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The Efficacy of Casual Videogame Play in Reducing Clinical Depression: A Randomized Controlled Study

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Abstract

Background: Depression is a debilitating illness that is estimated to affect more than 300 million people worldwide. Although there has been some success in treatment of this illness with pharmaceuticals and behavioral techniques like cognitive behavioral therapy, these are often costly and have stigma associated with them. The purpose of this study was to test whether a prescribed regimen of casual videogame (CVG) play could reduce symptoms associated with depression.

Subjects and Methods: Participants were screened for depression using the Patient Health Questionnaire-9 (PHQ-9). They were then randomized into the control ($n = 29$) or experimental ($n = 30$) group. Experimental participants were prescribed to play CVGs three times per week (with 24 hours between each session), for 30 minutes, over a 1-month period. Control participants surfed the National Institute of Mental Health's Web page on depression. The instrument used to test the hypothesis was the PHQ-9.

Results: Repeated-measures statistical analyses revealed there was a significant interaction of group and time, supporting the hypothesis that the groups would be different after the intervention. Moreover, when data were compared using tests of within-subjects contrasts between baseline (Time 1) and the end of the 1-month study (Time 3), we found significant decreases in depression symptoms in the experimental group. When this was compared with the control group changes, the results were still significant.

Conclusions: We found that a prescribed regimen of playing CVGs significantly reduced symptoms of clinical depression as measured by the PHQ-9. Clinicians should consider these low-cost CVGs as a possible intervention to address psychological and somatic symptoms associated with depression.

Introduction

According to the World Health Organization, depression is a common diagnosable disorder, affecting more than 350 million people worldwide. Depression was the leading cause of disability and the fourth leading contributor to the global burden of disease in 2000. By the year 2020, depression is projected to reach second place in the ranking of burden for diseases of all ages and sexes. Depression is currently listed as the second cause of disability in the age category 15–44 years. Unfortunately, fewer than 25 percent of those affected by depression have access to effective treatments.[1] An estimated 20.9 million American adults (9.5 percent of the U.S. population 18 years of age or older) suffer from a mood disorder, and more than two-thirds of those (14.8 million U.S. adults) are cases of major depression. Depression is the leading cause of disability in the United States for people ages 15–44 years.[2]

Depression is characterized by persistent sadness and impairment in functioning. Individuals experiencing depression do not always exhibit the same symptoms, but there are commonalities that provide criteria for defining the depressive disorder. These criteria include feeling persistently sad, anxious, or "empty" feelings, feelings of hopelessness and/or pessimism, feelings of guilt, worthlessness, and/or helplessness, irritability or restlessness, loss of interest in activities or hobbies once pleasurable (including sex), fatigue and decreased energy, difficulty concentrating, remembering details, and making decisions, insomnia, early-morning wakefulness, or excessive sleeping, overeating or appetite loss, and thoughts of suicide or suicide attempts.[3]

According to the National Institute of Mental Health, current treatments for depression fall into three categories: Medications, psychotherapies including cognitive behavioral therapy, and brain stimulation.[4] Although several studies have been written on the efficacy of combining

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antidepressant medications with cognitive/behavioral therapy, very little attention has been paid to the effects that pleasurable activities have on mood.[5] Ironically, one of the cardinal symptoms of depression is a lack of interest in pleasurable activities and withdrawal.

Casual videogames (CVGs) defy a standard definition because of their diverse nature. Instead, the Casual Games Association offers a functional definition that asserts that CVGs must be considered fun, quick to access, and easy to learn and require no previous special videogame skills, expertise, or regular time commitment to play. CVGs are based around familiar game concepts that consumers played as children in arcades.[6]

Early research surrounding the effects of videogaming was focused primarily on the negative effects such as violence and addiction.[7–10] In recent years researchers have begun to focus on the potential health benefits as one of the reason people play, such as development of social relationships,[11] facilitating education,[12] skill development, and multitasking.[13] Other studies have focused on the potential of active videogames in reducing obesity[14] and adherence to cancer medications.[15]

In a 2010 article Kato[16] reported that the use of games in psychology were primarily for education and training with patients. Indications included physical therapy, burn pain, diabetes, and asthma. In a recent meta-analysis of health games Kharrazi et al.[17] reported that although there had been significant growth of publications in this area, they tended to be focused on the areas of exercise and rehabilitation.

One videogame, "SPARX," designed specifically to teach cognitive behavioral therapy strategies to reduce symptoms of depression, has had some preliminary efficacy established[18] but is fundamentally different from the CVGs used in this study. In a 2009 randomized, controlled, study our lab tested the effects of these same CVGs and found that statistically significant changes in depression symptoms occurred during gameplay.[19]

If it is true that CVGs possess characteristics that help alleviate symptoms of depression and that results can be obtained by prescribing them in a purposeful manner, then there is the possibility they can be efficacious in the treatment of depression. Thus, the purpose of this randomized controlled study was to test whether a prescribed regimen of CVG play would significantly reduce symptoms associated with depression.

Subjects and Methods

Participants

Recruitment for the study began after approval from the University and Medical Center Institutional Review Board of East Carolina University (Greenville, NC). The study's hypotheses, methodology, and logistical plan were developed between July 2009 and August 2010. Likewise, the clinical state of the study was conducted between July 2010 and November 2010. Recruitment was completed by word of mouth and distributing a recruitment flier to possible referral sources (i.e., local mental health agencies, family medicine practitioners, and local newspapers). The flier was also posted at various campus locations (i.e., East Carolina University, Pitt Community College Campus Counseling Centers, East Carolina University Student Recreation Center, etc.).

Instruments

The Patient Health Questionnaire (PHQ)-9 (PHQ-9) is a nine-item self-administered depression scale and a component of a larger PHQ survey. The PHQ was originally a component of the Primary Care Evaluation of Mental Disorders (PRIME-MD),[20] a widely used diagnostic screening tool in primary care. The PRIME-MD was the first assessment to use the *Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition* diagnostic criteria to actually identify specific disorders.[21] In this study the depression scale (PHQ-9) was used as a screening tool for admission in to the study and to measure the efficacy of the CVG intervention.

The PHQ-9 has previously established internal reliability, test–retest reliability, and validity; the Cronbach's alpha coefficient of PHQ-9 was 0.857, and the test–retest reliability was 0.947. The correlation coefficient of the nine items with the total score of the scale was 0.588–0.784. The sensitivity and specificity of the PHQ-9 and the kappa value were 91 percent, 97 percent, and 0.884, respectively. The detection rate was 16.3 percent (95 percent confidence interval 13.4–19.3 percent).[22] The PHQ-9 is a useful tool to recognize not only major depression, but also subthreshold depressive disorder in the general population as well.[23] The PHQ-9 has also demonstrated ability in detecting depression symptoms and change over time and discriminated well between participants with any versus no depressive disorder, as well as between participants with and without major depression. A PHQ-9 score of ≥ 10 had 91 percent sensitivity and 89 percent specificity for major depression and 78 percent sensitivity and 96 percent specificity for any depression diagnosis.[24] The PHQ-9 has established concurrent validity[25] and established sensitivity to therapeutic effects.[26,27] The PHQ-9 uses a Likert-type scale and is interpreted as follows: 0–4 = none; 5–9 = mild depression; 10–14 = moderate depression; 15–19 = moderately severe depression; and 20–27 = severe depression.

Procedures

A statistical random number generator was used to randomize participants into the experimental and control groups. This was completed prior to the start of the study. If the participant was assigned to the control group, he or she was instructed to surf the National Institute of Mental Health's consumer Web site on depression (www.nimh.nih.gov/health/topics/depressionindex.shtml) for 30 minutes. The site provides extensive information on depression, including things that can be done to alleviate symptoms. The purpose was to simulate a similar physical and psychological experience (minus the entertainment) of the experimental group for comparison purposes.

If the participant was assigned to the experimental group, he or she was given a choice of three popular CVGs to play. Research has demonstrated that freedom to choose is an important precursor to experiencing the full benefits of recreation participation.[28] The experimental participants then played the games of their choice for 30 minutes while being recorded: 17 participants chose to play "Bejeweled 2," 9 participants chose "Peggle," and 4 participants played "Bookworm Adventures." All sessions were conducted with minimal distractions (blank walls, no outside view, minimal noise). All participants sat in the same chair in front of the same computer.

In addition to two lab sessions scheduled 1 month apart, the experimental group was instructed to play the CVG of their choice for at least 30 minutes three times per week with at least 24 hours in between sessions for 1 month. Participants were asked to keep a log of the amount of time spent playing the game during the month. Gameplaying time ranged from 30 to 68 minutes, with a mean for the experimental group at 40.7 minutes.

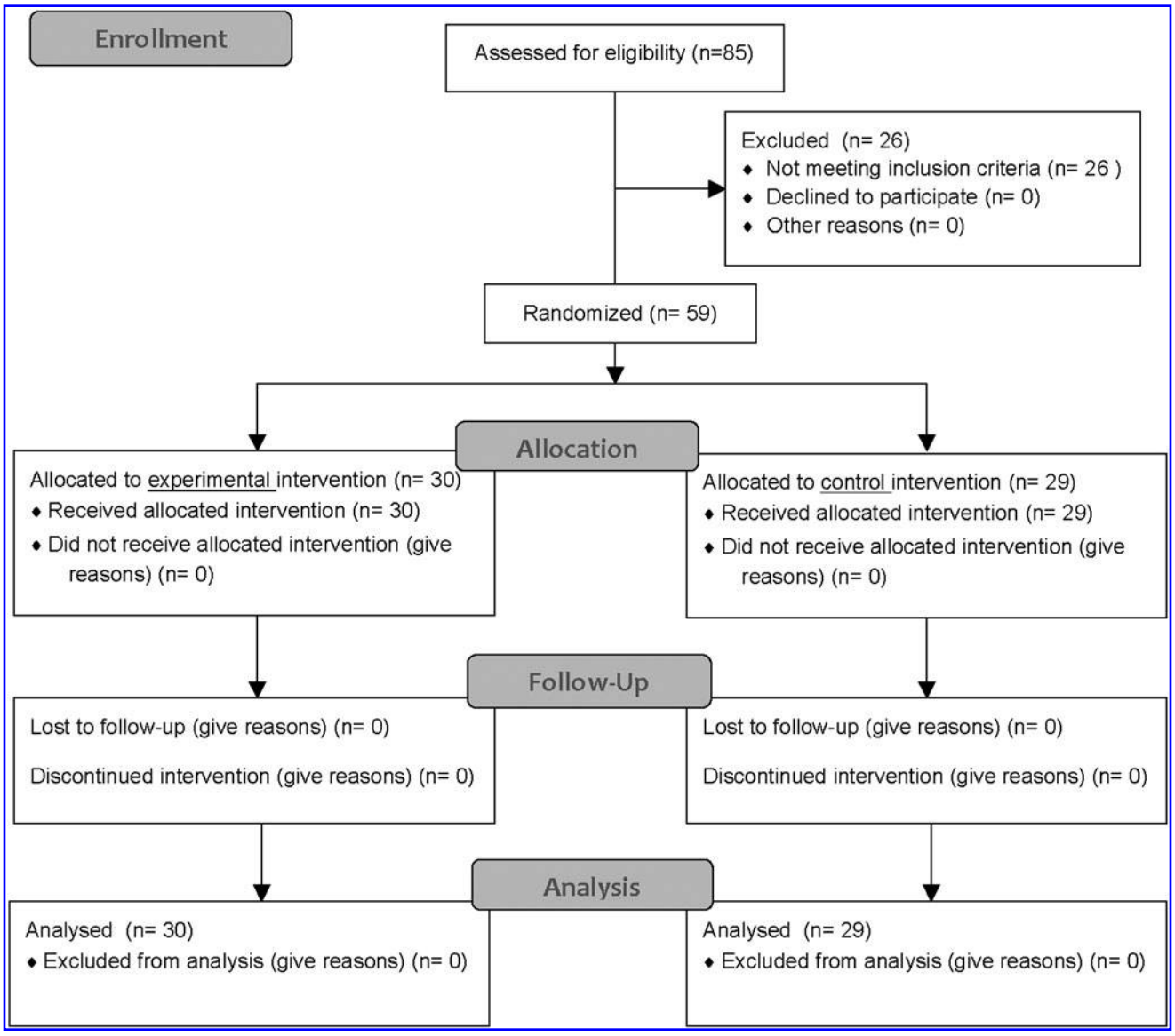
The researcher followed the same methodology for data collection during both the control and experimental group sessions. Before the first session participants completed the PHQ-9 following guidelines for standard administration. Participants returned in 1 month and followed the same procedures conducted during the first session. Participants in the control and experimental groups were asked to refrain from playing videogames other than those prescribed for the experimental group during the study. Participants were screened for depression using the PHQ-9 administered at the beginning of the first session and at the 1-month follow-up. During the pre-intervention assessment, demographic information was gathered on all participants.

The study followed the CONSORT statement guidelines for randomized controlled studies (http://www.consort-statement.org) and used the template (Fig. 1) provided by the CONSORT group to depict the flow of participants throughout the study.[29,30]

Statistical analyses

Power for this study was established on the whole sample size and based on a two-group Satterthwaite t test of equal means (unequal variances) (equal total n values). Results indicated a sample size of 40 per group would result in 78 percent power to detect significant size differences (mean ± standard deviation, 44.2 ± 14.7 versus 48.6 ± 16.5) (alpha = 0.05, one sided). This analysis was the basis for the sample size derivations.

FIG. 1. CONSORT 2010 flow diagram.



Data were collected by trained researchers, scored immediately, turned into the study coordinator for quality assurance, and entered into the computer. Data were coded and directly entered into SPSS version 20 software (IBM, Armonk, NY). Repeated-measures analysis of variance or mixed linear models were used to assess the changes within and between the control group and the experimental groups. Analysis of covariance statistical analysis was used to analyze covariates (i.e., medication use, sex, age, posttraumatic stress disorder level, etc.).

Results

In total, 59 participants included in the study: 85 people were screened for inclusion into the study, with 26 not meeting the entrance criteria, representing a rejection rate of 44 percent. There were 30 females and 29 males included in the study. Participants in the experimental group ranged in age from 18 to 56 years, with a mean age of 29 years, whereas participants in the control group ranged in age from 18 to 74 years, with a mean age of 31 years. Ethnic origins of respondents from the experimental group were reported to be 70 percent European American, 26.7 percent African American, and 3.3 percent Asian/Pacific Islander. Ethnic origins of participants in the control group were reported to be 65.5 percent European American, 20.7 percent African American, and 6.9 percent Latino American.

In the experimental group 56.7 percent of participants reported they had played a videogame in the previous week, and 40.0 percent had not. In the control group 75.9 percent of participants reported they had played a videogame in the previous week, and 24.1 percent had not. We conducted an analysis of covariance to determine whether medications had an effect and found 13.3 percent of the experimental group were using antidepressant medications, whereas 86.7 percent were not using any type of medication; values in the control group were 34.5 percent and 65.5 percent, respectively. There were no significant medication effects between the groups. Participants in the experimental group log sheet revealed that the experimental group played their CVG of choice three times a week for a minimum of 30 minutes, a maximum of 68 minutes, and an average of 40.7 minutes per week over the 1-month period (17 participants chose "Bejeweled 2," 9 participants chose "Peggle," and 4 chose "Bookworm Adventures").

Participants included in the study were individuals classified with clinical depression by a PHQ-9 minimum score of 5 or greater. In this study participants in the experimental group had a mean PHQ-9 score of 11. Participants in the control group had a mean score of 10.7 on the PHQ-9 depression scale.

Cronbach's alpha was used to calculate the reliability of the PHQ-9, with the coefficient being reported at 0.897. Repeated-measures statistical analyses were used to compare the difference between and within groups. Results indicated there was a significant interaction of group and time ($P = 0.018$), supporting the hypothesis that the groups would be different after the intervention. Moreover, when data were compared using tests of within-subjects contrasts between baseline (Time 1) and the end of the 1-month study (Time 3), we found significant decreases in depression symptoms in the experimental ($P = 0.000$) group. When this was compared with control group changes that also significantly changed ($P = 0.001$), the results were still significant ($P = 0.011$). When we compared Time 1 baseline with Time 4 (includes last transient recorded session), the results were similar ($P = 0.012$).

Table 1 presents the results for PHQ-9 scores for both the experimental and control groups during the four measurement times. The groups did not differ at baseline but did so at Time 2 (end of first recorded session), Time 3 (end of the 1-month home study), and Time 4 (end of the second recorded session).

Using Time 1 (initial baseline) and Time 3 (1 month later) as comparison points, the experimental group saw significant reductions in depression across the board, with all seven subjects previously classified as suffering from moderate to severe depression moving to the minor or minimal depression categories. At the same time, the number of subjects classified as having minor depression dropped from nine to four. Depression symptoms in males were significantly lower than in females ($P = 0.007$), differing at Time 2 ($P = 0.006$), Time 3 ($P = 0.004$), and Time 4 ($P = 0.000$). Participants' ages ranged from 18 to 74 years, with an average age of 30 years. To explore changes for young and old age groups, participants were separated into two equally distributed groups (26 years old and younger [$n = 30$] and 27 years of age and above). Results indicated those 26 years of age and younger experienced significant reductions in depression symptoms compared with those 27 years of age and older.

Discussion

The results of this randomized controlled clinical study clearly demonstrate that playing CVGs can facilitate a significant decrease in depression in the short term and also in the long term. It is remarkable that CVG play appeared to affect people suffering from depression whether it was mild or severe. Because there was no other intervention used besides CVGs, the findings lend support to the assertion that certain CVGs possess intrinsic value in terms of significant positive effects on depression.

There were no reports of negative or adverse effects during CVG play, illustrating that the intervention was safe. Lack of compliance, considered a major impediment to treatment success, was not an issue in this study as everyone in the experimental group reported that they played the minimum

Table 1. Comparisons Between Control ($N = 29$) and Experimental ($N = 30$) Groups During Four Measurements Using the Patient Health Questionnaire-9

Time	*MD*	*SE*	P *value*
1	−0.345	1.33	0.797
2	3.13	1.36	0.024
3	2.85	1.23	0.024
4	3.13	1.08	0.005

The mean difference (MD) is the average difference between the experimental and control group during each measurement. The standard error (SE) is the square root of the mean square error between groups from the repeated-measures analysis of variance multiplied by the square root of the sum of the reciprocals of the sample sizes.

required. These findings speak to the acceptance of this type of intervention by people.

One intriguing question that emerged involves how can game programmers, without healthcare training, develop games that reduce depression. One explanation is that the players tell the developers what they want, and they use their technical skills to build the program (intervention). Humans have always sought methods to alleviate depression, stress, and other harsh realities of life, whether they were board games, card games, sports, etc. It only makes sense that videogames would follow this route and become the modern version of these tried and true recreational activities. Thus, focus groups, user statistics, units sold, and the like have provided the information on "what works." These methods have helped produce games with safe environments, positive stroking, operant conditioning, mental distraction, mental challenge, individual accomplishment, and humor. A brief review of popular self-help books on managing depression will illustrate the similarities in recommended techniques and strategies.

New therapy strategies are developed in a similar fashion with clients and medical providers reporting things that work to researchers who study, refine, and sometimes publish them. The major advantage of CVGs, however, is they provide instant feedback and are fun, inexpensive, and readily available. Determining "what game actions produce which health affects" will provide insights into the underlying mechanisms of actions and assist programmers and clinicians get better at maximizing the effectiveness of these game and their outcomes.

Study limitations include findings that are based solely on self-reports. It is possible that participants did not play the game during the 1-month home CVG play but reported they did. Participants may not have liked the CVG they played, even though they were given the choice of three different CVGs to play. The ages of the participants ranged from 18 to 74 years, but most participants were in their early 20s and more game and technology savvy than older participants.

CVG participants had significant reduction in depression compared with surfing the National Institute of Mental Health's Web site (bibliotherapy). Many people do not receive any treatment for depression, and sometimes pharmacotherapy and other current interventions for depression are not optimal. Given the findings of this study, those working to ameliorate the affects of depression should consider offering the types of CVGs used in this study to assist in symptom reduction.

Future research is needed to assess the physiological changes that occur during gameplay to determine if these changes are related to reported changes in depression. Studying psychophysiological changes that occur during gameplay will help elucidate why CVG players experience changes in depression symptoms. Additional studies that help further establish the prescriptive parameters of CVGs for treating depression as an adjunct to, or even replacement for, standard therapies, including medication, are needed. Analysis of the contributions of various components of videogames in the reduction of depression symptoms is needed to maximize CVG efficacy and to establish standardized intervention protocols.

Author Disclosure Statement

No competing financial interests exist.

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