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Does playing different game genres affect obesity levels in gamers?

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RSCH 202: Introduction to Research Methods

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ABSTRACT

This paper examines the relationship between playing various gaming genres and its effect on obesity. While previous studies have generally associated gaming with obesity, some have highlighted that certain game genres, exergames, require gamers to be physically active to play the game, leading to a reduction in gamers' weight. To study this relationship, we conducted a survey and analyzed the collected data using ANOVA and Regression Analysis. Our preliminary findings from one-way ANOVA and two-way ANOVA with interaction, indicates significant association between game genre and engagement per session with BMI. The interaction between them suggests that the effect of game genre on BMI is dependent on the engagement per session, as the p-value of 6.54e-10 is less than the 5% significance level. Our regression results suggest that some game genres, such as Action and Multiplayer Online Battle Arena (MOBA), had a significant impact on obesity. However, first-person, puzzle/casual and simulation/sports games were not significantly associated with BMI. Our regression models also found that higher engagement in gaming per week and session correlates with a higher BMI. Our findings may offer game developers to collaborate with field experts, leading to evidence-based interventions that mitigate obesity risks and promote healthier gaming practices across game genres.

Keywords: Gaming, Obesity, Health, Gaming Genres

INTRODUCTION

In the past, most games played were, to name a few, lawn games, outdoor sports games, board games, pencil and paper games, and card games (Keerthi, 2022). With digital devices becoming more and more readily available for children, it increases the number of possible gaming platforms for children to game on. Video gaming has been in existence since the 1970s, and advances in technology have led to a rise in a variety of gaming platforms such as tablets, smartphones, and computers (Ayenigbara, 2018). Fast forward to early 2020 much of the world was under lockdown due to the Covid-19 pandemic, this created an environment where everyone had to stay home to avoid contracting the disease. A by-product of this environment led to an increase in gaming among the youth and adults and during the period of the initial outbreak there was a 39% global increase in time spent video gaming (Statista, 2021). According to Haug et al. (2022), the Covid-19 pandemic has had a significant impact on young people, especially children's physical and mental health. Additionally, the youth nowadays often spend their time on screen-based activities instead of physical activities like sports for example. This has led to many concerns about the possibility of children developing sedentary behaviors which are associated with a heightened risk of obesity and other health-related illnesses (Haug et al., 2022).

To better understand how playing particular game genres may lead to weight gain, this paper intends to explore the impact and association between video game genres and obesity levels among gamers. We expect that by studying this link, we will be able to give insights and important information for the creation of policies and programs to encourage better gaming practices among gamers.

With our research question being "Does playing different game genres affect obesity levels in gamers", it is important to note that the estimated number of global gamers is nearly half the world's population in 2023. Additionally, according to Rigby and Coghill (2023), the World Obesity Federation predicts that 51% of the world in the next 12 years will be obese or overweight, which is a looming concern.

As prior studies were focused on studying the relationship between game duration, gaming in general, and obesity, to contribute to this body of literature, we as a team have decided to determine whether different game genres affect obesity levels in gamers. Furthermore, the findings from our studies can guide game developers to promote healthier gaming practices and to avoid risks of obesity throughout the various existing gaming genres.

We would be collecting data by having 384 respondents, who are gamers, fill up our survey that would be shared on various gaming communities, consisting of questions that would provide us with quantitative and qualitative data. With the data that the respondents provided to the survey questions, it will be used to analyze if there is a relationship between playing various game genres and gamers' obesity levels, through using tests such as ANOVA and Regression Analysis. The main findings from our analysis are that gaming genres such as action and MOBA games were statistically significant and had an impact on gamers' obesity levels.

LITERATURE REVIEW

Previous Research

Prior studies that have been conducted mainly looked into game duration, gaming in general, and obesity, and the results of those studies have suggested that there is indeed a strong correlation between the duration of video gaming and obesity.

In a study conducted in 2019 by Phan et al. in which they examined the relationship between video game playing time and class 3 severe obesity in youth aged 11 to 17 with higher obesity rates observed among those playing video games for extended periods of time. The results of this study show that 28% of those who play 2 to 4 hours a day tend to be overweight or obese. Meanwhile, 48% of those who played 4 to 6 hours and 56% of those who played 6 hours a day had class 3 severe obesity.

In support of the claims that gaming can lead to obesity (Arnaez et al., 2018) conducted a cross-sectional study to determine if platform preferences, number of platforms used, and amount of gaming time correlate to obesity among adult gamers. This study found a significant linear relationship between the number of platforms used and the odds of being obese and spending more time sitting on the weekend. Furthermore, those who reported spending a large amount of time playing video games reported being obese at a higher rate.

Other studies done by Calvert et al. (2013) and Stubbledfield et al. (2017) have discovered that prolonged duration of device usage may potentially be associated with prolonged gaming and may lead to weight gain. The study done by Calvert et al. (2013) suggested that food advertisements promoted in games may tempt gamers to eat compulsively, as the longer one games, they would be exposed to more food advertisements, potentially tempting the gamers to eat compulsively.

The study done by Stubblefield et al. (2017) suggested that with the increase in screen hours, it can contribute to weight gain because of social dysfunction. Hence, both studies have discovered that with prolonged gaming involving longer periods of screen and device usage, it can lead to weight gain, resulting in obesity.

A study conducted by Mitchell et al. (2013) examined the effects of screen time on BMI distribution among 14-18-year-old adolescents. The longitudinal study included 1,429 participants from four suburban Philadelphia high schools who self-reported their height, weight, and the amount of time they spent watching television and playing video games. As a result of the study, it appears that a higher quantity of screen time leads to a higher BMI for those at the upper tail of the BMI distribution. Moreover, the study emphasizes the necessity of obtaining more accurate measurements of adipose tissue and BMI for future research. In summary, the study provides valuable insights into the relationship between screen time and adolescent obesity that can be used to inform interventions intended to reduce the prevalence of obesity in adolescents.

According to Vandewater, Shim, and Caplovitz (2004), obesity, physical activity, and children's media use, particularly television and video games, are related. The result of the study shows that playing video games was associated with obesity. Moreover, it was found that playing video games was associated with both linear and curvilinear of weight status, however, there was no indication as to the direction of the association. In addition, it was also found that children with greater weight status spent more time engaging in sedentary activities than children with lower weight status. There are limitations to this study due to its reliance on outdated data and the lack of clarity regarding the direction of the link between playing video and obesity. Nonetheless, the study suggests that there may be a relationship between playing video games and obesity in children, which warrants further research.

The next two studies by Kracht et al. (2020) and Chan et al. (2022), will shed some light on the research we are going to do. According to Kracht et al. (2020), their study on video gaming and obesity found ambiguous evidence on the relationship between gaming and obesity. From their review of 26 studies consisting of 25 cross sectional and 1 longitudinal study, 14 studies (53%) reported no association between video game play and obesity, and 12 studies reported positive associations.

However, they also found out that exergames – defined as “technology-driven physical activities, such as video game play, that requires participants to be physically active or exercise in order to play the game” (South Dakota Department of Health, n.d.) – were excellent tools for weight reduction. On the other hand, Chan et al. (2022), researched the extent of esports and its impact on lifestyle behaviors in the youth. Their findings suggest that the consumption of esports and online video gaming lead to poor lifestyle choices such as decreased levels of physical activity, poor diet, and decreased levels of sleep quality and duration. This study is very insightful as esports mainly constitutes a very specific genre of video games such as Valorant and League of Legends and it provides good backbone information on how different game genres can impact a gamer's obesity levels.

Our research

The previous researches have already demonstrated the correlation between gaming hours and obesity. Our study into this topic would be to contribute to the literature by investigating the impacts of playing different game genres on the obesity levels of gamers. Our study will mainly investigate whether different game genres such as action, sports and simulation will impact the obesity of gamers along with adopting some variables found in previous studies that are significant factors to our study such as physical activity, sleeping habits and diet. Overall, our study will provide valuable insights allowing us to provide policy recommendations to gamers about healthier gaming habits.

RESEARCH QUESTION

Our research question would be “How do playing different game genres affect obesity levels in gamers?”

THEORETICAL FRAMEWORK

The dependent variables in our study would be the gamers’ weight (in kg), height (in cm), body mass index (BMI), diagnosis of obesity or weight-related health conditions such as diabetes and high blood pressure, sleep quality (in hours) and physical activity levels.

The independent variable in our study would be the various genres of games such as action games, sports games, simulation games and more.

The control variables in our study would be the gamers’ age, gender, marital status, occupation, duration of gameplay, frequencies of engaging in gaming (in a week), type of food consumed, time that is spent sitting or inactive (in a day).

HYPOTHESES

With regards to our research question, the following are our hypotheses.

Null Hypothesis (H_0): The relationship between gaming and obesity levels among gamers remains consistent across different game genres.

Alternative Hypothesis (H_1): The relationship between gaming and obesity levels among gamers is not consistent across different game genres.

STUDY DESIGN

With advancements in technology today, it leads to a rise in various gaming platforms, such as tablets, smartphones, and computers as compared to the past. The Covid-19 pandemic resulted in an increase in gaming among youth and adults, leading to concerns about sedentary behaviors and associated health risks such as obesity. To address these concerns, the paper aims to explore the impact and association between video game genres and obesity levels among gamers, with the goal of providing insights for the creation of policies and programs to encourage better gaming practices.

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The research methodology and analysis portion of this proposal, will mention the method of sampling, chosen variables, data collection and data analysis methods that would be required for us to conduct the study for the research question as stated above. To obtain the quantitative data required for our research, we will be carrying out an online survey that would have gamers, in general, as our target audience, through voluntary sampling. With the data provided by the respondents, we would then execute several ANOVA and regression analysis tests to study and identify trends in playing different game genres with the obesity level in gamers.

POPULATION AND SAMPLE

The population for this study will consist of all individuals who play video games. The study will focus only on gamers as our study aims to examine the effect of the gaming genre on obesity among gamers specifically. Gamers and non-gamers have different lifestyles, and we want to ensure that we examine individuals who have a sedentary lifestyle due to their video game usage. Non-gamers and gamers have vastly different lifestyles, and including non-gamers would dilute the effects we are examining. Therefore, non-gamers will not be included in the study.

According to Clement (2022), there is an estimated number of about 3.2 billion gamers worldwide in 2023. The population size for this study is estimated to be more than 1 million worldwide. Based on the appendix, it is recommended to have a sample size of 384 for this population size, which would provide a reasonable estimate of the population's characteristics, based on the values provided by Guthrie (2013), that can be observed in Figure 1 in the appendix, while keeping the study's cost and time constraints in mind. To ensure the greatest efficiency, a necessary sample size for populations exceeding 1000 is between 300 to 400 subjects. A sample size of 384 will provide a 5% margin of error, a 95% confidence interval, a response distribution of 50%, and a critical value of 1.96 (Sample Size Calculator by Raosoft, Inc., n.d.). This means that the sample size of 384 will provide a reasonable estimate of the population's characteristics with limited bias.

Convenience sampling will be used to select our samples. The purpose of this approach is to select participants who are willing and able to participate in the study. In this case, we will conduct the survey among gamers who are easily accessible to us, such as those from gaming communities such as Reddit, Twitch, Discord, and Steam, or members of gaming clubs. We will also use social media platforms to recruit participants.

The sample will be selected based on their preferred gaming genre, as this is the focus of our study. We will ensure that we have a representative sample by including gamers who play a wide variety of gaming genres, such as action, sports, role-playing, and strategy games. The selected sample will be asked to provide information about their gaming habits and lifestyle, including their physical activity levels, diet, and body weight. The data collected from the sample will be analyzed to determine the relationship between the gaming genre and obesity among gamers.

VARIABLES AND MEASURES

Key Independent Variables

The key independent variable in this study is the gaming genre. The gaming genre refers to the different types of video games that individuals typically play, including action games, sports games, simulation games, MOBA, role-playing games, first-person games, and puzzle or casual games. The relationship between the key independent variable and the dependent variable, which is obesity among gamers, is that certain gaming genres may have a greater impact on the development of obesity than others. For example, action games may require less physical movement than sports or simulation games, which may contribute to a more sedentary lifestyle and increase the risk of obesity.

To measure the key independent variable, the survey will include a question that asks participants about the gaming genres they typically play. The question will be "What gaming genres do you typically play?" and will provide a list of response options, including action games, simulation or sports games, MOBA, role-playing games, first-person games, and puzzle or casual games. Participants will be able to select one or multiple genres they typically play. This information will allow for the examination of the relationship between gaming genre and obesity among gamers in the study.

Control Variables

In addition to the gaming genre, various other variables may influence the development of obesity among gamers. These variables include demographics, gaming habits, dietary habits, physical activity levels, and health status. For this study, age, gender, marital status, occupation, and duration of gameplay will be examined as demographic variables. Gender differences have been found to impact body weight and health outcomes, with men having higher rates of obesity and related conditions than women (Wadden et al., 2019). Marital status and occupation are also known to influence body weight and overall health outcomes (Godsey, 2013). Regarding gaming habits, frequencies of engaging in gaming (in a week) and duration of gameplay will be examined as predictor variables. Long hours of sedentary behavior associated with gaming have been linked to weight gain and obesity (Verloigne et al., 2012). Additionally, certain gaming genres may require more physical activity than others, potentially impacting the relationship between gaming and obesity. For example, sports and fitness games may have a different relationship with weight outcomes compared to action or strategy games. Dietary habits are also important to consider, with the type of food consumed being examined as a predictor variable. The consumption of high-calorie, nutrient-poor foods has been linked to obesity and related health conditions (Zhao et al., 2017). Furthermore, time spent sitting or inactive (in a day) will be examined as a predictor variable since prolonged sitting has been associated with increased risk of obesity and related conditions (Bailey et al., 2009). Physical activity levels, diagnosis of obesity or weight-related health conditions such as diabetes and high blood pressure, and sleep quality (in hours) will also be examined as predictor variables. Low physical activity levels have been linked to obesity and related health conditions. Individuals with a diagnosis of obesity or weight-related conditions may have different experiences with gaming and physical activity. Additionally, sleep quality has been linked to obesity and weight outcomes, with poor sleep quality contributing to increased risk (Miri et al., 2019).

To measure these control variables, we will include questions in the survey that ask about the relevant demographics, gaming habits, dietary habits, physical activity levels, health status, and sleep quality of the participants. These questions will be formulated to measure the different predictor variables in a reliable and valid manner. By accounting for these variables, we hope to gain a comprehensive understanding of the relationship between gaming genre and obesity among gamers while controlling for potential confounding factors.

Dependent Variables

The dependent variable in this study is obesity among gamers, which will be measured through body mass index (BMI). BMI is a commonly used measurement to determine an individual's body composition by dividing their weight (in kg) by the square of their height (in meters). In this case, the height of the gamers (in cm) will be converted to meters before calculating their BMI. Although BMI is a very generalized indicator to calculate one's body fatness, which is used to classify individuals into various weight categories, however, it is still a useful screening tool The relationship between the gaming genre and obesity will be measured by collecting data on the gamers' weight and height. This information will be obtained through surveys or other means of data collection, and the data will be converted into an Excel format for analysis. Weight and height will be measured in kilograms and centimeters respectively and will be used to calculate the BMI for each participant using the standard formula, BMI = weight / height^2, whereby the units for weight would be in kg, and the units for height in cm. The BMI scores will be classified according to the criteria provided by World Health Organization (WHO), with a score of less than 18.5 indicating underweight, 18.5 - 24.9 indicating normal weight, 25 - 29.9 indicating overweight, and 30 or above indicating obesity (World Health Organization, 2021). The BMI scores will then be analyzed to determine the relationship between the gaming genre and obesity levels among gamers. Overall, the dependent variable in this study is obesity, which will be measured through BMI scores calculated from the participants' weight and height data. The relationship between the gaming genre and obesity will be analyzed by comparing the BMI scores with the participants' gaming genre preferences.

DATA COLLECTION

For this study, we would be using a survey as our primary data collection. Through surveying, respondents would be asked the same questions and apart from being the cheapest method, it is also a quick way of collecting a large size of data in a short period of time. Furthermore, as we would be obtaining sensitive information, such as height and weight, from the respondents, the respondents will be able to remain anonymous (Business Research Methodology, n.d.). This will allow us to analyze and compare the data across the various respondents, whereby we would be able to conduct a quantitative analysis, through methods such as T-Test, ANOVA, Chi-Square Test and Regression.

We would be utilizing Qualtrics in the creation of our survey, enabling us to reach a diverse range of gamers as it would be a digital survey. As Qualtrics provides us with the options of sharing the survey through email, social media, offline app, QR code, and via links, we will opt to use the links method, which would be shared on social media, and QR code printed on a piece of flyer that would be placed in the classrooms and common areas in the university campus.

We would contact Embry-Riddle Aeronautical University (ERAU) Institutional Review Board Director, Teri Gabriel, to seek approval for our survey, ensuring its legality as we would be collecting sensitive information, such as height and weight of the respondents. Once approved, we will also distribute the survey to other worldwide ERAU campuses, such as Daytona, Prescott, and Berlin, to better represent the gaming population. Furthermore, we will also be approaching our university's Student Government Association (SGA) to coordinate the locations of where the QR code flyers will be placed.

In addition, we would also request for SGA to promote our survey on their various SGA social media accounts. Furthermore, we would also be sharing the link to our survey on various gaming platforms, such as on Reddit, Discord, and Twitch, to achieve a diverse range of respondents and data. As our desired sample size would be 385, to attract gamers to participate in our study through doing the survey, we would also be randomly selecting a respondent to be the winner of an Amazon Gift Card, of equivalent value to $20 in Singapore currency.

Our survey will consist of a total of 14 questions, whereby Questions 1 to 4 are demographic questions, Questions 5 and 6 are anthropometric measurement questions, Question 7 to 9 are questions regarding the gamers' gaming behaviours, and Question 10 to 14 are questions pertaining to the gamer's lifestyle behaviour and health-related habits. The respondents' responses would provide us with data that will assist us in our study of whether playing different game genres has an impact on gamers' obesity levels. The questions to the survey can be found under the Appendix section.

DATA ANALYSIS

The survey we conducted from Qualtrics will be used as a pilot study to determine if gaming genres impact gamers' obesity levels. The data we obtained will have to be cleaned and converted to a quantitative data form by replacing qualitative variables with dummy variables when needed. The variables of interest in our study are, Q2 (Gender), Q3 (Marital Status), Q4 (Current Occupation), BMI, Q7 (Gaming Genre), Q8 (How often do you engage in video gaming per week?), Q9 (How long do you play video games per session?), Q10 (How often do you engage in physical activity or exercise per week?), Q11 (How many hours of sleep do you typically get per night?), Q12 (How often do you consume fast food or processed snacks in a week?) and Q13 (On a typical day, how many hours do you spend sitting or being inactive?).

To analyze our data, we would be using ANOVA instead of a T-Test. We chose to use ANOVA instead of T-Test because T-Test can only be used for two-level data, such as “Yes or No”, or” Male or Female”. It would not be appropriate for us to use T-Test because we have various levels in our survey questions, hence, using ANOVA would be the best for analyzing our data.

We would be conducting One-Way ANOVA for BMI and Q7 (Gaming Genre), to determine if there are any significant differences between BMI and Q7 (Gaming Genre) and Two-Way ANOVA for BMI, Q7 (Gaming Genre) and Q9 (How long do you play video games per session?) to test for other variables that may have an interaction effect with BMI.

Figure 1

Descriptive statistics of our data retrieved from Qualtrics

```
       Q1              Q2              Q3              Q4              Q5
 Min.   :1.000   Min.   :1.000   Min.   :1.000   Min.   :1.0   Min.   :1.550
 1st Qu.:2.000   1st Qu.:1.000   1st Qu.:1.000   1st Qu.:1.0   1st Qu.:1.680
 Median :6.000   Median :1.000   Median :1.000   Median :1.0   Median :1.730
 Mean   :4.767   Mean   :1.233   Mean   :1.067   Mean   :1.5   Mean   :1.731
 3rd Qu.:6.000   3rd Qu.:1.000   3rd Qu.:1.000   3rd Qu.:1.0   3rd Qu.:1.780
 Max.   :7.000   Max.   :2.000   Max.   :3.000   Max.   :5.0   Max.   :2.100

       Q6                Q7          Q8            Q9            Q10
 Min.   : 40.30   6         : 6   Min.   :1.0   Min.   :1.000   Min.   :1.000
 1st Qu.: 63.00   1,2,3,4,5: 4   1st Qu.:2.0   1st Qu.:1.000   1st Qu.:1.000
 Median : 66.00   1,2,4,5   : 4   Median :2.0   Median :2.000   Median :2.000
 Mean   : 71.16   1,2,5     : 4   Mean   :2.6   Mean   :2.667   Mean   :2.067
 3rd Qu.: 78.00   1,4,5,6   : 4   3rd Qu.:4.0   3rd Qu.:3.000   3rd Qu.:2.000
 Max.   :117.00   2         : 4   Max.   :4.0   Max.   :6.000   Max.   :4.000
                  (Other)   :34
      Q11             Q12             Q13             Q14             BMI
 Min.   :2.0   Min.   :1.0   Min.   :2.000   Min.   :4.0   Min.   :14.70
 1st Qu.:3.0   1st Qu.:2.0   1st Qu.:3.000   1st Qu.:5.0   1st Qu.:20.81
 Median :5.0   Median :2.5   Median :6.500   Median :5.0   Median :22.87
 Mean   :4.5   Mean   :2.7   Mean   :5.333   Mean   :4.9   Mean   :23.63
 3rd Qu.:5.0   3rd Qu.:3.0   3rd Qu.:7.000   3rd Qu.:5.0   3rd Qu.:26.26
 Max.   :6.0   Max.   :5.0   Max.   :7.000   Max.   :5.0   Max.   :35.66
```

The above figure shows the descriptive statistics of our respondents.

Pilot one-way ANOVA test

In this analysis, the null hypothesis would be, there is no significant difference in BMI between the different game genres (Q7) and the alternative hypothesis would be there is a significant difference in BMI between different game genres (Q7). Based on our results, where we extrapolated our original 30 respondents in our survey to 60 to increase the sample size and significance of the results. The results tell us that there is a significant difference between BMI between different game genres (Q7) as seen in the low p-value o f4.87e-05, which is less than 0.05 or 5% significance level. This means that we can reject the null hypothesis and conclude that game genre does have an impact on BMI.

Figure 2

Results of pilot one-way ANOVA test

```
> onewayANOVA<-aov(BMI~Q7,data=ANNOVATEST2)
> summary(onewayANOVA)
             Df Sum Sq Mean Sq F value   Pr(>F)
Q7           17  895.0   52.65   4.381 4.87e-05 ***
Residuals    42  504.7   12.02
---
```

The above figure shows the results for the pilot test using One-Way ANOVA.

The disadvantage of this test is that we cannot tell which specific categories of game genres are associated with a lower or higher BMI and how much of an impact these differences are. Additionally, it is also important to note that other variables may affect BMI that are not included in this statistical test, but it does suggest from this analysis that the gaming genre does have an impact on BMI therefore obesity levels of gamers, whereby the results can be seen in Figure 2 above.

Pilot two-way ANOVA test

In this analysis, there are three null and alternative hypotheses for each variable. They are listed below:

H_{0A}: There is no significant difference in BMI between the different game genres(Q7).

H_{1A}: There is a significant difference in BMI between different game genres(Q7).

H_{0B}: There is no significant difference in BMI between different lengths of video game sessions (Q9).

H_{1B}: There is a significant difference in BMI between different lengths of video game sessions (Q9).

H_{0C}: There is no significant interaction effect between game genre(Q7) and the length of video game sessions (Q9) on BMI.

H_{1C}: There is a significant interaction effect between game genre(Q7) and the length of video game sessions (Q9) on BMI.

Figure 3

Results of pilot two-way ANOVA test

```
> summary(aov(BMI~Q7*Q9,data=ANNOVATEST2))
             Df Sum Sq Mean Sq F value   Pr(>F)
Q7           17  895.0   52.65   23.54 5.44e-14 ***
Q9            1  138.4  138.39   61.88 3.69e-09 ***
Q7:Q9         7  290.3   41.46   18.54 6.54e-10 ***
Residuals    34   76.0    2.24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The above figure shows the result for the pilot test using Two-Way ANOVA with interaction, with the independent variable being Game Genre (Q7) and dependent variable being Engagement per session (Q9).

Based on our results, as seen above in Figure 3, we found out that individually the main effects of game genre (Q7) and length of video game session (Q9) are significant indicated by the low p-values of 5.44e-14 and 3.69e-09 respectively. Both values are less than the significance level of 0.05 or 5% meaning that we can reject both null hypotheses H01 and H02. In other words, we can say that both game genre (Q7) and length of video game sessions (Q9) do have an impact on BMI. Another aspect of the results is the interaction effect between BMI and variables game genre (Q7) and length of video game session (Q9). Based on our results there is a significant interaction between game genre (Q7) and the length of video game sessions (Q9) on BMI, as seen by the low p-value of 6.54e-10, which is less than the significance value of 0.05 or 5%. This suggests that the effect of game genre on BMI depends on how long the video game sessions are. With that said, the disadvantage of using ANOVA to analyze our data is that we would be able to tell that there would be a difference, but we would not be able to tell where there is a difference. To be able to tell where the difference is, we would need to conduct more operations, such as using Regression, to be able to pinpoint where the difference is. Therefore, we are also going to conduct a preliminary Regression analysis with the data we collected in Qualtrics.

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Regression Analysis

Regression analysis is a statistical test that involves examining the relationship between one dependent variable and multiple independent variables. In our study, we will be examining whether our key independent variable game genre(Q7) alongside other control variables, affects the obesity (BMI) levels of gamers.

The equation for multiple regression analysis is $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k + \varepsilon$, where Y is the dependent variable, X_1, X_2, and X_K are the independent variables, β_0 is the y-intercept, β_1, β_2, and β_k, are the regression coefficient associated with each independent variable included, and ε is the residuals or error term.

In our study, Y will be BMI and X_1 to X_k, will be, Q2 (Gender), Q3 (Marital Status), Q4 (Current Occupation), Q8 (How often do you engage in video gaming per week?), Q9 (How long do you play video games per session?), Q10 (How often do you engage in physical activity or exercise per week?), Q11 (How many hours of sleep do you typically get per night?), Q12 (How often do you consume fast food or processed snacks in a week?) and Q13 (On a typical day, how many hours do you spend sitting or being inactive?). The purpose and main advantage of performing regression analysis in our study is to examine the impact of the independent variables on our dependent variable BMI. The sign and magnitude of the coefficient in a regression model can provide us with information about the direction, positive or negative impact, and strength of this relationship and this will give us a better idea of whether obesity (BMI) is significantly impacted by gaming genre (Q7) and other variables included in our study.

Pilot Multi-Regression Analysis

Figure 4

Results of Multi-regression analysis

```
Call:
lm(formula = BMI ~ Q7 + Q2 + Q3 + Q4 + Q8 + Q9 + Q10 + Q11 +
    Q12 + Q13, data = ANNOVATEST2)

Residuals:
   Min     1Q Median     3Q    Max
-5.388 -1.120  0.000  1.120  5.388

Coefficients: (1 not defined because of singularities)
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  21.59288    4.93464   4.376 0.000109 ***
Q71,2,4,5   -11.03816    2.82806  -3.903 0.000427 ***
Q71,2,5      -0.58297    2.56146  -0.228 0.821326
Q71,2,6      -4.32474    2.56134  -1.688 0.100474
Q71,3,5      -5.05405    3.44625  -1.467 0.151691
Q71,4,5,6     0.92380    2.14910   0.430 0.670015
Q72           1.89070    2.42270   0.780 0.440548
Q72,3,4       6.68868    3.30172   2.026 0.050689 .
Q72,4,5,6    -0.26923    2.93785  -0.092 0.927521
Q72,4,6       1.25293    2.67891   0.468 0.642983
Q72,5         0.75335    3.51828   0.214 0.831729
Q72,5,6      12.35946    2.29671   5.381 5.49e-06 ***
Q73           7.20616    1.96193   3.673 0.000818 ***
Q73,6         3.04491    3.09915   0.982 0.332794
Q74           0.04288    2.43272   0.018 0.986040
Q75           0.57528    2.47298   0.233 0.817445
Q75,6       -10.88842    5.01775  -2.170 0.037088 *
Q76          -0.24717    2.13864  -0.116 0.908672
Q2            1.48342    1.62621   0.912 0.368089
Q3                NA         NA      NA       NA
Q4            1.37039    1.06288   1.289 0.205992
Q8           -1.72631    0.54656  -3.159 0.003320 **
Q9            2.39135    0.53544   4.466 8.36e-05 ***
Q10          -0.42138    0.52227  -0.807 0.425372
Q11          -0.87368    0.57481  -1.520 0.137771
Q12          -1.20311    0.51949  -2.316 0.026726 *
Q13           0.72151    0.27831   2.593 0.013946 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.517 on 34 degrees of freedom
Multiple R-squared:  0.8461,    Adjusted R-squared:  0.7329
F-statistic: 7.474 on 25 and 34 DF,  p-value: 8.496e-08
```

The above figure shows the result of multi-regression analysis, with BMI as the dependent variable, and other independent variables such as game genre (Q7), being out key independent variable, gender (Q2), marital status (Q3), employment (Q4), engagement per week (Q8), engagement per session (Q9), engagement in physical activity (Q10), hours of sleep (Q11), consumption of fast or processed food (Q12), and duration spent being inactive (Q13).

Does playing different game genres affect obesity levels in gamers?

Based on our results from the pilot test, several variables are significantly associated with BMI with reference to 0.05 or 5% significance level. The first observation involved our key independent variable Q7 (Game genre) which consists of multiple levels associated with different genres of games. The variable (Q71,2,4,5) which consists of action, simulation/sports, role-playing, and first-person game genres, particularly, action games were associated with a decrease in BMI indicated by the estimated values of -11.03816 and p-value of 0.000427. This suggests that individuals who play action games have a lower BMI level compared to those that do not play action games. However other gaming genres such as MOBA games (Q73) were associated with an increase in BMI which is observed in the estimated value of 7.20616 and p-value of 0.000818.

This suggests that individuals who play MOBA games typically have higher BMI levels compared to those who do not play MOBA games. Other genres such as simulation/sports games (Q72), role-playing games (Q74), first-person games (Q75), and puzzle/casual games (Q76) were not significantly associated with BMI. Other significant variables that were associated with an increase in BMI levels include Q9 (How long do you play video games per session?) and Q13 (On a typical day, how many hours do you spend sitting or being inactive?). Unexpected observations were also made in the regression model. To start, variable Q8 (How often do you engage in video gaming per week?), was associated with a decrease in BMI which is indicated by an estimated value of -1.17631 and p-value of 0.0003320. Another unexpected observation was the variable Q12 (How often do you consume fast food or processed snacks in a week?) and its association with a decrease in BMI as indicated in the estimated value of -1.20311 and p-value of 0.026726.

It is important to note however that even with these unexpected outcomes, other variables may have an interaction effect with variables Q8 and Q12 which calls for further research into these interactions in the future. The other variables included in the model like Gender (Q2), marital status (Q3), current occupation (Q4), frequency of physical activity or exercise per week (Q10), and hours of sleep per night (Q11) were observed to not have any significant associations with BMI. The overall model shows a high level of significance ($p < 0.05$) and a strong goodness of fit, with the R-squared value being 0.8461, and adjusted R-squared value being 0.7329, suggesting that the independent variables in the model explain a large portion of the variability in BMI.

CONCLUSION

In conclusion, our research proposal aimed to investigate the effects of gaming genres on obesity. Our main findings from one-way ANOVA and two-way ANOVA with interaction, indicates significant association between game genre and engagement per session with BMI. The interaction between them suggests that the effect of game genre on BMI is dependent on the engagement per session, as the p-value of 6.54e-10 is less than the 5% significance level. Our regression results suggest that some game genres, such as Action and Multiplayer Online Battle Arena (MOBA), had a significant impact on obesity. However, first-person, puzzle/casual and simulation/sports games were not significantly associated with BMI. Our regression models also found that higher engagement in gaming per week and session correlates with a higher BMI.

However, it is important to acknowledge certain limitations that may impact the interpretation of our findings. Firstly, our study's reliance on self-reported data from participants may introduce response inaccuracies. Secondly, due to time constraints, we had to turn to convenience sampling despite being aware of its disadvantages like the sample not being random, which may result in biased observations.

Despite these limitations, the findings of our study hold implications for policy and public health interventions. With the growing popularity of video games and the rising prevalence of obesity, our research can inform the development of targeted strategies to promote healthier gaming habits. By understanding the specific genres associated with increased obesity risk, policymakers and health professionals can design interventions that encourage the adoption of active or educational gaming alternatives.

Furthermore, our study focuses solely on the effects of gaming genres on obesity, excluding other potential factors that contribute to obesity, such as diet and physical activity levels, which could be further investigated.

In conclusion, our research proposal contributes to the literature by investigating the effects of gaming genres on obesity. While there are limitations to consider, the findings of our study have important policy implications, allowing for the development of evidence-based strategies to mitigate the potential negative impact of certain gaming genres on obesity rates.

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APPENDIX

The following survey questions were created and designed to gather information on gamers health and their gaming habits. All the questions only allowed the respondent to pick only one option per question, with the exception of Question 7, whereby the respondent is able to pick more than one option as their response.

1. What's your age?
    - 10 - 15 years
    - 15 - 20 years
    - 20 - 25 years
    - 25 - 30 years
    - 30 - 35 years
    - 35 and above

0. What gender do you identify as?
    - Male
    - Female
    - Prefer not to say

0. Marital Status:
    - Single
    - Married
    - Prefer not to say

0. What is your current occupation?
    - Full-time student
    - Part-time student
    - Employed Full Time
    - Employed Part Time
    - Unemployed

Does playing different game genres affect obesity levels in gamers?

0. What is your height (in cm)?

0. What is your weight (in kg)?

0. What gaming genres do you typically play?

- Action games (Tekken, Star Wars)
- Simulation/Sports game (FIFA, NBA2K, Forza)
- MOBA (League of Legends, Dota 2)
- Role-playing games (Skyrim, Fallout 4, Witcher 3)
- First person games (Counter Strike, Valorant, Call of Duty)
- Puzzle/Casual Games (Portal 2, Party Games)

0. How often do you engage in video gaming per week?

- 1 - 2 times
- 3 - 4 times
- 5 - 6 times
- Everyday

0. How long do you play video games per session?

- 30 minutes - 1 hour
- 1 - 2 hours
- 3 - 4 hours
- 4 - 5 hours
- 5 - 6 hours
- 7 hours and above

0. How often do you engage in physical activity or exercise per week?

- 1 - 2 times
- 2 - 4 times
- 4 - 6 times
- Everyday

Does playing different game genres affect obesity levels in gamers?

0. How many hours of sleep do you typically get per night?

- Less than 3 hours
- 3 - 4 hours
- 4 - 5 hours
- 6 - 7 hours
- More than 7 hours

0. How often do you consume fast food or processed snacks in a week?

- 0
- 1 - 2 per week
- 3 - 4 per week
- 4 - 5 per week
- Almost everyday

0. On a typical day, how many hours do you spend sitting or being inactive?

- Less than 1 hour
- 2 - 3 hours
- 3 - 4 hours
- 4 - 5 hours
- More than 5 hours

0. Have you ever been diagnosed with obesity or a weight-related health condition (Diabetes, High Blood Pressure etc.)?

- Yes
- No

Figure 1

Population and sample size

N	*S*	*N*	*S*	*N*	*S*	*N*	*S*	*N*	*S*
10	10	100	80	280	162	800	260	2,800	338
15	14	110	86	290	165	850	265	3,000	341
20	19	120	92	300	169	900	269	3,500	346
25	24	130	97	320	175	950	274	4,000	351
30	28	140	103	340	181	1,000	278	4,500	354
35	32	150	108	360	186	1,100	285	5,000	357
40	36	160	113	380	191	1,200	291	6,000	361
45	40	170	118	400	196	1,300	297	7,000	364
50	44	180	123	420	201	1,400	302	8,000	367
55	48	190	127	440	205	1,500	306	9,000	368
60	52	200	132	460	210	1,600	310	10,000	370
65	56	210	136	480	214	1,700	313	15,000	375
70	59	220	140	500	217	1,800	317	20,000	377
75	63	230	144	550	226	1,900	320	30,000	379
80	66	240	148	600	234	2,000	322	40,000	380
85	70	250	152	650	242	2,200	327	50,000	381
90	73	260	155	700	248	2,400	331	75,000	382
95	76	270	159	750	254	2,600	335	1,000,000	384

Source: Krejcie and Morgan (1970).

Note: N = population size; S = sample size.

The figure above shows the recommended number of sample sizes for the respective population size (Guthrie, 2013).