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Level Up: The Use of Video Games in Healthcare

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I. Introduction

Have you ever played video games? If the answer to that question is yes, you have contributed to the United States' multibillion-dollar gaming industry. The video game industry has expanded exponentially over the past few years and continues to grow.[1] Up until recently, this industry has been a cause of concern for many American households, especially those with young children.[2] However, in recent years, video games have been shown to improve patient health outcomes and transform how the healthcare field functions.[3] These new technologies are turning the healthcare field on its head in the best way possible.

This paper concludes that the positive effects associated with playing video games outweigh the negative impact that concerns most people. Part II of this paper will discuss the history of video games and how they have evolved to get to their current point. Part III discusses various purposes video games are serving in the healthcare field. Part IV discusses the adverse effects associated with gaming. Part V discusses gaming's positive impacts, including medical training, anxiety management, physical therapy, pain management, and more. Lastly, Part VI will conclude that although gaming sometimes has a bad reputation across the American population, using these technologies can be significantly advantageous.

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[1] Andrew Beattie, *How the Video Game Industry Is Changing*, INVESTOPEDIA, https://www.investopedia.com/articles/investing/05311/how-video-game-industry-changing.asp (last updated Oct. 31, 2021).

[2] AM. ACAD. OF CHILD & ADOLESCENT PSYCHIATRY, *Children and Video Games: Playing with Violence,* FACTS FOR FAMILIES (March 2011), https://www.aacap.org/App_Themes/AACAP/docs/facts_for_families/91_children_and_video_games_playing_with_violence.pdf.

[3] Brian A. Primack et al., *Role of video games in improving health-related outcomes: a systematic review*, AM. J. PREV. MED., June 2012, at 1, 2, 9.

II. Video Game History

The video game industry was estimated to be worth $159.3 billion in 2020 and is forecasted to increase to $200 billion by 2023.[4] Statistically, as described in *Video Game Industry Statistics, Trends and Data 2021*, "there are more than 2.7 billion gamers worldwide, with the United States covering only 19 percent of the global gaming market share."[5] The Asian-Pacific market is the current leader with roughly 48 percent.[6] Furthermore, "studies estimate that 214 million Americans play video games; 79 percent say games provide relaxation and stress relief."[7] Currently, 45 percent of video gamers are females, and 55 percent are males.[8] In sum, 64 percent of adults in the United States and 70 percent of those under 18 play video games.[9] These numbers are not surprising, considering video games have been around for decades and range from being played on arcade systems, home consoles, handheld consoles, and now even mobile phones. However, today, video games are more than a way to pass the time or unwind after a long workday.

Physicist William Higinbotham invented the first video game, *Tennis for Two,* which served as the inspiration for the popular game, *Pong*.[10] In the beginning, the first games did not have fancy graphics, and were rather simple.[11] The first home gaming console to be released in North

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[4] *Video Game Industry Statistics*, *Trends and Data In 2021,* WEPC, https://www.wepc.com/news/video-game-statistics/#:~:text=The%20Video%20Gaming%20Industry%20is,increase%20of%209.3%25%20from%202019 (last updated Nov. 17, 2021).

[5] *Id.*

[6] *Id.*

[7] ENTM'T SOFTWARE ASS'N, 2020 ESSENTIAL FACTS ABOUT THE VIDEO GAME INDUSTRY, 3 (July 15, 2020), https://www.theesa.com/wp-content/uploads/2021/03/Final-Edited-2020-ESA_Essential_facts.pdf.

[8] *Distribution of video gamers in the United States from 2006 to 2021, by gender*, STATISTA, https://www.statista.com/statistics/232383/gender-split-of-us-computer-and-video-gamers/ (last visited Nov. 21, 2021).

[9] ENTM'T SOFTWARE ASS'N, *supra* note 7, at 5.

[10] *This Month in Physics History,* APS NEWS, Oct. 2008, at 1, 2.

[11] *See id.*; *see* Ben Lewin, *The First Gaming Console,* COMPUTER MUSEUM OF AM. (June 22, 2020), https://www.computermuseumofamerica.org/2020/06/22/the-first-gaming-console/#:~:text=The%20Odyssey%20was%20manufactured%20by,gameplay%20that%20the%20Odyssey%20offered.

America was The Odyssey in 1972.[12] Following its release, it had great commercial success but eventually fizzled out.[13] In 1977, Atari released the Atari 2600, commencing the second generation of video game consoles.[14] Atari's home console featured joysticks and interchangeable game cartridges.[15] The years following Atari's release had notable milestones in video games, including the introduction of *Pac-Man* in the United States, Nintendo's creation of *Donkey Kong*, and the release of the *Space Invaders* arcade game.[16]

In 1982, the United States' gaming industry crashed and did not recover until 1985.[17] Nonetheless, in the early 1980s, the industry was thriving because the cost of home consoles was low, and the demand for new games was high.[18] However, because video games were a niche market, it was a fraction of the size it is today.[19] The first significant problem that contributed to the crash was the oversaturation of the video game console market.[20] Companies were also rushing to produce video games given the high demand, which led to console makers losing design control of the games being developed for their platforms.[21] Lastly, as described in *What was the Great Video Game Crash of 1983*, "the final contributing factor to the crash was the competition from personal computers."[22] Many consumers chose to purchase a home computer instead of a gaming console because computers had gaming abilities in addition to other

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[12] Ben Lewin, *The First Gaming Console,* COMPUTER MUSEUM OF AM. (June 22, 2020), https://www.computermuseumofamerica.org/2020/06/22/the-first-gaming-console/#:~:text=The%20Odyssey%20was%20manufactured%20by,gameplay%20that%20the%20Odyssey%20offered.

[13] *Video Game History*, HISTORY, https://www.history.com/topics/inventions/history-of-video-games (last updated June 10, 2019).

[14] *Id.*

[15] *Id.*

[16] *Id.*

[17] Joey the PM, *What was the Great Video Game Crash of 1983?*, BUGSPLAT BLOG, https://www.bugsplat.com/blog/video-games/great-video-game-crash-1983/ (last updated Aug. 28, 2020).

[18] *Id.*

[19] *Id.*

[20] *Id.*

[21] *Id.*

[22] *Id.*

functions that consoles did not have.[23] Luckily, the video game industry recovered a few years after the crash, this recovery was primarily due to the introduction of the Nintendo Entertainment System (NES) from Japan.[24] Three months after the introduction of the NES, stores had sold approximately 90,000 systems, and by the end of 1986, stores had sold 1.1 million systems.[25] Those numbers increased over the next few years because of the introduction of *Super Mario Bros*, which revolutionized the video game industry.[26] By the end of the 1980s, the NES became the premiere gaming device in the United States, with 30 percent of American households owning one.[27]

Historically, people thought of video games as entertainment; however, "serious games" have become increasingly popular in recent years.[28] Serious games are video games designed for training and education.[29] These games have proven that people can learn while they play.[30] Typically, the primary objective of serious games is learning or practicing a skill.[31] Their use has grown in the fields of education, science, health, and aeronautics.[32] The use of serious games has had a positive effect on these industries and continues to grow.[33]

Creating a serious game is no easy task. These games vary in format and objective; however, the same essential elements are required to ensure efficiency and effectiveness.[34] These elements

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[23] *Id.*

[24] *Video Game History*, *supra* note 13.

[25] Corey Irwin, *35 Years Ago: Nintendo Bring the NES to America*, ULTIMATE CLASSIC ROCK (Oct. 18, 2020), https://ultimateclassicrock.com/nintendo-nes-history/.

[26] Sam Stone, *How Super Mario Saved the American Video Game Industry*, CBR.COM (Sept. 4, 2020), https://www.cbr.com/super-mario-saved-american-video-game-industry/.

[27] Irwin, *supra* note 25.

[28] Pamela M. Kato, *Video Games in Health Care: Closing the Gap*, 14 REV. GEN. PSYCHOL. 113, 113 (2010).

[29] *Eight examples that explain all you need to know about serious games and game-based learning*, GAMELEARN, https://www.game-learn.com/all-you-need-to-know-serious-games-game-based-learning-examples/ (last visited Mar. 31, 2021).

[30] *Id.*

[31] *Id.*

[32] *Id.*

[33] *Id.*

[34] *Id.*

include a story, gamification, immediate and individualized feedback, simulation, and a goal.[35]

The purpose of a story is to motivate and keep players interested in the game.[36] Secondly,

gamification refers to the gaming dynamics, such as the rankings, rewards, or point systems.[37]

Gamification tends to motivate players and encourage their continued use of the game.[38] Thirdly,

players receive personalized feedback on their performance; this can be as simple as a reward or

a punishment.[39] However, some sophisticated games tell the player where they went wrong and

what to do to fix the problem.[40] Simulation is also an essential element because, in most cases,

games reproduce or imitate real-life situations.[41] Simulations allow players to develop and

practice new skills.[42] Lastly, serious games need to have a purpose that is not recreational.[43]

III. Video Games in Healthcare

There has been much research on the harmful effects of video games, effects such as obesity,

depression, vision problems, and desensitization.[44] However, recent research suggests that video

games may increase physical activity and enhance cognitive skills.[45] Video games can increase

activity and cognitive skills by targeting individuals with a sedentary lifestyle.[46] People who play

physically active video games tend to engage in physical activity more than those using

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[35] *Id.*
[36] *Id.*
[37] *Id.*
[38] *Id*.
[39] *Id.*
[40] *Id.*
[41] *Id.*
[42] *Id.*
[43] *Id.*
[44] Peter Grinspoon, *The Health Effects of Too Much Gaming*, HARV. HEALTH BLOG (Dec. 22, 2020), https://www.health.harvard.edu/blog/the-health-effects-of-too-much-gaming-2020122221645.
[45] *See* Allie Nicodemo, *Video Games Can Improve Your Health. You Just Need to Play the Right Ones.*, NEWS@NORTHEASTERN (July 24, 2018), https://news.northeastern.edu/2018/07/24/how-playing-the-right-video-games-can-lead-to-better-health/.
[46] *See id.*

traditional workout equipment.[47] This is because they get more enjoyment and feel more engaged in the activity.[48] Due to the success video games have had in the healthcare field, many institutes across the United States use gaming technology to help provide enhanced patient care.[49] These institutes include hospitals, doctors' offices, and medical schools.[50] In prior years, video games were used merely as a distraction for pain and to keep patients busy.[51] However, as technology has advanced, these games have developed to work muscles, increase movement, regulate breathing, and much more.[52] Some examples of video games that increase activity include *BoxVR*, *Zumba*, *Just Dance*, and *Ring Fit*.[53] Video games may very well be the future of the healthcare industry.

Nowadays, video games come in all shapes and sizes, including virtual reality (VR). VR is a computer-generated simulation of a three-dimensional image that one can interact with in a seemingly real or physical way using special electronic equipment.[54] There are many emerging hardware and software options in the VR space; however, HTC Vive Pro Eye, Oculus Quest, and PlayStation VR lead the way.[55] These companies began emerging around 2016 and have had tremendous success.[56]

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[47] *Study supports value of video games in promoting physical activity,* LIFESPAN (Mar. 7, 2019), https://www.lifespan.org/news/study-supports-value-video-games-promoting-physical-activity.
[48] *Id.*
[49] Tim Lougheed, *Video games bring new aspects to medical education and training*, CMAJ, Sept. 16, 2019, at E1034, E1035.
[50] *Id.*
[51] Meeri Kim, *Virtual reality is being used by hospitals to help people cope with pain*, THE WASH. POST (June 9, 2018), https://www.washingtonpost.com/national/health-science/virtual-reality-is-being-used-by-hospitals-to-help-people-cope-with-pain/2018/06/08/07e8b39e-6424-11e8-a768-ed043e33f1dc_story.html.
[52] *Are Video Games Changing The Way We Deliver Healthcare*?, HEALTHCARE GLOBAL (May 17, 2020), https://www.healthcareglobal.com/technology-and-ai-3/are-video-games-changing-way-we-deliver-healthcare.
[53] *See* Vic Hood, *Best Fitness games 2021: top exercise games to make you break a sweat*, TECHRADAR (May 23, 2021), https://www.techradar.com/news/best-fitness-games.
[54] *Virtual Reality*, LEXICO, https://www.lexico.com/en/definition/virtual_reality (last visited Mar. 26, 2021).
[55] Joe Bardi, *What is Virtual Reality (Definition and Examples)*, MARXENT, https://www.marxentlabs.com/what-is-virtual-reality/ (last updated Sept. 21, 2020).
[56] *See id.*

In the 1980s, people began using video games for therapeutic purposes.[57] At the time, most of the players were children, since videogame manufacturers targeted this market.[58] However, the market has boomed since the 1980s and continues to grow.[59] Currently, the healthcare field uses video games primarily to help medical students master various skills.[60] While this may be the primary use, it certainly is not the only use. Medical professionals can now use games to improve cognitive ability, increase mobility (with the help of VR), and treat pediatric attention-deficit/hyperactivity disorder (ADHD).[61]

IV. Negative Effects

Playing video games can also come with consequences. It is best to play games in moderation and be mindful of the risks associated with gaming.[62] The most commonly discussed adverse effects include obesity, social disconnection, and enabling violent tendencies.[63] However, most of these concerns stemmed from the use of traditional video games.[64] While

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[57] Mark Griffiths, *The educational benefits of videogames*, 20 EDUC. AND HEALTH J., no.3, 2002 at 47, 48.

[58] Kato, *supra* note 28, at 114.

[59] Laura Stockdale & Sarah M Coyne, *Parenting paused: Pathological video game use and parenting outcomes*, 11 ADDICTIVE BEHAV. REP. 1, 1 (2020).

[60] *Video games are changing medical education*, AMA, (Jan. 28, 2016), https://www.ama-assn.org/education/accelerating-change-medical-education/video-games-are-changing-medical-education.

[61] N. A. Hashim et al., *Video Game–Based Rehabilitation Approach for Individuals Who Have Undergone Upper Limb Amputation: Case-Control Study*, 9 JMIR SERIOUS GAMES 1, 2 (2021); Tom Huddleston Jr., *See the first-ever video game approved by the FDA as a mental health treatment*, CNBC (June 17, 2020), https://www.cnbc.com/2020/06/17/video-endeavorrx-is-first-video-game-approved-by-fda-to-treat-adhd.html; *Can playing video games help cancer patients?*, CANCER TREATMENT CTRS. OF AM. (Feb. 14, 2017), https://www.cancercenter.com/community/blog/2017/02/can-playing-video-games-help-cancer-patients.

[62] Kevin Joy, *Video Games OK in Moderation, If You Know When to Hit 'Pause'*, MICHIGAN HEALTH (Sept. 23, 2016), https://healthblog.uofmhealth.org/childrens-health/video-games-ok-moderation-if-you-know-when-to-hit-pause.

[63] Catharine Paddock, *Video Game Addiction Tied To Depression, Social Problems And Poorer Grades In School*, MEDICALNEWSTODAY (Jan. 17, 2011), https://www.medicalnewstoday.com/articles/213929#1.

[64] *See* Christopher J. Baker, *Video Games: Their Effect on Society and How We Must Modernize Our Pedagogy for Students of the Digital Age* (Dec. 2014) (unpublished B.A. thesis, Virginia Commonwealth University) (on file with the Graduate School at VCU Scholars Compass, Virginia Commonwealth University).

playing video games may have some benefits, our psychological health may suffer if we spend too much time gaming, specifically because of the potential social disconnection.[65]

The greatest concern arises from parents with young children. They believe their children are becoming "addicted" if they spend most of their free time playing video games.[66] As such, the issues associated with extensive video game playing are the leading causes of concern. These issues include craving, loss of control, low self-esteem, and anxiety.[67] While playing video games is not necessarily problematic, children still need to interact with other children in real life to develop social skills, regulate their emotions, and form a sense of identity.[68] Additionally, children need to expend their energy, and parents should encourage children to play outdoors if they allow their children to play video games.[69] Children are only children once and should be exposed to a wide array of activities.

Research has shown that exposure to violence increases aggressive behavior in children.[70] However, aggressive behavior can be anything from physical to nonphysical acts intended to injure or irritate, meaning the definition of aggressive behavior typically varies on each survey.[71] Additionally, these studies usually look at television and movies instead of video games, making it difficult to definitively state that video games cause aggressive behavior.[72] However, as stated in the October 2009 *Harvard Health Letter*, research has shown that aggressive thoughts and

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[65] Paddock, *supra* note 64.

[66] Kabir Lal, *How Does Game Addiction Affect Families?,* HEALTHY GAMER, https://www.healthygamer.gg/blog/how-does-video-game-addiction-affect-families (last visited Nov. 21, 2021).

[67] Juliane M. von der Heiden et al., *The Association Between Video Gaming and Psychological Functioning*, FRONTIERS IN PSYCHOL., July 26, 2019, at 1, 2.

[68] *What is Social and Emotional Development,* HELP ME GROW MN, https://helpmegrowmn.org/HMG/HelpfulRes/Articles/WhatSocialDev/index.html.

[69] *See* Claire McCarthy, *6 reasons children need to play outside*, HARV. HEALTH BLOG (Oct. 27, 2022), https://www.health.harvard.edu/blog/6-reasons-children-need-to-play-outside-2018052213880.

[70] *Game on*, HARV. HEALTH LETTER 4 (Oct. 2009), https://www.health.harvard.edu/newsletter_article/game-on.

[71] L. Rowell Huesmann & Laramie D. Taylor, *The Role of Media Violence in Violent Behavior*, 27 ANNU. REV. PUBLIC HEALTH 393, 395 (2006).

[72] *Id.* at 395, 399; *Violence in the media: Psychologists study potential harmful effects*, AM. PSYCHOL. ASS. (2013), http://www.apa.org/topics/video-games/violence-harmful-effects.

"violent scenes in shooter games activate the same part of the brain."[73] These video games

include *Halo* and *Doom* where the game is played from the perspective of someone shooting a

gun and typically killing someone.[74] An important note is that some researchers suggest that

these action games have benefits on their players including, sharper attention and spatial

awareness.[75] The best way to determine if video games harm someone is to look at other factors

such as personality traits, home life and family history, and overall response to playing video

games.[76]

Another adverse effect of playing video games is obesity, specifically in children.[77] The

United States pediatric obesity rate has tripled in the past few decades.[78] The cause of the

increased obesity rate cannot be based solely on genetics; the child's environment has also

played a crucial role.[79] To maintain the same weight, the number of calories consumed must

equal the amount expended.[80] If someone does not live an active lifestyle, it becomes easy to

gain weight, and a sedentary lifestyle is typical in today's society, as many people have a desk

job or are pursuing higher education.[81] This sedentary lifestyle continues after work, with most

people using television and video games as a form of relaxation.[82] While children are typically

more active than adults, it is not always the case today, and it is best to encourage mobility in

children.[83] On a positive note, many video games now promote an active lifestyle, such as *Dance*

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[73] *Game on*, s*upra* note 70.
[74] *Id.*
[75] Isabela Granic et al., *The Benefits of Playing Video Games*, 69 AM. PSYCHOLOGIST, no.1, 2014 at 66, 68-69.
[76] *Id.* at 74.
[77] Sandra L. Calvert et al., *Electronic Gaming and the Obesity Crisis*, NEW DIRECTIONS FOR CHILD AND ADOLESCENT DEV., Spring 2013, at 1, 1.
[78] *Id.*
[79] *Id.*
[80] *Id.*
[81] *See id.* at 3.
[82] *See id.* at 1.
[83] Allana G. LeBlanc et al., *Active Video Games and Health Indicators in Children and Youth: A Systematic Review*, PLOS ONE, June 14, 2013, at 1,1.

Dance Revolution.[84] Those playing "active" games expend more energy than those playing

traditional "inactive" games.[85]

Lastly, playing video games typically leads to social disconnection.[86] Gamers start to spend

most of their time playing in a virtual world, which minimizes their interaction with people in the

real world. However, some people may develop friendships with other gamers, but their

interaction is nowhere near as meaningful as the interaction they would have in real life.[87] While

these friendships may be strong in the gaming community, it is rare that gamers meet up in

person and have an authentic human interaction.[88] One Iranian study showed that those addicted

to video games had lower social skills.[89] One must have social interaction; social skills are not

entirely naturally occurring.[90] By not interacting with others, these skills deteriorate over time.[91]

The best way to continue to develop these skills is to practice social interaction.[92]

V. Positive Effects

It is not surprising that most studies conducted regarding video games emphasize their

adverse effects.[93] People commonly associate video games with teenage boys and staring at a

screen for hours on end. However, video games can also impact the human body in positive

ways.[94] While there may not be many studies, some have demonstrated that video games

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[84] Calvert, *supra* note 77, at 1*;* Vic Hood, *Best Fitness games 2021: top exercise games to make you break a sweat*, TECHRADAR (May 23, 2021), https://www.techradar.com/news/best-fitness-games.
[85] Calvert, *supra* note 77, at 3-4.
[86] Kabir Lal, *10 Negative Effects of Video Games,* HEALTHY GAMER, https://www.healthygamer.gg/blog/10-negative-effects-of-video-games (last visited Nov. 21, 2021).
[87] *See id.*
[88] *Id.*
[89] *Id.*
[90] T. Bovey & P. Strain, *Promoting Positive Peer Social Interactions*, CTR. ON THE SOC. AND EMOTIONAL FOUND. FOR EARLY LEARNING, https://challengingbehavior.cbcs.usf.edu/docs/whatworks/WhatWorksBrief_8.pdf (last visited Dec. 28, 2021).
[91] Lal, *supra* note 86.
[92] *See id.*
[93] Von der Heiden, *supra* note 67, at 1-2.
[94] Christian M. Jones et al., *Gaming well: links between videogames and flourishing mental health*, FRONTIERS IN PSYCHOL., Mar. 31, 2014, at 1, 2.

positively affect depression management, physical therapy, cancer treatment, Parkinson's disease, and autism.[95] Furthermore, doctors and surgeons are now using video games to fine-tune their skills and get additional practice before operating on a real-life human body.[96] By allowing this form of training, doctors feel more comfortable in the operating room, leading to fewer errors and patient deaths.[97]

Video games for doctors have become a growing trend.[98] In 2016, medical experts and software developers teamed up to create *Osso VR*.[99] The goal of using VR was to attempt to minimize unpredictability and give surgeons the tools to handle surgery properly.[100] This technology has had wild success. In fact, it was one of *Time Magazine*'s best inventions of 2019.[101] According to a study conducted at the University of California at Los Angeles, training with VR is 230 percent more efficient than traditional training.[102] This training method is likely more beneficial because it provides immersive, hands-on training, similar to what one sees in the operating room.[103]

Additionally, prior video game experience might give an advantage to novice robotic surgeons. With robot-assisted surgery growing, more and more surgeons are being trained with

[95] Shawn Wood, *Video Games Help Patients and Health Care Providers*, UNEWS ARCHIVE (Sept. 19, 2012), https://archive.unews.utah.edu/news_releases/video-games-help-patients-and-health-care-providers/.
[96] Verena Dobnik, *Surgeons may err less by playing video games*, NBC NEWS (April 7, 2004) https://www.nbcnews.com/id/wbna4685909.
[97] *Id.*
[98] Elise Favis, *From surgery simulators to medical mishaps in space, video-game tech is helping doctors at work*, WASH. POST (Jan. 9, 2020), https://www.washingtonpost.com/video-games/2020/01/09/surgery-simulators-medical-mishaps-space-video-games-are-helping-doctors-do-their-jobs/.
[99] *Id.*
[100] *Id.*
[101] *Id.*
[102] Gideon Blumstein, *Research: How Virtual Reality Can Help Train Surgeons*, HARV. BUS. REV. (Oct. 18, 2019), https://hbr.org/2019/10/research-how-virtual-reality-can-help-train-surgeons.
[103] *Id.*

this technology.[104] In one observational study, thirty medical students and two interns were divided into groups according to prior gaming experience, some gaming experience, and no gaming experience.[105] The participants with gaming experience significantly outperformed those with no gaming experience in three of twenty-four performance metrics and an upward trend toward better results for seven of the twenty-one remaining metrics.[106] Overall, prior video game experience (even if minimal) might give doctors a slight advantage in robotic surgery.[107]

Mental health is just as important as physical health. Anxiety, depression, and stress are prevalent, although they remain under-diagnosed.[108] Some anxiety is expected, such as when taking a test, public speaking, or preparing for and participating in a job interview.[109] However, once someone develops an anxiety disorder, it can be challenging to overcome.[110] Anxiety disorders can be intense and debilitating.[111] An anxiety attack is "a feeling of overwhelming apprehension, worry, distress, or fear."[112] Common symptoms include dizziness, shortness of breath, sweating, and numbness.[113] Anxiety is not something one can brush off, and anyone can be susceptible to it regardless of age and gender. So how exactly does playing video games reduce stress and anxiety? Video games reduce stress by simply being engaging and

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[104] *CMH Grows Robotic Surgery Program with More Trained Surgeons, Top-of-the-Line Robots*, COMMUNITY MEMORIAL HEALTH SYS. (Feb. 18, 2020), https://blog.cmhshealth.org/2020/02/18/cmh-grows-robotic-surgery-program-with-more-trained-surgeons-top-of-the-line-robots/.

[105] Andreas Pierre Hvolbek et al.*, A prospective study of the effect of video games on robotic surgery skills using the high-fidelity virtual reality RobotiX simulator*, 10 ADVANCES MED. EDUC. AND PRAC. 627, 627 (2019).

[106] *Id.*

[107] *Id.* at 630, 633.

[108] *See* Paul Swift et al.*, Living with Anxiety*, MENTAL HEALTH FOUND., 3, 9 (2014), https://www.mentalhealth.org.uk/sites/default/files/living-with-anxiety-report.pdf.

[109] Kendra Cherry, *What Is Situational Anxiety?,* VERYWELL MIND (Dec. 4, 2020), https://www.verywellmind.com/what-is-situational-anxiety-5088417.

[110] *Id.*

[111] Kimberly Holland, *Everything You Need to Know About Anxiety*, HEALTHLINE, https://www.healthline.com/health/anxiety#disorders (last updated Sept. 3, 2020).

[112] *Id.*

[113] *Id.*

enjoyable.[114] Additionally, gaming results in dopamine secretion, which results in positive feelings.[115] Lastly, as stated by Kabir Lal in his article about how video games reduce stress, he found that video games "present a challenge and reward you for overcoming it, which leads to a feeling of competence."[116] In turn, that feeling reduces the stress of achieving long-term goals.[117] Although not everyone can overcome the challenges presented in video games, it incentivizes perseverance.[118] Instead of developing depression or anxiety for not overcoming the obstacles, players are motivated to keep trying rather than conceding.[119]

Another area of the potential utility of video games is in physical therapy.[120] Many people believe that physical therapy is hard on the body, and it is very easy for someone to get discouraged, especially as it is a long-term challenge.[121] As stated in Amanda Staino and Rachel Flynn's article on the therapeutic uses of active video games, these active games may be "useful for promoting physical activity for therapeutic uses such as improved balance, rehabilitation, and better management of illness or disease."[122] Traditionally, in the first six months following a stroke, there are significant amounts of recovery.[123] Physical therapists take advantage of the increased neuroplasticity by using rigorous physical therapy techniques.[124]

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[114] Kabir Lal, *Do Video Games Reduce Stress*?, HEALTHY GAMER, https://www.healthygamer.gg/blog/do-video-games-reduce-stress (last visited Dec. 27, 2021).

[115] Amy Paturel, *Game Theory: The Effects of Video Games on the Brain*, BRAIN&LIFE (June 2014), https://www.brainandlife.org/articles/how-do-video-games-affect-the-developing-brains-of-children/.

[116] Lal, *supra* note 114.

[117] *Id*.

[118] Granic, *supra* note 75, at 71.

[119] *Id.*; Jane McGonigal, *How Video Games Can Teach Your Brain to Fight Depression*, SLATE (Nov. 9, 2015), https://slate.com/technology/2015/11/how-video-games-can-teach-your-brain-to-fight-depression.html.

[120] Amanda E. Staiano & Rachel Flynn, *Therapeutic Uses of Active Videogames: A Systematic Review*, 3 GAMES FOR HEALTH J. 351, 351 (2014).

[121] *No Pain, No Gain*?, INTEGRATED REHABILITATION SERVICES (April 3, 2018), https://integrehab.com/blog/physical-therapy/no-pain-no-gain/.

[122] Staiano, *supra* note 112.

[123] Keith Lohse et al., *Video Games and Rehabilitation: Using Design Principles to Enhance Engagement in Physical Therapy*, 37 J. NEUROLOGIC PHYSICAL THERAPY 166, 167 (2013).

[124] *Id.* at 167.

Virtual reality can be used to supplement bilateral training and constraint-induced movement therapy techniques (CIMT).[125] As defined by Phisiopedia, "CIMT forces the use of the affected side by restraining the unaffected side."[126] Patients who are taught motor skills in virtual reality have better retention and are better at transferring those skills to the real world.[127] To maximize effectiveness, therapy needs to utilize high repetition, clear rewards, and supervision.[128] All of these elements can be monitored with the technology of VR.[129]

Many techniques are available for facilitating physical therapy; however, motivation is one of the biggest obstacles that people face.[130] Motivation, access, and cost all attribute to the amount of time someone spends in therapy following an accident.[131] Studies have shown that playing video games in a rehabilitative setting will positively impact therapy performance.[132] As such, by adding games to a physical therapy routine, patients will see a more significant improvement.[133]

Cancer treatment is strenuous and can take a toll on the body.[134] Many cancer patients have trouble focusing and remembering.[135] These patients exercise their brain by playing video games which helps them combat memory loss and treatment-related side effects.[136] According to

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[125] Eun-Kyu Ji & Sang-Heon Lee, *Effects of virtual reality training with modified constraint-induced movement therapy on upper extremity function in acute stage stroke: a preliminary study,* 28 J. PHYS. THERAPY SCI. 3168, 3171 (2016).

[126] *Constraint-Induced Movement Therapy (CIMT)*, PHYSIOPEDIA, https://www.physio-pedia.com/Constraint-Induced_Movement_Therapy_(CIMT) (last visited March 26, 2021).

[127] N. A. Hashim et al., *Video Game–Based Rehabilitation Approach for Individuals Who Have Undergone Upper Limb Amputation: Case-Control Study*, 9 JMIR SERIOUS GAMES 1, 2 (2021).

[128] *Id.*

[129] *See id.*

[130] *See id.* at 6, 8.

[131] Kristen Jack et al., *Barriers to treatment adherence in physiotherapy outpatient clinics: A systematic review*, 15 MANUAL THERAPY 220, 223, 227 (2010).

[132] *See* Hashim, *supra* note 119, at 6, 8.

[133] *See id*.

[134] *See Memory or Concentration Problems and Cancer Treatment*, NIH NATIONAL CANCER INSTITUTE, https://www.cancer.gov/about-cancer/treatment/side-effects/memory (last updated Jan. 15, 2020).

[135] *Id.*

[136] *Can playing video games help cancer patients?*, CANCER TREATMENT CTRS. OF AM. (Feb. 14, 2017), https://www.cancercenter.com/community/blog/2017/02/can-playing-video-games-help-cancer-patients.

the American Society of Clinical Oncology, 75 percent of patients have memory and cognition challenges while undergoing treatment.[137] These issues may include "difficulty learning new information or tasks, having trouble multitasking, recalling common words, names or dates, or just taking longer to process information."[138] Since video games require rapid movement and quick decision-making, some studies have shown that games improve a patient's attention and decision-making skills.[139]

Memory loss occurs in more than just cancer patients.[140] Recently, researchers have discovered a link between video games and a reduced risk of Alzheimer's disease and dementia.[141] As Alzheimer's disease progresses, caregivers have trouble keeping their patients engaged.[142] According to a 2015 study in the United Kingdom, playing online games that exercise reasoning and memory skills could significantly benefit older people.[143] Since the release of this study, researchers have focused on the impact of video games.[144] A study from the University of Montreal tested the effects of video games on grey matter in the hippocampus (the part of the brain that promotes memory building).[145] In the study, researchers separated adults aged 55-75 into three groups, one taking computerized piano lessons, another taking no specific action, and one playing *Super Mario 64*.[146] The group playing *Super Mario 64* experienced an increase in grey matter.[147] As a result of this study, researchers concluded that

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[137] *Id.*

[138] *Id*.

[139] Granic, *supra* note 75, at 69; Daphne Bavelier et al., *Brains on video games*, NAT. REV. NEUROSCI., Nov. 18, 2011, at 1, 2-4.

[140] Becky Brown, *The Most Common Causes of Memory Loss*, FORBES HEALTH (JULY 28, 2021), https://www.forbes.com/health/healthy-aging/memory-loss-causes/.

[141] *Alzheimer's, Brain Activity, and Video Games*, BEST ALZHEIMER'S PRODUCTS, https://best-alzheimers-products.com/alzheimers-video-games.html (last visited April 23, 2021).

[142] *Id.*

[143] *Id.*

[144] *See id.*

[145] *Id.*

[146] *Id.*

[147] *Id.*

video games improve memory and potentially reduce the risk of Alzheimer's and similar diseases.[148]

Lastly, an increasing number of doctors prescribe video games for children with ADHD.[149] More than 6.1 million children aged 2 to 17 years old have been diagnosed with ADHD.[150] Roughly two-thirds of children diagnosed with ADHD are on medication. While many argue that the medication greatly helps children, treating children with stimulants has been an ongoing controversial debate.[151] The crux of the debate is that doctors often overprescribe to children, and stimulants have many side effects, including long-term dependency.[152] In 2015, the United States Food and Drug Administration approved the first video game therapeutic as a treatment for ADHD based on research by Adam Gazzaley, a professor at UC San Francisco.[153] In 2013, Gazzaley published a paper about his research findings that showed that after six weeks of training on *Neuroracer* (a video game), older adults showed improved attention.[154] These results led to FDA approval for a children's version of the technology called *EndeavorRX*.[155] While this may be the first prescription video game, children with ADHD can benefit from game-based digital therapeutic devices.[156] The games can help with time management skills,

[148] *Id.*

[149] Tom Huddleston Jr., *See the first-ever video game approved by the FDA as a mental health treatment*, CNBC (June 17, 2020), https://www.cnbc.com/2020/06/17/video-endeavorrx-is-first-video-game-approved-by-fda-to-treat-adhd.html.

[150] Sarah Sheppard, *FDA Approves Prescription Video Game for ADHD*, VERYWELL MIND, https://www.verywellmind.com/a-new-video-game-has-been-approved-by-the-fda-to-treat-adhd-5069615 (last updated June 29, 2020).

[151] *Id.*

[152] *See* Shaheen E. Lakhan & Annette Kirchgessner, *Prescription stimulants in individuals with and without attention deficit hyperactivity disorder: misuse, cognitive impact, and adverse effects*, BRAIN AND BEHAV. 661, 662-3, 671 (2012).

[153] Laura Kurtzman, *FDA Approves Video Game Based on UCSF Brain Research as ADHD Therapy for Kids,* UNIV. OF CALI. S.F. (June 15, 2020), https://www.ucsf.edu/news/2020/06/417841/fda-approves-video-game-based-ucsf-brain-research-adhd-therapy-kids.

[154] *Id.*

[155] *Id.*

[156] *FDA Permits Marketing of First Game-Based Digital Therapeutic to Improve Attention Function in Children with ADHD*, FDA (June 15, 2020), https://www.fda.gov/news-events/press-announcements/fda-permits-marketing-first-game-based-digital-therapeutic-improve-attention-function-children-adhd.

problem-solving, hand-eye coordination, and collaboration.[157] Doctors do not prescribe

EndeavorRX to replace medication; instead, it is used to minimize the need for high doses or

additional medications.[158] Products similar to *EndeavorRX* are becoming increasingly popular

today.[159]

VI. The Future of Healthcare

In conclusion, the hobby that Americans once used to pass the time and relax is

transforming how the healthcare field operates. Video games are being used by more than just

the general population and are helping treat a wide variety of diseases and conditions. It is only a

matter of time before we see these technologies take over modern medicine for specific health

needs. With the emergence of apps and mobile devices, developers can create more games to

help patients. Hopefully, in the years to come, we will see some significant drastic improvements

in the healthcare system. Despite some of the limitations that come with gaming technology,

video games can improve health outcomes. We simply must get everyone to accept this fact.

However, to fully assess the potential benefits, future research is needed to get a comprehensive

understanding of video games' potential. With this research, hopefully, more Americans are

helped.

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[157] Regina Boyle Wheeler, *ADHD and Video Games: Is There a Link?,* WEBMD (July 7, 2020),
https://www.webmd.com/add-adhd/childhood-adhd/adhd-and-video-games-is-there-a-link.
[158] Sheppard, *supra* note 150.
[159] *See* Darius Tahir, *More than a game*, POLITICO (Sept. 9, 2020), https://www.politico.com/newsletters/future-pulse/2020/09/09/more-than-a-game-790295.