaviors of young adult veterans for the comparator intervention (ie, attention-matched normative feedback on video game behaviors); we did not prespecify any of the analyses on the video game behavior data reported in this manuscript. The Human Subjects Protection Committee at the RAND Corporation approved all procedures for both studies.

Participant Recruitment and Eligibility

We recruited nontreatment seeking young adult (age, 18-34 years) veteran participants in both samples through advertisements on Facebook that did not mention video games or behavioral health. We have previously reported comprehensive details of the recruitment strategy and methods for validating veteran participants for Study 1 [27] and Study 2 [28]. We conducted all procedures online.

Study 1

Study 1 involved a survey on the behavioral health symptoms of a large general sample of young adult veterans recruited outside of VHA settings. We targeted a series of Facebook ads to users between the ages of 18 and 40 years who expressed an interest in (ie, “liked”) specific veteran or military Facebook pages as well as media (movies, TV shows, and video games) related to military (eg, Act of Valor, Generation Kill, Call of Duty). Interested Facebook users who clicked on ads were directed to a Web-based informational statement and consent form. Eligible participants who consented to participate were first verified to be actual veterans using data check procedures we have described in detail elsewhere [27], before completing a longer Web-based survey of the measures described below.

Study 2

Study 2 involved a screening and baseline survey for an RCT of a brief, Web-based, personalized normative drinking intervention, where participants saw feedback about their drinking (intervention) or video game playing behavior (control) compared with their peers. As with Study 1, participants clicked on targeted Facebook ads, although we did not include ads targeting any media regarding video games (eg, Call of Duty). The eligibility criteria were the same across studies, except that participants in Study 2 needed to score at least a 3 (females) or 4 (males) on the 10-item Alcohol Use Disorders Identification Test (AUDIT) [29]. These AUDIT cutoff scores were selected to include participants in the larger RCT who drank at moderate to high levels and were at risk for hazardous or problem drinking [30,31].

Participant Characteristics

Study 1

We recruited 1023 young adult veterans overall, of whom 552 (53.9%) reported playing video games at least 1 hour per week. To match the eligibility criteria of Study 2, we restricted the subsample who reported playing video games at least 1 hour per week to the 350 veterans who also had scores of at least 3 (females) or 4 (males) on AUDIT.

Study 2

We recruited 784 young adult veterans overall. Because we were interested in veterans who reported any video game use for analyses in the current study, we restricted our sample to 582 veterans (74.2%, 582/784) who reported playing video games at least 1 hour per week.

Materials

Data Collection

For both studies, we collected information on demographics, behavioral health symptoms, behavioral health services use, and video game behaviors. In this manuscript, we report analyses on similar constructs assessed in both Study 1 and Study 2, although we operationalized several constructs using different measures ([Multimedia Appendices 1 and 2](#)).

Demographics

Participants in both studies filled out the same measures regarding age, gender, ethnicity or race, education, marital status, number of children, annual household income, and branch of military service.

Behavioral Health Symptoms

Participants completed brief screening measures for behavioral health problems.

Posttraumatic Stress Disorder Symptoms

In Study 1, we assessed PTSD symptoms with the 4-item Primary Care PTSD scale (PC-PTSD). A score of 3 or higher (ie, participants endorsed “yes” for 3 of the 4 PTSD symptoms) on PC-PTSD indicated a probable diagnosis of PTSD [32]. In Study 2, we assessed PTSD symptoms in the past month with the 20-item PTSD Checklist for Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (PCL-5). Items in PCL-5 ranged from 0 “not at all” to 4 “extremely,” with a cutoff score of 33 or higher as screening for a probable diagnosis of PTSD [33].

Depression Symptoms

In Study 1, we assessed depression symptoms with the 2-item Patient Health Questionnaire (PHQ-2). Participants rated two symptoms (ie, “little interest or pleasure in doing things” and “feeling down, depressed, or hopeless”) from 0 “not at all” to 3 “nearly every day” for the past 2 weeks. A score of 2 on the PHQ-2 indicated screening for a depression diagnosis [34]. In Study 2, we assessed depressive symptoms for the past 2 weeks with the 8-item Patient Health Questionnaire (PHQ-8). Items on the PHQ-8 ranged from 0 “not at all” to 3 “nearly every day,” with a cutoff score of 10 or higher as screening for a probable diagnosis of a major depressive disorder [35].

Alcohol Use

In both studies, we assessed alcohol use disorder (AUD) symptoms in the past year using AUDIT [29]. A score of 8 or higher indicated hazardous drinking. Participants in both studies also reported for the past 30 days, the number of days the participants drank; the amount of alcohol consumed per occasion; heavy drinking days, that is, days when they consumed more than 4 drinks for females or more than 5 for males; and largest number consumed on any one occasion. We assessed consequences with the Brief Young Adult Alcohol Consequences Questionnaire [36], where participants indicated if they experienced each of the 21 consequences related to drinking in the past month.

Cannabis Use

We asked participants if they used any cannabis or marijuana in the past 6 months (yes or no), and if so, how many days in the past month did they use. The Study 1 survey referred to the drug as cannabis and the Study 2 survey referred to it as marijuana.

Behavioral Health Services Use

In both studies, participants indicated whether they had attended any appointments (in any setting: VHA, Vet Centers, or community providers) for mental health concerns or substance

use concerns since discharge from active duty in the past month or year.

Video Game Behaviors

In both studies, participants indicated the typical number of hours they played video games per day, hours they played video games per week, and days they played video games per week in the past 30 days using slightly different methods. In Study 1, participants indicated how many hours on each day of the week they typically played video games, while in Study 2, they responded to 3 single items about the hours per day, hours per week, and days per week they typically played video games. In both studies, participants were asked to consider computer-based games, console video games, arcade video games, mobile phone or tablet games, or Web-based JavaScript games.

Analysis Procedures

We first calculated descriptive statistics for, and differences in, demographics between Study 1 and Study 2 samples. Then, we used Welch’s *t* test to examine whether participants who screened positive for a behavioral health issues played video games to a different degree than those who did not screen positive. Lastly, among participants who screened positive for behavioral health issues, we used Welch’s *t* test to examine whether those who received services played video games to a different degree than those who did not report using any services. We examined the results from the analyses on behavioral health and video game behaviors in two ways [37,38]. First, we assessed whether the “existence” (statistical significance) and direction of any differences were replicated across both studies: (ie, $P < .05$ in same direction in both studies). Second, we calculated the fixed-effect meta-analytic estimate for the mean difference in effects by pooling differences from both studies [39].

Results

Demographics

We included 350 participants from Study 1 and 582 participants from Study 2 (see Table 1). The average ages of participants in Study 1 and Study 2 were 28 and 29 years, respectively. Study 1 had significantly more males (323/350, 92.6%) than Study 2 (505/582, 86.8%), $\chi^2_1=6.8$, $P=.009$ ($N=931$). Study 1 had significantly more Hispanic participants (72/349, 20.6%) than Study 2 (60/582, 10.3%), $\chi^2_1=19.1$, $P<.001$ ($N=931$). Study 2 had more White participants (499/582, 85.7%) than Study 1 (273/350, 78.0%), $\chi^2_1=8.7$, $P=.003$ ($N=932$). A substantial majority of participants in both Study 1 (64/350, 18.3%) and Study 2 (116/582, 19.9%) had not earned a college degree, although more participants in Study 1 (163/350, 47%) were currently in college than in Study 2 (200/582, 34.4%), $\chi^2_1=13.2$, $P<.001$ ($N=932$). In both studies, the modal annual household income was US \$25,000 to US \$49,999; about half of the participants in each study were married, with an average of one child per veteran. Among those with children, the average number of children living at home was 2. The majority of participants in both studies served previously in the army, with about a quarter previously serving in the marines.

Table 1. Participant characteristics.

Demographics	Study 1 (N=350)	Study 2 (N=582)	<i>P</i> value ^a
Age, mean (SD)	28.4 (3.4)	28.7 (3.4)	.11
Male, n (%)	323 (92.6)	505 (86.8)	.009
Hispanic ethnicity, n (%)	72 (20.6)	60 (10.3)	<.001
Race, n (%)			.003
White	273 (78.0)	499 (85.7)	
Other	77 (22.0)	83 (14.3)	
Education, n (%)			.60
Some college or less	286 (81.7)	437 (80.1)	
College graduate	64 (18.3)	116 (19.9)	
Currently in college, n (%)			<.001
No	187 (53.4)	382 (65.6)	
Yes	163 (46.6)	200 (34.4)	
Annual household income, n (%)			.29
<US \$10,000	29 (8.3)	32 (5.5)	
US \$10,000 to US \$14,999	29 (8.3)	46 (7.9)	
US \$15,000 to US \$24,999	70 (20.0)	90 (15.5)	
US \$25,000 to US \$49,999	121 (34.6)	238 (40.9)	
US \$50,000 to US \$99,999	84 (24.0)	142 (24.4)	
US \$100,000 to US \$149,999	14 (4.0)	28 (4.8)	
US \$150,000 to US \$199,999	3 (0.9)	3 (0.9)	
US \$200,000 +	0 (0.0)	1 (0.2)	
Married, n (%)	186 (53.1)	278 (47.8)	.13
Number of children, mean (SD)	1.4 (1.5)	1.3 (1.4)	.14
Number of children living at home, mean (SD)	1.7 (1.1)	1.7 (1.3)	.82
Branch of service, n (%)			.25
Air Force	22 (6.3)	57 (9.8)	
Army	215 (61.4)	348 (59.8)	
Marine Corps	87 (24.9)	129 (22.2)	
Navy	26 (7.4)	48 (8.2)	
Mental health, n (%)			
Positive screen for posttraumatic stress disorder	152 (43.4)	227 (39.0)	.21
Positive screen for depression	169 (48.3)	271 (46.6)	.66
Alcohol use			
Positive screen for disorder, n (%)	151 (43.1)	174 (29.9)	<.001
Total drinking days, mean (SD)	10.4 (9.1)	12.4 (8.8)	.001
Drinks per drinking day, mean (SD)	4.8 (4.3)	4.7 (3.3)	.77
Heavy drinking occasions, mean (SD)	4.6 (6.2)	5.8 (7.2)	.01
Max drinks on a drinking day, mean (SD)	8.5 (6.0)	9.4 (6.0)	.03
Alcohol consequences, mean (SD)	7.8 (7.1)	7.6 (6.8)	.58
Cannabis use			
Cannabis use in past 6 months, n (%)	106 (41.9)	169 (29.0)	<.001
Total number of cannabis use days, mean (SD)	9.9 (11.4)	3.3 (8.6)	<.001

Demographics	Study 1 (N=350)	Study 2 (N=582)	P value ^a
Any behavioral health services receipt, n (%)			
Services since discharge	183 (52.3)	338 (58.1)	.10
Services in past year	119 (34.0)	238 (40.9)	.04
Services in past month	42 (12.0)	101 (17.4)	.04
Mental health services receipt, n (%)			
Services since discharge	175 (50.0)	320 (55.0)	.16
Services in past year	116 (33.1)	228 (39.2)	.08
Services in past month	42 (12.0)	98 (16.8)	.06
Substance use services receipt, n (%)			
Services since discharge	67 (19.1)	121 (20.8)	.60
Services in past year	31 (8.9)	66 (11.3)	.28
Services in past month	1 (0.3)	18 (3.1)	.007
Video game use, mean (SD)			
Total hours spent playing per day	2.3 (1.8)	3.5 (3.2)	<.001
Total hours spent playing per week	12.8 (13.5)	18.4 (21.9)	<.001
Total days spent playing per week	5.0 (2.3)	4.7 (2.2)	.046

^aP values are reported from the Welch's two-sample *t* test for continuous measures and chi-square test for categorical measures.

Behavioral Health

Similar proportions of patients screened positive for PTSD (Study 1, 152/350, 43.4%; Study 2, 227/582, 39.0%) and depressive disorder (Study 1, 169/350, 48.3%; Study 2, 271/582, 46.6%). Participants consumed about 5 drinks per drinking day. Screening positive for an AUD was more likely for participants in Study 1 (151/350, 43.1%) than in Study 2 (174/582, 29.9%), $\chi^2_1=16.3$, $P<.001$ (N=932). However, compared with participants in Study 1, participants in Study 2 drank more days in the past month (Study 1 mean 10.4 [SD 9.1]; Study 2 mean 12.4 [SD 8.8]; $t_{715}=-3.2$; $P=.001$), drank more drinks on their peak drinking day (Study 1 mean 8.5 [SD 6.0]; Study 2 mean 9.4 [SD 6.0]; $t_{662}=-2.2$; $P=.03$) and had more heavy drinking days (Study 1 mean 4.6 [SD 6.2]; Study 2 mean 5.8 [SD 7.2]; $t_{743}=-2.5$; $P=.01$). Compared with participants in Study 2, more participants in Study 1 used cannabis in the past 6 months (Study 1, 106/253, 41.9%; Study 2, 169/582, 29.0%), $\chi^2_1=12.6$, $P<.001$ (N=835), and on more days in the past month (Study 1 mean 9.9 [SD 11.4]; Study 2 mean 3.3 [SD 8.6]), $t_{100}=5.01$, $P<.001$. Approximately half of the participants reported any use of behavioral health services since their discharge, a little over a third reported use within the past year, and less than one-fifth reported use within the past month.

Video Game Behaviors

Participants in Study 1 reported playing video games fewer hours per day (Study 1 mean 2.3 [SD 1.8]; Study 2 mean 3.5 [SD 3.2]; $t_{925}=-7.4$; $P<.001$) and per week (Study 1 mean 12.8 [SD 13.5]; Study 2 mean 18.4 [SD 21.9]; $t_{929}=-4.8$; $P<.001$) than participants in Study 2. However, participants in Study 1 spent more days per week playing video games than participants

in Study 2 (Study 1 mean 5.0 [SD 2.3]; Study 2 mean 4.7 [SD 2.2]; $t_{717}=2.0$; $P=.046$).

Video Game Behaviors by Positive Screen

Within each study, participants with any positive screen (PTSD, depression, AUD, or cannabis use) did not differ significantly from participants without any positive screen on video game behavior, while participants with either positive mental health screen (PTSD, depression) spent more hours per day and per week playing video games than those without a positive mental health screen (Multimedia Appendix 3). Pooling data across studies, participants with any positive screen for a mental health or substance use issue spent 2.61 more hours per week (95% CI 0.11-5.10) playing video games than participants without any positive screen. Participants with any positive mental health screen (PTSD, depression) spent 0.61 more hours per day (95% CI 0.30-0.92), 4.74 more hours per week (95% CI 2.54-6.94), and 0.41 more days per week (95% CI 0.13-0.70) playing video games.

Video Game Use by Services Receipt Among Participants With a Positive Screen

No association was found between video game use and either any services receipt, mental health services receipt, or substance use services receipt within both studies. Pooling data across studies, participants with any positive screen for a behavioral health issue who had received any type of behavioral health services (mental health services, substance use services) since discharge from active duty spent 2.67 more hours per week (95% CI 0.14-5.20) and 0.48 more days per week (95% CI 0.14-0.82) playing video games than participants with any positive screen who had not received any type of behavioral health services since discharge. Participants with any positive SUD screen who had received any type of substance use services

since discharge spent 0.75 more days per week (95% CI 0.28-1.21) playing video games than participants with any positive SUD screen who had not received any type of substance use services since discharge.

Discussion

Principal Findings

We examined the video game playing behavior of two separate samples of young adult veterans recruited online. First, we found evidence across the two samples that most young veterans played video games: 54% of a general sample of young veterans and 74% of a sample of young adult veteran drinkers reported playing video games at least 1 hour per week. Next, among the video game players, we found that young adult veterans spent about 13-18 hours per week playing video games and about 2.5-3.5 hours per day playing video games. In a typical week, young adult veterans played video games on most days of the week. These findings suggest that video games might be a feasible intervention modality for young veterans generally and for behavioral health concerns specifically.

While most analyses did not yield differences that were replicated across both studies, we did find several replicated differences in video game behaviors among young adult veterans depending on their screening positive for a behavioral health issue as well as their receiving services for a behavioral health need. Regarding screening positive for a behavioral health issue, we identified the strongest evidence for more hours per day and per week playing video games among participants with a positive screen for both PTSD and depression compared with those without positive screens for these conditions. Regarding the receipt of services for a behavioral health need, we identified the strongest evidence that participants who had a positive SUD screen and received substance use services since discharge spent more days per week playing video games than those with a positive SUD screen who had not received substance use services.

Although most veterans in our sample played video games and those that did played quite often, our findings aimed to identify the potential groups of young adult veterans for the development and evaluation of video games as a modality for behavioral health services. Specifically, with respect to playing video games more per day and per week, young adult veterans screening positive for PTSD and depression may be more familiar with and dedicate more time to behavioral health services delivered via video games because these veterans already play more video games and more frequently than those without these issues and those not receiving services. For this population, relatively more intensive video game-based interventions might be acceptable. For example, previous research has demonstrated the feasibility of incorporating the core components of traditional cognitive behavioral therapies and exercise-based interventions for mental health into engaging, video games in Web-based, computer, console, and application-based formats [15-17,20,23,40,41]. Similarly, young adult veterans who have previously sought care but are currently not receiving services for SUDs are a more promising population than those with SUDs who have never sought care since their discharge from active duty.

Because these veterans were open to receiving services in the past, video game-based interventions for this population could focus on delivering motivational interviewing techniques that encourage them to enter a new treatment episode [17,42] or be used to supplement care received after initiation to encourage retention and compliance with treatment goals (eg, completing cognitive behavioral therapy “homework” via video games).

Strengths and Limitations

Several strengths and limitations are worth noting. Strengths of this study include replicating analyses from two independent samples to reduce the rate of false positives [37,38]; sharing the data, code, and materials to facilitate computational reproducibility and verification (Multimedia Appendices 4 and 5) [43]; and signaling that these findings are exploratory [44] as they were not included in the study preregistrations [25]. In addition, using social media, we efficiently recruited hundreds of young adult veterans who currently play video games and screened positive for a behavioral health issue. We did this through Facebook advertisements that did not advertise the study to video game players exclusively. We did not mention in the ads that the study was looking for video game players, heavy drinkers, those with substance use or mental health problems, or those looking for treatment. Limitations include the exploratory nature of these analyses [45], recruiting our sample from Facebook, which limited the generalizability of our findings (though 10% learned about the study from family or friends and not directly from Facebook) [27] and the use of only self-report measures (ie, not diagnostic interviews) collected via the internet [25].

Future Work

Findings suggest several avenues of future research as well as collaborations between researchers and video game developers. First, analyses from this study would benefit from direct, preregistered replications to strengthen the credibility of our findings. Direct assessment of acceptability and willingness to engage with video games for behavioral health services should be incorporated into this research [16]. If our results are replicated, an empirically testable theoretical framework should be prospectively developed to provide more useful understandings of the relationships among video game use, behavioral health, and intervention than those provided by our entirely exploratory empirical analyses. Second, research is needed on the optimal types of video games (eg, role-playing, adventure, fantasy) for different young adult veteran populations [20]. Third, future research should investigate which types of behavioral health services can be best integrated into video games for different young adult veteran populations [17], with particular attention to young adult veterans facing health concerns not investigated in this manuscript yet likely in this population, such as physical pain and traumatic brain injury. Importantly, future research is needed to confirm that the number of hours spent playing traditional video games can be converted to engagement with games that address their behavioral health issues. Lastly, as video games are developed and implemented, rigorous evaluations are needed to assess the effects for specific behavioral health issues [22].

Acknowledgments

This research was supported by grant R34AA022400 awarded to ERP from the National Institute on Alcohol Abuse and Alcoholism (NIAAA).

Conflicts of Interest

SG's spouse is a salaried-employee of Eli Lilly and Company and owns stock. SG has accompanied his spouse on company-sponsored travel. All other authors declare no conflicts of interest.

Multimedia Appendix 1

Codebook for Grant, Spears, and Pedersen (Study 1 and Study 2).

[[PDF File \(Adobe PDF File\), 114KB - games_v6i3e15_app1.pdf](#)]

Multimedia Appendix 2

Comparison of measures in Study 1 and Study 2.

[[PDF File \(Adobe PDF File\), 30KB - games_v6i3e15_app2.pdf](#)]

Multimedia Appendix 3

Exploratory replication analyses of video game use by young adult veterans.

[[PDF File \(Adobe PDF File\), 30KB - games_v6i3e15_app3.pdf](#)]

Multimedia Appendix 4

Markdown analytic code and output for exploratory analyses.

[[PDF File \(Adobe PDF File\), 819KB - games_v6i3e15_app4.pdf](#)]

Multimedia Appendix 5

De-identified dataset.

[[XLSX File \(Microsoft Excel File\), 173KB - games_v6i3e15_app5.xlsx](#)]

References

1. Seal K, Cohen G, Waldrop A, Cohen B, Maguen S, Ren L. Substance use disorders in Iraq and Afghanistan veterans in VA healthcare, 2001-2010: Implications for screening, diagnosis and treatment. *Drug Alcohol Depend* 2011 Jul 01;116(1-3):93-101. [doi: [10.1016/j.drugalcdep.2010.11.027](#)] [Medline: [21277712](#)]
2. Analysis of VA health care utilization among Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND) veterans. In: Department of Veterans Affairs. Washington, DC: Department of Veterans Affairs; 2015.
3. Pietrzak RH, Johnson DC, Goldstein MB, Malley JC, Southwick SM. Perceived stigma and barriers to mental health care utilization among OEF-OIF veterans. *Psychiatr Serv* 2009 Aug;60(8):1118-1122. [doi: [10.1176/ps.2009.60.8.1118](#)] [Medline: [19648201](#)]
4. Schell TL, Marshall GN. Survey of individuals previously deployed for OEF/OIF. In: Tanielian T, Jaycox LH, editors. *Invisible wounds of war: Psychological and cognitive injuries, their consequences, and services to assist recovery*. Santa Monica, CA: RAND; 2008.
5. Veterans Health Administration. Analysis of VA Health Care Utilization among Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND) Veterans: Cumulative from 1st Qtr FY 2002 through 2nd Qtr FY 2015 (October 1, 2001 – March 31, 2015). Washington, DC: Epidemiology Program, Post-Deployment Health Group, Office of Public Health; 2015.
6. Bagalman E. Mental disorders among OEF/OIF veterans using VA health care: Facts and figures. Washington, DC: Congressional Research Service; 2013.
7. Nelson K, Starkebaum G, Reiber GE. Veterans using and uninsured veterans not using Veterans Affairs (VA) health care. *Public Health Rep* 2007;122(1):93-100.

8. Fasoli DR, Glickman ME, Eisen SV. Predisposing characteristics, enabling resources and need as predictors of utilization and clinical outcomes for veterans receiving mental health services. *Med Care* 2010 Apr;48(4):288-295. [Medline: [20355260](#)]
9. Grossbard JR, Lehavot K, Hoerster KD, Jakupcak M, Seal KH, Simpson TL. Relationships among veteran status, gender, and key health indicators in a national young adult sample. *Psychiatr Serv* 2013 Jun;64(6):547-553. [doi: [10.1176/appi.ps.003002012](#)] [Medline: [23450338](#)]
10. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *N Engl J Med* 2004 Jul 01;351(1):13-22. [doi: [10.1056/NEJMoa040603](#)] [Medline: [15229303](#)]
11. Garcia H, Finley E, Ketchum N, Jakupcak M, Dassori A, Reyes SC. A survey of perceived barriers and attitudes toward mental health care among OEF/OIF veterans at VA outpatient mental health clinics. *Mil Med* 2014 Mar;179(3):273-278. [doi: [10.7205/MILMED-D-13-00076](#)] [Medline: [24594461](#)]
12. DeViva JC, Sheerin CM, Southwick SM, Roy AM, Pietrzak RH, Harpaz-Rotem I. Correlates of VA mental health treatment utilization among OEF/OIF/OND veterans: Resilience, stigma, social support, personality, and beliefs about treatment. *Psychol Trauma* 2016 Dec;8(3):310-318. [doi: [10.1037/tra0000075](#)] [Medline: [26237497](#)]
13. Fox A, Meyer E, Vogt D. Attitudes about the VA health-care setting, mental illness, and mental health treatment and their relationship with VA mental health service use among female and male OEF/OIF veterans. *Psychol Serv* 2015 Feb;12(1):49-58. [doi: [10.1037/a0038269](#)] [Medline: [25365245](#)]
14. Vogt D. Mental health-related beliefs as a barrier to service use for military personnel and veterans: a review. *Psychiatr Serv* 2011 Feb;62(2):135-142. [doi: [10.1176/ps.62.2.pss6202_0135](#)] [Medline: [21285091](#)]
15. Barak A, Grohol JM. Current and future trends in Internet-supported mental health interventions. *Journal of Technology in Human Services* 2011;29:155-196.
16. Cheek C, Bridgman H, Fleming T, Cummings E, Ellis L, Lucassen MF, et al. Views of Young People in Rural Australia on SPARX, a Fantasy World Developed for New Zealand Youth With Depression. *JMIR Serious Games* 2014 Feb 18;2(1):e3 [FREE Full text] [doi: [10.2196/games.3183](#)] [Medline: [25659116](#)]
17. Ceranoglu TA. Video games in psychotherapy. *Review of General Psychology* 2010;14(2):141-146.
18. Granic I, Lobel A, Engels RCME. The benefits of playing video games. *Am Psychol* 2014 Jan;69(1):66-78. [doi: [10.1037/a0034857](#)] [Medline: [24295515](#)]
19. Kato PM. Video games in health care: Closing the gap. *Review of General Psychology* 2010;14(2):113-121.
20. Baranowski T, Buday R, Thompson DI, Baranowski J. Playing for real: video games and stories for health-related behavior change. *Am J Prev Med* 2008 Jan;34(1):74-82 [FREE Full text] [doi: [10.1016/j.amepre.2007.09.027](#)] [Medline: [18083454](#)]
21. Thompson D, Baranowski T, Buday R, Baranowski J, Thompson V, Jago R, et al. Serious Video Games for Health How Behavioral Science Guided the Development of a Serious Video Game. *Simul Gaming* 2010 Aug 01;41(4):587-606 [FREE Full text] [doi: [10.1177/1046878108328087](#)] [Medline: [20711522](#)]
22. Lau H, Smit J, Fleming T, Riper H. Serious Games for Mental Health: Are They Accessible, Feasible, and Effective? A Systematic Review and Meta-analysis. *Front Psychiatry* 2016;7:209 [FREE Full text] [doi: [10.3389/fpsy.2016.00209](#)] [Medline: [28149281](#)]
23. Fernández-Aranda F, Jiménez-Murcia S, Santamaría JJ, Gunnard K, Soto A, Kalapanidas E, et al. Video games as a complementary therapy tool in mental disorders: PlayMancer, a European multicentre study. *J Ment Health* 2012 Aug;21(4):364-374 [FREE Full text] [doi: [10.3109/09638237.2012.664302](#)] [Medline: [22548300](#)]
24. Merry S, Stasiak K, Shepherd M, Frampton C, Fleming T, Lucassen MFG. The effectiveness of SPARX, a computerised self help intervention for adolescents seeking help for depression: randomised controlled non-inferiority trial. *BMJ* 2012 Apr 18;344:e2598 [FREE Full text] [Medline: [22517917](#)]
25. Pedersen ER, Marshall GN, Schell TL. Study protocol for a web-based personalized normative feedback alcohol intervention for young adult veterans. *Addiction Science & Clinical Practice* 2016;11(1):1-15.
26. Pedersen E, Parast L, Marshall G, Schell T, Neighbors C. A randomized controlled trial of a web-based personalized normative feedback alcohol intervention for young adult veterans. *Journal of Consulting and Clinical Psychology* 2017;85:459-470.
27. Pedersen ER, Helmuth ED, Marshall GN, Schell TL, PunKay M, Kurz J. Using facebook to recruit young adult veterans: online mental health research. *JMIR Res Protoc* 2015 Jun 01;4(2):e63 [FREE Full text] [doi: [10.2196/resprot.3996](#)] [Medline: [26033209](#)]
28. Pedersen E, Naranjo D, Marshall GN. Recruitment and retention of young adult veteran drinkers using Facebook. *PLoS One* 2017;12(3):e0172972 [FREE Full text] [doi: [10.1371/journal.pone.0172972](#)] [Medline: [28249027](#)]
29. Saunders J, Aasland O, Babor T, de LFJ, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption--II. *Addiction* 1993 Jun;88(6):791-804. [Medline: [8329970](#)]
30. Bradley KA, Bush KR, McDonnell MB, Malone T, Fihn SD, the Ambulatory Care Quality Improvement Project (ACQUIP). Screening for problem drinking. *Journal of General Internal Medicine* 1998;13(6):379-388.

31. Bradley KA, Bush KR, Epler AJ, Dobie DJ, Davis TM, Sporleder JL, et al. Two brief alcohol-screening tests From the Alcohol Use Disorders Identification Test (AUDIT): validation in a female Veterans Affairs patient population. *Arch Intern Med* 2003 Apr 14;163(7):821-829. [doi: [10.1001/archinte.163.7.821](https://doi.org/10.1001/archinte.163.7.821)] [Medline: [12695273](https://pubmed.ncbi.nlm.nih.gov/12695273/)]
32. Prins A, Ouimette P, Kimerling R, Cameron R, Hugelshofer D, Shaw-Hegwer J, et al. The primary care PTSD screen (PC-PTSD): development and operating characteristics. *Primary Care Psychia* 2003;9(1):9-14.
33. Bovin M, Marx B, Weathers F, Gallagher M, Rodriguez P, Schnurr P, et al. Psychometric properties of the PTSD Checklist for Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (PCL-5) in veterans. *Psychol Assess* 2016 Dec;28(11):1379-1391. [doi: [10.1037/pas0000254](https://doi.org/10.1037/pas0000254)] [Medline: [26653052](https://pubmed.ncbi.nlm.nih.gov/26653052/)]
34. Kroenke K, Spitzer R, Williams JBW. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care* 2003 Nov;41(11):1284-1292. [doi: [10.1097/01.MLR.0000093487.78664.3C](https://doi.org/10.1097/01.MLR.0000093487.78664.3C)] [Medline: [14583691](https://pubmed.ncbi.nlm.nih.gov/14583691/)]
35. Kroenke K, Strine T, Spitzer R, Williams J, Berry J, Mokdad AH. The PHQ-8 as a measure of current depression in the general population. *J Affect Disord* 2009 Apr;114(1-3):163-173. [doi: [10.1016/j.jad.2008.06.026](https://doi.org/10.1016/j.jad.2008.06.026)] [Medline: [18752852](https://pubmed.ncbi.nlm.nih.gov/18752852/)]
36. Kahler C, Hustad J, Barnett N, Strong D, Borsari B. Validation of the 30-day version of the Brief Young Adult Alcohol Consequences Questionnaire for use in longitudinal studies. *J Stud Alcohol Drugs* 2008 Jul;69(4):611-615 [FREE Full text] [Medline: [18612578](https://pubmed.ncbi.nlm.nih.gov/18612578/)]
37. Anderson S, Maxwell SE. There's more than one way to conduct a replication study: Beyond statistical significance. *Psychological Methods* 2016;21(1):1-12.
38. Patil P, Peng R, Leek JT. What Should Researchers Expect When They Replicate Studies? A Statistical View of Replicability in Psychological Science. *Perspect Psychol Sci* 2016 Dec;11(4):539-544 [FREE Full text] [doi: [10.1177/1745691616646366](https://doi.org/10.1177/1745691616646366)] [Medline: [27474140](https://pubmed.ncbi.nlm.nih.gov/27474140/)]
39. Open Science Collaboration. Estimating the reproducibility of psychological science. *Science* 2015;349(6251):aac4716.
40. Cutter C, Schottenfeld R, Moore B, Ball S, Beitel M, Savant J, et al. A pilot trial of a videogame-based exercise program for methadone maintained patients. *J Subst Abuse Treat* 2014 Oct;47(4):299-305 [FREE Full text] [doi: [10.1016/j.jsat.2014.05.007](https://doi.org/10.1016/j.jsat.2014.05.007)] [Medline: [25012555](https://pubmed.ncbi.nlm.nih.gov/25012555/)]
41. Coyle D, Doherty G, Sharry J. An evaluation of a solution focused computer game in adolescent interventions. *Clin Child Psychol Psychiatry* 2009 Jul;14(3):345-360. [doi: [10.1177/1359104508100884](https://doi.org/10.1177/1359104508100884)] [Medline: [19515752](https://pubmed.ncbi.nlm.nih.gov/19515752/)]
42. Papastergiou M. Exploring the potential of computer and video games for health and physical education: A literature review. *Computers & Education* 2009;53(3):603-622.
43. Miguel E, Camerer C, Casey K, Cohen J, Esterling K, Gerber A, et al. Social science. Promoting transparency in social science research. *Science* 2014 Jan 03;343(6166):30-31 [FREE Full text] [doi: [10.1126/science.1245317](https://doi.org/10.1126/science.1245317)] [Medline: [24385620](https://pubmed.ncbi.nlm.nih.gov/24385620/)]
44. Lilienfeld SO. Clinical Psychological Science: Then and now. *Clinical Psychological Science* 2017;5(1):3-13.
45. Benjamin D, Berger J, Johannesson M, Nosek B, Wagenmakers E, Berk R, et al. Redefine statistical significance. *Nature Human Behaviour* 2018;2(1):6.

Abbreviations

- AUD:** alcohol use disorder
AUDIT: Alcohol Use Disorders Identification Test
PTSD: posttraumatic stress disorder
RCT: randomized controlled trial
SUD: substance use disorder
VHA: Veterans Health Administration

Edited by G Eysenbach; submitted 01.11.17; peer-reviewed by S Barbieri, A Teo, J Kahn; comments to author 07.12.17; revised version received 20.12.17; accepted 21.06.18; published 26.07.18

Please cite as:

Grant S, Spears A, Pedersen ER

Video Games as a Potential Modality for Behavioral Health Services for Young Adult Veterans: Exploratory Analysis

JMIR Serious Games 2018;6(3):e15

URL: <http://games.jmir.org/2018/3/e15/>

doi: [10.2196/games.9327](https://doi.org/10.2196/games.9327)

PMID: [30049668](https://pubmed.ncbi.nlm.nih.gov/30049668/)

©Sean Grant, Asya Spears, Eric R Pedersen. Originally published in JMIR Serious Games (<http://games.jmir.org>), 26.07.2018. This is an open-access article distributed under the terms of the Creative Commons Attribution License

(<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work, first published in JMIR Serious Games, is properly cited. The complete bibliographic information, a link to the original publication on <http://games.jmir.org>, as well as this copyright and license information must be included.