VOL.10

"THESE ARE SOME OF THE PRESSING ISSUES THAT THESE ORGANIZATIONS WILL BE FORCED TO ADDRESS IN FUTURE CBA NEGOTIATIONS."

-Ethical Analysis of Biometric Data Collection in Collegiate Athletics

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The Journal of Undergraduate Research at The Ohio State University

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Letter From the Editor

Dear Reader,

Welcome to the Ninth Edition of the Journal of Undergraduate Research at Ohio State. This publication is presented to you by our incredible team of editors and authors from a wide range of colleges and majors at The Ohio State University during the 2019-2020 year. This year came with unexpected challenges and changes that altered our plans as students, researchers, workers, and people. For these reasons and hundreds more, I would like to take a moment to thank all those that worked through these hardships to complete this journal and share the research of our remarkable authors.

The Ohio State University takes great pride in the research of their undergraduate students and offers opportunities for all students to get involved no matter their field of study. JUROS attempts to encapsulate that pride into print to share these works with readers like you. Our journal handles all types of research from any and all colleges on Ohio State's campus, including English literature, economics, medication, mental health, and more. JUROS hopes to provide an outlet for undergraduates to publish their papers in order to spread the word about the hard work of students and faculty at our university.

This year is a vastly different experience than usual. We are presenting to you from a virtual platform with a team of JUROS members who are scattered around the nation. As we all know, and will always remember, 2020 was the year of COVID-19, resulting in many losses and many adjustments to our daily lives. We hope to grant our authors a print publication in the coming year once campus reopens – as a full tribute to the work they have done here at Ohio State.

Best Wishes,

Emily Katula

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Anterior cruciate ligament reconstruction associated with brain activity differences during unilateral lower extremity motor imagery: A Pilot Study.

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Anterior cruciate ligament (ACL) tears are a prevalent injury, particularly in youth competitive sports. Post ACL reconstruction (ACL-R) surgery and rehabilitation, a significant patient population never returns to full functionality1. The contralateral leg is also seen to double its risk of ACL injury2. It is now thought that ACL-R affects multiple physiological factors, such as mechanical, anatomical, hormonal, etc., suggesting that rehabilitation needs a broader focus than just the involved limb. Recent research has indicated that ACL-R is associated with altered neurological factors 3-6. It is speculated that these neurological adaptions affect motor processes5,6. However, it is unclear if these adaptions influence the feedforward and feedback mechanisms of motor control. In order to address this, a study was conducted to determine if ACL-R is associated with a neuroplastic alteration in feedforward motor control. A control group of healthy, active participants with no previous ACL-R (n (sample size)=3, age=24.5±0.71 years, height=1.74±0.05m, weight=74.16±18.28kg) and a group of participants with a left ACL-R (n=3, age=22.5±4.95 years, height=1.79±0.09m, weight=87.32±24.06kg, 52±31 months post-surgery) were locally recruited. The subjects performed a kinesthetic motor imagery (MI) task which served as a model indicator of feedforward motor control. What the MI task subjects were asked to perform consisted of remaining motionless while mentally performing unilateral left (involved) 45° knee extension/flexion at a rate of 1.2 Hz. This was done for 30 seconds at a time in four blocks, with 30 second of rest in between. Functional magnetic resonance imaging (fMRI) was performed for analysis of brain activation during the task. The two groups were compared using a mixed-effects general linear model with a cluster-forming threshold of $z>3.1$. Results revealed that, in comparison to the control group, the ACL-R group had increased activity within the ipsilateral inferior temporal sulcus (voxels:88; $p<0.001$, z-max:4.32, MNI coordinate voxel: -52,-4,-18), and contralateral insula (voxels:77; $p<0.001$, z-max:5.86, MNI coordinate voxel:34,2,18), dorsolateral prefrontal cortex (voxels:43; $p<0.03$, z-max:5.02, MNI coordinate voxel:38,36,14), and visual cortex (voxels:42; $p<0.03$, z-max:4.45, MNI coordinate voxel:10,-94,16). The described brain activity areas occurred relative to the side of injury (i.e. contralateral is right side of the brain, since side of injury is left). Furthermore, decreased activation in the basal gan-

glia (voxels: 230; p<0.001, z-max:5.44, MNI coordinate voxel:12,-24,-8) was recorded. These results indicate that ACL-R is associated with potential alterations in motor planning, as the analysis showed significant neurological changes in individuals who underwent ACL-R in comparison to healthy individuals. Specifically, ACL-R may lead to increasing executive function and visual-motor activity to engage in motor imagery. This predicted neuroplasticity may create more reliance on a different area of the brain than before ACL-R, contributing to the high rates of reinjury post ACL-R. Future research should focus on understanding what neural networks are associated with, the observed neuroplastic adaptations within this ACL-R population, and developing therapeutic interventions to restore neural sensorimotor planning activity in hopes of bettering the recovery of ACL-R.

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Ethical Analysis of Biometric Data Collection in Collegiate Athletics

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Background

Technology has become an integral part of all aspects of life, especially for health and wellness. The most familiar use of technology within health and wellness are devices that track biometric data on fitness tracking devices such as such as a Fitbit®, Apple Watch®, and other health monitoring services. Applying health data to overall wellness and performance has also been implemented into athletics as a means to track performance and analyze risk of injury. As new technology is developed and implemented into athletics, rules and regulations are warranted to ensure these devices are used effectively and responsibly. In the United States, major sports leagues such as the National Basketball Association (NBA), National Hockey League (NHL), and National Football League (NFL) have made provisions about wearable technology and established protocols for the collection, analysis, and management of biometric data. Many of these challenges at the professional level have been outlined in Barbara Osborne's article, "Legal and Ethical Implications of Athletes' Biometric Data Collection in Professional Sport".3 Similar to professional sports organizations, technology for performance and injury risk analyses is being considered for college sports. College athletes, however, do not have the same rights and responsibilities as professionals. At the college level, there are unique potential legal and ethical challenges in regard to data collection and usage.

Defining Biometric Data

Biometrics is the measurement and analysis of any particular physical characteristic; more specifically, biometrics refers to the methods of the collection of such data.2 Biometric data can take the form of heart rate, sleep data, and biomechanical processes. These processes include measuring landing forces and accelerations of joints.

Biometrics is the measurement and analysis of any particular physical characteristic. Specifically, biometrics refers to the method of the collection of such data2. Biometric data can take form in a variety of ways, including the measurement of heart rate, sleeping patterns, and biomechanical processes. These processes include measuring landing forces and acceleration of joints.

This data is useful in athletics as one can monitor player health, performance, and possible injury risk factors. Currently, no federal laws exist to specifically regulate biometric data collection, which leads professional and college organizations, as well as the technology companies who manufacture devices, to self-regulate and manage extensive biometric data. Most of the data that is collected falls in the parameters of the Health Insurance Portability and Accountability Act (HIPAA), however, it depends on how the medical staff has handled and transmitted the data.7 Biometric data is still considered health data and must adhere to the regulations set under HIPAA regulation.

Professional Precedent

Professional athletes sign collective bargaining agreements (CBA) which are deals between owners and players associations that dictate the rules of contracts, trades, revenues, salary cap, and drafting.7 The current language in CBAs is unclear with regards to whether an athlete can leverage power for having better than average biometric data. The question of player privacy in regard to this data is also a factor. Players' concerns about biometric data are that it will be used against them in contract negotiations. Coaches are also motivated to collect this data as it grants teams a competitive edge and better understanding of their athletes. The NBA CBA is the first of its kind to address biometric data, with provisions to protect players.1 Some of the stipulations include that wearable technology is not allowed to be worn in games, players have full access to their data, teams cannot use the data for contract negotiations, and teams can be fined up to $250,000 if found in violation of these policies.7 However, CBAs of other major American sports leagues are not as comprehensive in language as the NBA's, thus failing to define the ownership and responsibility that a team has over biometric data of the player and the future implications of this data in terms of the athlete and his or her careers. These are some of the pressing issues that these organizations will be forced to address in future CBA negotiations.

The Unique Challenge of the Collegiate Environment

College athletics has its unique challenges in terms of biometric data collection and usage. Unlike professionals, who get paid lucrative contracts in exchange for the forfeiture of some private health rights that may include biometric data, student-athletes do not get financially compensated for their participation in sport. While athletes may receive generous perks for competing for a university, including scholarships and stipends, they are still not considered employees of the university, which can present legal challenges. Arguably, student-athletes are de-facto employees as they bring the university publicity, contracts, and money. In the 2016-2017 school year, the NCAA made $1 billion in revenue, of which $761 million came from the NCAA's men's basketball tournament.4 Professional athletes are able to unionize and bargain for their rights with their respective players associations via CBAs, while collegiate student-athletes do not have access to these options. However, that may be subject to change.

In September of 2019, California Governor Gavin Newsom signed a bill that allows college athletes to profit from their name, image, or likeness.6 The bill states that colleges cannot allow such endorsement deals to affect students' ability to receive scholarships. California student-athletes are also now permitted to have agents. Proponents of the bill say that this measure will drive top recruits to schools in the state. Others are concerned that the NCAA may retaliate by preventing California schools from competing in NCAA events.6

The most prominent case of an attempt to unionize was demonstrated by the Northwestern University Football Team in 2015; however, the National Labor Relation Board rejected the petition denying their claim that student-athletes are university employees and should be allowed to collectively bargain.5 This ruling prevented student-athletes from bargaining for more personal freedoms and monetary negotiation. The complicated relationship that collegiate student-athletes hold with their respective universities as a quasi-employee only expands in scope with respect to biometric data. Another important distinction is the pressures that can be placed on student-athletes to comply with the university and the team medical staff in their request for biometric data. There may also be social pressures from their teammates, thus diminishing the autonomy of the athlete. Pressure to comply with data submission can be potentially hazardous as the player may not fully understand the implications and repercussions of the usage of data, especially when rights to data privacy may not be respected.

Pros and Cons of Implementing Biometric Data Into College Athletics

The implementation of biometric data in college athletics has a promising future. There is a common saying that "knowledge is power", and such holds true for biometric data. Team personnel can acquire everything ranging from real-time feedback on player performance to information summarizing a season's worth of athlete exposures to dangerous concussive forces and other biometric data such as heart rate trends. Long-term data collection can inform team personnel on injury prevalence patterns, allowing them to adjust training programs to potentially mitigate injury risk. Player performance can be optimized by identifying biomechanical movement patterns and other individual deficits that may put a player at risk for injury. Tracking sleep and eating habits can help ensure the athletes are still at a high level of performance even when out of practice or the gym. The use of biometric data in sport can be beneficial for college athletes to help identify injury and risk factors for personal health and sport-specific longevity.

Biometric data and its utilization within athletics are a promising means to track and manage athlete performance and possible injury risk. Some considerations that must be addressed, many of which are specific to college athletics. These considerations are unique to the college setting and may not translate closely to the challenges and situations experienced by professional athletes. Biometric data may provide valuable information on player health and risk of injury; however, student-athletes do not receive workers' compensation or a guaranteed salary payout if they were to be injured during participation, unlike professional athletes. Access to biometric data is an additional consideration that needs to be evaluated, especially since student-athletes do not receive a salary to participate in sport. Lastly, with technology still developing, there is further research that needs to be done into the accuracy and validity of this data in game-time situations. Therefore, both on the college and professional level, this data should not override a health-care professional's' diagnosis.

Looking Forward

Given the exponential rate of technological advancement, there are some challenges to maintaining the same pace while developing regulations to manage and implement biometric data. As college teams move forward in the future, considerations of managing information and data are warranted to protect the student-athlete. Further research and exploration are needed on the topic of wearable technology and the scope of which it can provide accurate information, and how it can be utilized in the context of player

health and safety. Universities and the NCAA may benefit from collaboration to establish privacy standards for these types of data, with emphasis on player privacy within the university and in commercial operations. Failure to implement policy could result in negative consequences for player mental and physical health, as well as possible litigation against universities and private industry if information is mishandled. As technology advances, the issues that have been outlined above will continue to be present in both professional and college athletic spheres. The unique challenges in each athletic environment will require critical examination, not only on validating new biometric technology, but also on the attitudes of affected parties on the evaluation and the collection of biometric data.

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Childhood, Adolescent Sexual Education and Sexual Behavior Among Ohio State Students

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Abstract

Sexual health is affected by a number of demographic and behavioral factors, including ethnic background, religion and self-efficacy. Sexual health is largely defined by sexual health behaviors, which are a broad, overarching group of health behaviors that can cover everything from abstinence at the simplest level, to any array of nuanced health decisions. There is not much understood about how educational experiences, especially as an adolescent, can affect sexual health behaviors in subsequent college years. This study examines the relationship between childhood and adolescent sexual health education and its effects on sexual health behavior as a college student. A non-randomized, convenience sample of approximately 300 Ohio State students was surveyed in order to elucidate this relationship. Correlation and chi square analyses were performed, and it was found that sexual health education prior to high school graduation has a consistent, but small effect on the frequency of testing for sexually transmitted infections (STI's), demonstrating an important example of a protective sexual health behavior.

Introduction

Sexual and reproductive health are essential aspects of wellbeing yet are frequently stigmatized due to their association with sexuality-an extremely taboo and volatile topic in contemporary American society. The stigma surrounding sexual health has created an information deficit, especially among young people. Younger populations are arguably the group in need of the most access to this information, as they experience a disproportionate number of sexual health issues in comparison to the rest of the population. The U.S. Centers for Disease Control and Prevention (CDC) reports that young adults, ages 15-24, make up only 25% of the United States population, yet account for 50% of the 20 million STI's that occur each year (2017). This means that teens and young adults throughout the United States receive about 10 million new STI's every year, which is equivalent to the population of the entire state of Michigan. In the state in which this research was conducted, Ohio ranks 7th and 10th highest for national Gonorrhea and Chlamydia infections among adolescents, respectively (Centers for Disease Control and Prevention, 2017). Ohio also experiences dramatically high adolescent pregnancy rates, with 23.2 babies born for every 1,000 young women aged 15-19, totaling more than 8,000 babies born to adolescent mothers in 2016 (U.S. Department of Health and Human Services, 2019).

Survey-based studies have compiled statistics for many sexual health behaviors among college students, though the exact, multifactorial mechanisms that determine these behaviors are unknown. Past research into these mechanisms suggests that multiple factors, such as ethnicity, spirituality, and religion, stemming from childhood and adolescent experiences may affect sexual health behaviors in young adults (Adamczyk and Hayes, 2012; Luquis, et al., 2015). Other studies suggest that self-efficacy or access to health care could affect sexual health behaviors (Eisenberg, et al., 2013; Lewis, et al., 2010). However, little is known about how educational experiences affect sexual health behaviors. Considering the poor sexual health outcomes among Ohio's adolescents, the behaviors that precipitate these outcomes could follow young students to higher education. This could potentially lead to poor sexual health behaviors among college students enrolled in large state universities, where they make up a majority of the student body. This study will examine the association between sexual health behaviors of students at The Ohio State University and potential educational factors that may affect sexual health in this population, with special emphasis on sexual education received prior to high school graduation. Sexual education as a child or adolescent is expected to have an effect on the sexual behaviors among Ohio State students. It is projected that receiving more comprehensive information and less abstinence-based messaging will lead to an increase in protective sexual health behaviors among Ohio State students.

A convenience sample of self-reported survey data from 321 respondents currently attending The Ohio State University was obtained and analyzed in order examine this relationship. On a written, multiple choice questionnaire, respondents self-identified the type of sexual education that they received before graduating from high school as well as the number of STI tests they have received in the past two years.

Literature Review

Sexual Health Education

Sexual health education is typically provided to students at grade school, middle school, or high school levels. It can also be frequently found on University campuses, typically containing subject matter that has to do with consent and bystander intervention programs. The three types of sexual health education programming typically found in the United States are: abstinence-centered, abstinence-plus, and comprehensive sexual education (Advocates for Youth, n.d.). Abstinence-centered education focuses on emphasizing abstinence until marriage, typically censoring other topics such as contraception or STI transmission. Abstinence-plus education focuses on emphasizing abstinence until marriage, but also will provide information about contraceptives and STI transmission in the context of pushing for abstinence. Comprehensive sexual education teaches abstinence as the only way to 100% avoid STI transmission or unwanted pregnancy, but focuses on contraception, STI, and Human Immunodeficiency Virus (HIV) education, as well as skills to communicate effectively and maintain healthy intimate relationships (Advocates for Youth, n.d.). Sexual education programs differ drastically from school-to-school and state-to-state.

As of 2016, only 24 states mandate the instruction of sexual education in public schools, only 33 states require their schools to distribute information about HIV to their students, and 38 states allow parental censorship of sexual education. Only 20 states require sexual health and HIV education to be deemed medically accurate or evidence-based by the authorities that determine the gold standard for medical practice (National Conference of State Legislatures, 2019). Knowledge of sexual health has been and continues to be restricted to students in grade school to high school in Ohio, which is one of only two states that does not have any form of state-mandated standards for health education in its schools. Our current laws regarding "venereal disease" education mandates that abstinence should be emphasized in all sexual health programs in schools, and that students should be taught that conceiving children while unmarried is harmful to themselves as well as society (Ohio Revised Code, 2001). Thus, sexual education programming is frequently not required to convey factual information and is particularly vulnerable to censorship or manipulation by legislative bodies and parental authority. In restrictive states like Ohio, it is very difficult to obtain accurate information about sexual health, which is not only frustrating to adolescents, but can also be reflected in our high rates of STI transmission and teen pregnancy.

Sexual Health Behavior

A recent national survey of female college students, including a sample of women from Ohio State, found that among the 13,484 women included in the analysis, almost one in every five (18%) were virgins, suggesting that abstinence remains a common sexual health behavior among college students (Armstrong, et al., 2012). Sexual health behaviors may also differ among minority groups. Among Latino students, sexual behaviors were significantly affected by spirituality, which was not found among their white counterparts (Luquis, et al., 2015). On an international scale, Muslims and Hindus report less premarital sex than Christians, Jews, and Buddhists, with Buddhists having the most premarital sex of all religions. Different cultures place differential emphasis on abstinence until marriage (Adamczyk and Hayes, 2012). Thus, ethnicity and religion may also influence attitudes towards sexual health.

Though different demographics have shown different sexual health behavioral patterns, other aspects that shape sexual health behavior can be analyzed. College students report lacking self-confidence in their ability to perform protective sexual health behaviors and report low rates of condom usage for oral, vaginal, and anal sex; this is possibly due to ignorance of how to use it or unwillingness to ask that a sexual partner put one on (Lewis, et al., 2010). Students reported low self-efficacy, or self-confidence, in regard to their ability to have discussions with their partners about STI testing or their sexual partner history (Lewis, et al., 2010). Furthermore, the availability of sexual health resources on a college campus could also influence the sexual health behaviors of its students. A study in Minnesota has found that the more sexual health resources that a college provides to its students, the greater the number of students that will have access to reliable birth control and contraceptives. This increased access resulted in fewer students reporting having intercourse without a method of pregnancy or STI prevention (Eisenberg, et al., 2013). Moreover, on the Ohio State Campus, there is free STI testing that is confidential and does not require health insurance. However, students must be aware of this resource and be willing to use it to perform this protective sexual health behavior.

Methods

Sample and Survey

A 61-question survey was created by the Spring 2019 Social Research Methods class, under the supervision of PhD Candidate, Rob VandenBerg to perform a non-randomized sample the student population at The Ohio State University. Each student in the class submitted two to three questions to be included in the survey, some of whom had overlapping questions. In addition to student research questions, demographic questions were used to collect basic information about each respondent at the beginning of the survey. Each student in the class received 15 paper copies of the

survey in class and distributed them to students who attend The Ohio State University. The survey was distributed to a non-randomized, convenience sample of 321 Ohio State University students during March of the Spring 2019 Semester. Response data was added to survey data taken in the previous semester, adding up to a total of 556 respondents.

Questions 22 and 55 of the survey represent the independent and dependent variables studied, respectively (see Appendix A). Both of the questions received 320 responses, indicating that one out of the 321 respondents omitted the question. As these questions were new to the survey and not included in the previous semester's version, data from respondents in the previous semester was marked as missing for each question. In bivariate analysis, 32 respondents who identified as sexually abstinent were excluded from the sample in order to best assess the research question.

Dependent Variable

The dependent variable for this study was sexual health behavior. Sexual health behaviors are a broad, overarching group of health behaviors that can cover everything from abstinence at the simplest level, to any array of nuanced health decisions. Sexual health behaviors could also include the number of sexual partners a person has, condom usage, contraceptives, pre-exposure prophylaxis (PrEP) to prevent HIV infection, as well as STI and HIV testing, and the frequency at which it occurs. For the purpose of this study, sexual health behavior was defined as STI testing and the number of times that respondents have been tested within the last two years given that they have been sexually active. Sexual health behavior can include a number of decisions that have an impact on personal sexual health.

Though there are many different manners by which sexual health behaviors can be measured, STI testing was used to measure this behavior among the respondents as it is a more difficult sexual health behavior to perform that requires a higher degree of sexual education and empowerment. Survey respondents must not only be aware that they should receive STI testing if they are sexually active, but they also need to know where they can receive these services and have sufficient self-efficacy to do so.

This variable needed to be manipulated in a few ways in order to be best-suited for analysis. First, when it was ordered numerically, it assigned the number 9 to those who have never been sexually active and thus have never received a STI test, which drives up the mean number of STI tests for people who have no medical need for a STI test. Respondents who indicated never being sexually active were recoded as missing data points.

This question should generally have high reliability and validity as it should be relatively easy to answer truthfully. However, those who are sexually active and have not gotten tested for an STI may feel a social desirability bias to say that they have because getting tested for an STI is something that people are supposed to do for their sexual health. Others may be afraid to admit they are not sexually active – because we live in a culture that "prude shames" those who decide to remain abstinent until marriage. Similarly, some may be afraid to admit they are sexually active if they come from a cultural background in which premarital sex is discouraged.

Independent Variable

The independent variable for this study is sexual health education, specifically the sexual health education received up until respondents graduated from high school. For most, this encompasses grade school, middle school, and sometimes high school sexual education. For this reason, the question remained broad and asked respondents about the type of sexual education they received in middle school and in high school. College sexual education was not included in this question because Ohio State students go through the same online modules and classes about consent every year. Since it is a university requirement for all freshmen and transfer students, it is presumed to be standard among all respondents.

Respondents were asked to identify the type of sexual education that they received during their grade school and high school years, measuring their childhood

sexual education in a formal setting. Respondents were asked to indicate whether they received abstinence-centered, abstinence-plus, comprehensive, or no sexual education while attending grade school through high school programs. Definitions of each program were provided to the respondents in the question, as follows: abstinence-centered sexual education only focuses on not having sex until marriage, abstinence-plus sexual education strongly recommends no sex until marriages but also covers some forms of contraception and various STI's, and comprehensive sexual education focuses on the prevention of STI's and contraceptives.

This variable should also have relatively high reliability and validity as it should have been straightforward and simple to answer truthfully among the survey respondents. This question asks about the type of sexual education that someone has received, and there is little-to-no perceived social desirability bias in the reporting of education, even if it has to do with sexual health. The wording of the question spans from grade school to high school and it was assumed that middle school was included in that range.

Control Variables

Question 55 (of a 61 question survey) also gave respondents the ability to indicate that they have not been sexually active in the past two years, which provided a measurement of those who are sexually abstinent among the sample of respondents. This question also sought to separate the portion of respondents who are not sexually active, as it does not make sense for this section of the sample to receive STI tests. For this reason, there is a "Not Applicable" choice included in the question, which gives respondents the option to provide reasoning as to why they have not received any STI testing within the past two years. This controls for respondents who have not received STI testing because they have no medical need for it.

Survey responses were submitted on a Google Form by the students in the Social Research Methods Class. Google form responses were combined with the response data from the previous semester into an Excel file. The Excel file was exported and coded into the STATA Software program by Rob VandenBerg, where

Results

data analysis was performed by the students.
Univariate Analysis

The mean age of the sample was 20.85 years. The gender ratio of the sample was nearly evenly split, with 52.85% female and 47.15% male. 84.9% of the sample identified as an in-state student with Ohio residency. The dependent variable examined was the number of times that a respondent has received an STI test, if they have been sexually active in the past two years, which gives respondents the opportunity to exclude themselves from the analysis. Of the respondents, approximately 10% of the sample, 32 people identified as not receiving any STI tests due to being sexually abstinent for the past two years and were excluded from this analysis. Their responses were coded as missing responses, along with the data from the past semester. The most common response for the dependent variable was receiving no STI test in the last two years, which was 59.9% of respondents, a majority of the sample. The second most common response was having received one STI test within the past two years, which was 17.0% of respondents. The remaining results showed that 14.2% of respondents received two STI tests, and 8.9% received three or more STI tests in the past two years. The mean number of STI tests received among respondents in the past two years was 0.780, less than one STI test on average per person (standard deviation of 1.18), indicating high variability in results.

The independent variable examined was the type of sexual education that respondents have received during their middle school and their high school years. The most common response was abstinence-plus sexual education, which 36.9% of the respondents received. The next common response was comprehensive sexual education, at 30.9% of respondents, and the next smallest category was abstinence-centered sexual education, which was 24.8% of respondents. A small number of respondents, 7.3% reported never receiving sexual health education in school.
Bivariate Analysis

Students who never received formal, classroom sexual education received the second smallest mean number

of STI tests with 0.667 STI tests in the past two years, on average, and a standard deviation of 0.96. Those who received abstinence-centered sexual education received 0.881 STI tests on average with a standard deviation of 1.34. Those who received abstinence-plus sexual education 0.654 STI tests on average with a standard deviation of 0.856, which was the lowest mean number of STI tests and the lowest variation of the number of STI tests in the sample. Finally, respondents who received comprehensive sexual education received 0.888 STI tests on average in the past two years, with a standard deviation of 1.41. Those who did receive comprehensive sexual education received the highest mean number of STI tests, which agreed with the hypothesized results for this experiment. There was a small, positive correlation between childhood sexual education and sexual health behavior, respectively. This means that as sexual health education as a child or teenager becomes less abstinence-based and more comprehensive, it has a small, but consistent effect on sexual health behaviors as a college student (see Appendix B). The correlation coefficient was 0.0251, and though this was a small number, it was found to be significant with a p-value of 0.006. Thus, this indicates that there is a consistent, small effect that causes childhood and adolescent sexual health education experiences to be correlated with sexual health behaviors, specifically STI testing behaviors, at a college age. Thus, these variables do correlate as predicted by the hypothesis. As sexual health education becomes more comprehensive and less abstinence-based, it results in respondents receiving slightly more STI tests as college students.

Discussion

One important caveat is that the correlation coefficient between the independent and dependent variable examined in this study was extremely small, at only 0.0251. However, this value was still statistically significant. When a correlation is very close to 0 and still statistically significant, that means that the independent variable has a consistent, albeit very small, effect on the dependent variable. In the case of this study, childhood sexual education has a small effect on the number of STI tests that respondents have received in the past two years. The cross-tabulated bar graph could also explain why the correlation coefficient is so small, but still significant. For an unknown reason, those who have received abstinence-plus sexual education have received less STI tests, on average, than those who received abstinence-centered sexual education, which was not expected by the hypothesis (see Appendix B). It is clear that each category does not have the same number of average STI tests, but there does appear to be a curvilinear trend, with abstinence-plus sexual education having the lowest mean for STI testing. This could be due to a small sample size.

A more extensive sample size could be much more indicative of the true relationship. Regardless of the relationship between sexual health education and STI testing, it was alarming that the mean number of STI tests that respondents had received over the past two years was smaller than one, at just 0.780 (standard deviation of 1.18) tests. There is a need to increase rates of STI testing among young people, as STI testing is an important way to ensure the maintenance of sexual health and to prevent potential health issues such as HPV-related cancers, painful urination, and pelvic inflammatory disease which can all be caused by STI transmission. Another troubling finding was that 7.3% of respondents reported never receiving sexual education prior to high school graduation.

After finding a statistically significant, small positive correlation between increasingly more comprehensive sexual health education and protective sexual health behaviors, the study could be repeated with different operationalization of the dependent variable of sexual

health behaviors to learn more about the sexual health behaviors of students at The Ohio State University. This research could be repeated with other iterations of the dependent variable, sexual health behavior, in order to examine the relationship between sexual health education and other protective behaviors or indicators that relate to sexual health. There may be specific sexual health behaviors that relate to sexual health education more than others, allowing for findings of larger, positive correlations between comprehensive sexual health education and sexual behavior. There are many ways that the dependent variable could be operationalized in order to measure sexual health behaviors in a different way, which could include condom usage, HIV testing, STI or HIV disclosure to partners, abstinence, monogamy, among many other potentially interesting variables.

It may also be interesting to investigate other childhood factors besides sexual education to study their relationship with adulthood sexual health behaviors. Future research directions could include the use of many different independent variables into a multiple linear regression model in order to consider more variables than just childhood schooling. This could be done by asking questions about familial socioeconomic status, whether they went to public or private school, their religion, whether sex is considered taboo in their household or not, among many other variables that could have an effect on sexual health behaviors. Furthermore, future directions on this topic could also look at the type of grade, middle, and high school that college students have attended. This could include whether they attended public, private with no religious focus, private with a religious focus, or received homeschooling. Students could reflect on how that type of school experience affects the sexual education they received, and whether this affects sexual health behaviors as a young, college-aged adult.

One limitation of the study was the structure of the survey itself – for Question 55, the number of times that respondents have received STI tests in the past two years, the answer choices were split onto two different pages as a result of a page break. The "Not Applicable – I have not been sexually active during the past two years" option was on the second page, while the "None" option was on the first page directly underneath the question. It is completely possible that respondents who may not have been sexually active but saw the "None" option first before flipping to the next page never saw the "Not Applicable" option and didn't self-identify as having been abstinent for the past two years. If this survey should be distributed in the future, the "Not Applicable" option should be moved up to be the first answer choice for this question so that respondents, who are very likely experiencing survey fatigue at question 55 on a 60-question survey don't accidentally skip the answer choice that applies most closely to their situation and paints the most accurate picture of their sexual health. As this question could be considered double-barreled to an extent, as it asks about sexual activity and STI testing, a more effective solution to this limitation could be the creation of a contingency question that first asks about sexual activity for the past two years. If respondents have been sexually active, they will be asked to answer follow-up, contingency questions about their STI testing history during that time period.

Another potential limitation of this study was asking about sexual health education before high school graduation in Question 22, which also could have been considered a double-barreled question for a portion of respondents. Some respondents may have received different types of sexual education on multiple occasions before their high school graduation, potentially in different school districts or even different states or countries. For example, if a respondent received abstinence-centered sexual education in middle school, but comprehensive sexual education in high school, they may not know how to answer the question. A qualifier to help respondents know how to respond to this question would be to add the words "most recent" when describing sexual education experiences before high school graduation to the question.

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Conclusion

This study was performed to examine the relationship between childhood and adolescent sexual education and its effects on sexual health behaviors of college students who attend The Ohio State University. It was predicted that as sexual education prior to high school graduation became more comprehensive and less abstinence-based, protective sexual health behaviors, as measured by the frequency of STI testing in the past two years, would increase. After analyzing this relationship, it was found that sexual education prior to high school graduation was found to have a small, consistent effect on sexual health behavior among college students. These findings warrant greater research on how sexual health education has an effect on sexual health behaviors in adulthood, with great potential for longitudinal studies or linear regression models to try to explain the relationship. This study could also be repeated with a number of operationalizations of the dependent variable, sexual health behavior, in order to better understand this complicated and potentially multifactorial relationship.

Acknowledgements

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Eagle-Eyed Sharp Shooters: The Importance of Visual Skills and Acuity in Precision and Military Marksmanship

Primary authors: Emily Nothnagle (Pistol Team Captain at The Ohio State University)

Marksmanship is the ability to consistently and accurately shoot one's desired target. It is an important skill for members of the military or competitive shooters to refine. As a soldier in the military, it is crucial to be able to accurately shoot because it could protect many lives by eliminating dangerous threats. Competitive shooting athletes must also be stellar marksmen in order to elevate their careers and compete in world-class matches, such as the Olympic Games. There are many components that go into becoming an elite marksman, such as significant amounts of practice, but vision is one of the most important. Vision includes visual acuity , saccadic latency , fixation stability , and binocular versus monocular amplitude . Some of these aspects of vision are more exclusive to competitive precision shooting, such as monocular amplitude. Other aspects are more relevant to military shooting, such as saccadic latency or binocular amplitude . However, visual acuity is crucial for all aspects of marksmanship.

In fact, visual acuity, or the clarity of a person's vision, is so important to military marksmanship that there are visual acuity standards that must be met by prospective soldiers in order to enlist. These standards state that a person's corrected or uncorrected vision must be 20/40 or better, to be in the United States Navy, Army, or Marine Corps (Hatch, Hilber, Elledge, Stout, & Lee, 2009). The inclusion of visual acuity in physical aptitude assessments began in World War II (Wells, Wager, Reich, & Hardigan, 2009). The requirements have been refined as the standards have evolved over time, leading to the annual vision screening for all service members beginning in 1995. Presently, visual acuity standards are set to monitor both military occupational special eligibility and the ability to enlist in special operations and jobs, combat readiness, and marksmanship (Wells et. al. 2009).

There have been several studies done to test the accuracy of the visual acuity standards set by the United States military. Hatch et. al. analyzed the effect of visual acuity on marksmanship and target discrimination. Participants simulated five different visual acuity ranges by wearing refractive lenses that corrected, over-corrected, and under-corrected vision to various degrees. Participants then shot at randomly presented targets from varying distances with the glasses to test the effects of visual acuity on shooting performance. To test target discrimination, "enemy" and "friend" targets were presented randomly in each of the visual acuity levels, and participants were instructed to shoot at only at "enemy" targets (Hatch et. al., 2009). The performance-based results of the study lead to the conclusion that the United States military's visual acuity standards are accurate and valid, as they support optimal marksmanship performance and target discrimination.

In a similar study by Wells et. al., the relationship between marksmanship performance and visual acuity was investigated. Wells et. al. eval-

uated twenty-eight participants under simulated night conditions and day conditions using either a prescription that created blurry vision or the participant's normal prescription. The participants then used the Army's Engagement Skills Trainer 2000, which is a video simulation system, to test their marksmanship skills. They concluded that a significant relationship between marksmanship performance and visual acuity exists, showing that marksmanship performance decreases as visual acuity decreases (Wells et. al., 2009). This study also supports the visual acuity requirements of the military, as individuals who have better visual acuity are more likely to demonstrate accurate shooting. Studies have also been conducted to find ways of improving marksmanship in relation to eyesight, such as the Moore et. al. quiet eye training study. Teaching task-specific gaze control, also known as quiet eye training, has been known to enhance motor skill attainment (Moore, Vine, Smith, Smith, & Wilson, 2014). Moore et. al. randomly assigned twenty participants to either technical training or quiet eye training in simulated maritime marksmanship tasks to see how quiet eye training affected the accuracy of firing at rapidly approaching target with machine guns. A moving-target task was completed as a baseline test prior to the trainings and two retention trials. The quiet eye training group demonstrated more accurate performance and stronger gaze control than the technical training group (Moore et. al., 2014). This study indicates that the use of quiet eye training in the military could enhance marksmanship skills as soldiers would be able to focus for longer periods of time and have greater visual target locking which leads to increased accuracy. This could be particularly useful for maritime marksmen, such as members of the United States Navy, as targets are typically in motion while in the water. By having an increased ability to visually lock into a target in motion, the soldier would be more likely to shoot accurately as the target is in greater focus.

While studying the effect of visual acuity on marksmanship in the United States military is still relevant, as evidenced by research exploring the necessity of visual acuity requirements, there are also other focuses currently being explored regarding visual acuity and marksmanship. Research has found a relationship between vision and competitive shooting accuracy. Competitive shooting has taken the spotlight largely due to the Olympic Games bringing competitive shooting to an international stage and introducing the sport to spectators and researchers all over the world.

One study conducted related to vision and competitive shooting accuracy analyzed the benefit of moveable pistol sights. Carkeet, Brown, and Chan examined how spatial interference affects vertical pistol sight alignments (see Figure 1) and its effects on shooting accuracy. Participants simulated aligning virtual pistol sights to a virtual target displayed on a computer screen. The simulated target displayed varying distances and the participants aimed the simulated pistol at it accordingly by adjusting the virtual sights. The accuracy of the adjustment of the placement of the virtual sights in relation to the virtual target demonstrated that systematic error of vertical sight alignment is affected by the proximity of the target in the visual field. This would affect the performance of pistol shooters as the visual sight picture would have to change based on target distance in order to consistently hit the center of the target (Carkeet, Brown, & Chan, 1996). However, because sights on modern pistols are adjustable, performance in pistol shooting would not be likely to change significantly if the shooter adjusts their sights to compensate for the systematic errors. This study demonstrates the importance of the moveable sights in precision pistol shooting because they enable shooters to create a more consistent visual cue even when the target is placed at different distances. Without the adjustable sights, the pistol shooter would need to visually place the sights in different places on the target as it moved distances, creating more room for error as the marksman is less consistent in their visual cues.

Another study examined the effect of a three-month visual training program on pistol shooting and visual function at the Olympic Training Center in Sant Cugat, Barcelona, Spain. Eleven members of the Catalan Government Special Intervention Squad participated in this clinical trial that worked to enhance visual skills in order to improve pistol shooting performance (Quevedo i Junyent & Solé i Fortó, 1995). A pre-test evaluated the pre-existing visual function and the average shooting scores, and a post-test analyzed these same features after the participants completed the three-month training program. The results indicate that precision shooting scores increased significantly. Three months after completing the program – six months after the commencement of the program – the researchers evaluated the scores again to determine if the increase could be attributed to the visual training or simply practice. The pistol scores decreased significantly three months after the completion of the visual training program, indicating that visual training caused the improvement in pistol shooting performance – not merely practicing pistol shooting (Quevedo i Junyent & Solé i Fortó, 1995).

Additionally, the visual training program by Quevedo i Junyent and Solé i Fortó improved visual function itself. This is seen in several of the variables evaluated in the pre- and post-tests, including saccadic fixations or the points between rapid eye movements, accommodative facility at distance and at near, binocular analytical amplitude, negative relative accommodation, among others. Typically, elite competitive pistol shooters tend to have a dominant eye that is much stronger than the non-dominant eye. After completing the visual training program, there was a reduction in the average differences between both eyes, improving binocularity rather than the monocularity typical

of precision shooters (Quevedo i Junyent & Solé i Fortó, 1995). This is also beneficial for non-competitive shooters such as police forces or the military, as they often must aim with both eyes open and non-blinded. This study also suggests a causal relationship between visual skills improvement and improvement in pistol shooting scores, demonstrating the transfer of visual skills into performance skills (Quevedo i Junyent & Solé i Fortó, 1995).

Visual skills relate to shooting performance in disciplines outside of pistol shooting as well. A study by Francesco Di Russo, Sabrina Pitzalis, and Donatella Spinelli examined the visuo-motor functions used in visual scanning in high-level clay target shotgun shooters in comparison to a control group. Visual scanning was measured by fixation tasks and saccadic tasks in this study. Each of the individuals in the experiment throughout both the professional shooting group and the control group had normal visual acuity. In the fixation task, participants were subjected to a standard condition and a distracter condition while fixating on a center point over the course of one minute. The shooters were significantly better at the fixation task than the control group, both with and without the distracters (Di Russo, Pitzalis, & Spinelli, 2003). In the saccadic task, participants once again experienced a standard condition and a distracter condition while performing visually guided saccades toward a target as quickly as possible. The shotgun shooters demonstrated faster saccadic latency than that of the control group in both conditions (Di Russo et. al., 2003). This reveals that elite shooters in shotgun disciplines have stronger visual skills in relation to fixation stability and saccadic latency than people who do not shoot. These skills are likely developed due to the nature of the sport; shotgun shooters need to track sporting clays in order to shoot them. Having faster saccadic latency and a stronger fixation stability is likely to improve target locking with the target in motion, similar to maritime marksmen needing to locate and lock onto moving targets in the sea.

A future research study could analyze the ability to strengthen the non-dominant eye to the point where it functions comparably, if not equally, as well in precision pistol shooting to the dominant eye. According to the study by Quevedo i Junyent and Solé i Fortó, the differences between the dominant and the non-dominant eye could be generally reduced following their three-month visual training program. Competitive precision pistol shooting is a monocular sport; often special glasses have a prescription lens over the dominant eye and a blinder that covers the non-dominant eye, allowing it to remain open and absorb light without providing any visual interference when aligning the sights to the target. A visual training program that spans longer than three-months with more frequent practice sessions could potentially strengthen the non-dominant eye more significantly.

If more balanced monocular vision could be obtained, either eye could be used for aiming purposes in precision pistol shooting. This could be beneficial for precision shooters who have sustained an injury or infection to their dominant eye by enabling them to continue shooting at a high level by switching eyes. Additionally, precision shooters who have a dominant hand that is different from the dominant eye – for example, shooting left-handed with a right eye dominance – could benefit from the ability to switch eyes. Learning to switch eyes would enable these shooters to become more balanced and stable, as they would no longer need to twist around in order to see their sights clearly. Finally, balancing out the capabilities of the dominant and non-dominant eye could enable stronger binocular vision, which would be beneficial to military marksmen as they often are shooting with both eyes open when in battle.

Overall, visual skills and visual acuity are incredibly useful in marksmanship. This can be seen in competitive settings, such as precision pistol or clay-target shooting, and in military or police settings. While each of these shooting disciplines is very different, they all rely on similar visual capabilities in order to lock on to a target and properly align the sights to take accurate and consistent shots. As more visual training programs are developed, marksmen of all disciplines can improve their craft, making them more competitive or keeping communities safer.

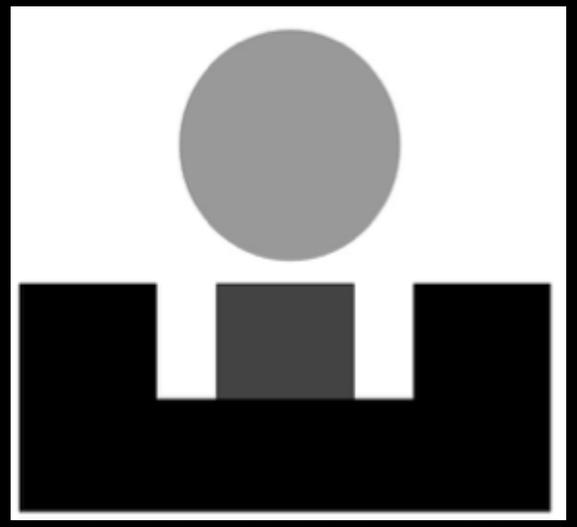

Figure 1 – The front sight (middle rectangle) is lined up with the back sights (outside rectangles), controlling the up/down placement of the shot. The front sight is directly in between the back sights, controlling the left/right placement of the shot. The gray circle simulates the target (Nothnagle, 2019).

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When Good, Bad, and Evil Don't Matter: An Analysis of the Characterization of Satan in Paradise Lost

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Abstract

John Milton's epic, Paradise Lost, has long been equally regarded as one of the most brilliant and most complicated works in the history of literature. While Milton himself claims to write in the poem in order to "justify the ways of God to men," he sometimes appears to depict God in an unfavorable light while also giving Satan various qualities that can be said to make him a sympathetic or even heroic character, rather than simply portraying him as villainous and objectively evil (Black 1018). While scholars of Biblical literature tend to balk at the notion of a heroic Satan, precedents set by Grecian heroes such as Achilles and Odysseus in Homeric epics suggest that Lucifer would be considered worthy of emulation and praise in the ancient Hellenic hero cult. Ultimately, the characterization of Milton's Satan as hero, villain, or something in-between depends on the cultural lens through which the poem is viewed.

Along with works such as Virgil's Aeneid, Homer's Iliad and Odyssey, and Dante's Inferno, John Milton's Paradise Lost exists in the Pantheon of epic poetry. Milton's work depicts in vivid detail the Biblical story of the Fall of Man and focuses much of its attention on the intentions of the fallen angel, Satan. Perhaps surprisingly, Satan—the universal symbol for evil incarnate and the embodiment of sin—has many admirable qualities about him that not only make it difficult for the reader to detest him, but actually make him frighteningly relatable. Most of the poem is centered around the character Satan, bringing him directly into the role of the epic's protagonist. But what has been debated since Paradise Lost was published in 1667 is Satan's potential characterization as a hero. Throughout the poem, Satan shows that he possesses no shortage of attributes that are outright admirable and are shared with literary heroes across history. Milton's Satan is charismatic, courageous, witty, convincing, a brilliant speaker, and has an indomitable will. Satan claims that God is a tyrant and that his rebellion against his creator was spurred by his unwillingness to be subjugated, and in this sense he once again proves to be relatable or admirable to the reader. But is this enough for Satan to truly be considered a hero? Ultimately, the answer to that question will depend on the cultural lens through which Satan is viewed.

Before one can attempt to categorize the character of Satan in Paradise Lost, he or she must first examine the various cultural definitions of what it means to be a hero. The word "hero" is often thrown around rather liberally in literature and has become something of a layman's term for the "good guy" in any particular story. This definition of a hero is completely subjective and holds little weight as a literary term. Instead, the category of a "hero" is culturally variable and exists in many forms across different times and societies, often as a simple matter of perspective. For example, Italian explorer Christopher Columbus has been hailed as a hero for centuries and is honored with a federal holiday in the United States, but is seen as a ruthless conquistador and the leader of a genocide by the Native Americans who were already living on the land that he "discovered". Likewise, the character of Satan in Paradise Lost may or may not be considered a hero depending upon the cultural lens through which he is viewed.

One of the earliest and most influential definitions of a hero in all of literature was the Greek hero-cult largely defined by ancient Homeric literature. By far the greatest models of the hero-cult in Greek literature are Homer's immortalized epics, The Iliad and The Odyssey. These epic poems tell the tales of brave men who take up arms to fight for country, honor, family, glory, and plunder. But in the Greek hero-cult, the motivations of a warrior are of far less importance than his fortitude and feats of strength and courage. In The Iliad, Homer writes aristeias—dramatic scenes depicting a hero's dominance in battle—for warriors on both sides of the war. Hector, the Trojan's greatest warrior, is a brilliant leader, a brave fighter, and a morally good man with a loving mother and father, a devoted wife, and an infant son. But Hector's good morals do nothing to protect him from the rage of the famed Greek warrior Achilles, whose godlike fighting ability is unmatched by any mortal as he cuts Hector down with ease in single

combat. While Hector is certainly more sympathetic and admirable for his humanity, The Iliad is a merciless illustration of the Greek hero-cult's emphasis on strength, fortitude, and ability over morality.

But perhaps the most well-known hero in all of Greek literature is Odysseus, the cunning and wayward warrior who must find a way home after the Trojan War. While Odysseus is far from the most skilled swordsman among the Greek ranks, he is the most deceitful. If Achilles is the archetypal figure for strength and brawn in Greek literature, then Odysseus is certainly the brains. Odysseus is a natural leader, a brilliant speaker and skilled rhetorician, a brave fighter, and a renowned—or infamous among the Trojans—tactician. While his skill and usefulness in battle is of a very different nature than that of Achilles, Odysseus's legendary intuition thrusts him among the ranks of the greatest of heroes in Greek literature. Thus, cleverness, wits, and trickery are on par with strength, bravery, and physical dominance as heroic virtues in the Greek hero-cult. But despite his intellect, Odysseus is brash, vain, at times driven by rage and selfishness, and fails to do the morally correct thing in several difficult situations, which shows that one does not necessarily have to be "good" to be a hero through the lens of the Greek hero-cult. However, according to Vanessa Nikolovska's "The Natures of Monsters and Heroes," there are a few virtues that are shared across all Greek heroes, and these are "pride, glory, and bravery" (Nikolovska 2). As will be seen later in this essay, these qualities are favorable for Satan's characterization as a hero in Paradise Lost.

It will also be crucial to examine the definition of "hero" through a Biblical lens in order to comment on Satan's characterization in Paradise Lost. While a Biblical hero is usually concerned with doing what is right, the determiner of "what is right" is typically not the hero, but rather God himself. Take Noah of Biblical fame, for example. According to the Book of Genesis, God had become dissatisfied with the sinful nature of humanity and his creation. Thus, the Lord bade Noah to construct a massive ark and to take his family along with one male and one female of each species of animal upon the vessel. When this had been done, God sent down a great flood that destroyed all life on earth save for those on the ark. From a moral standpoint, Noah's actions—namely his decision not to allow anyone other than his family to board the ark and thus be spared from a very unpleasant death—certainly raise some eyebrows. But according to the Bible, Noah was doing the most heroic thing possible, and that was to be faithful to and follow the will of God. So while the doctrines of Christianity and Judaism do usually consider it to be of utmost importance to be morally just, the Bible itself makes it clear that obedience to God is the greatest heroic virtue. Obviously, one does not exactly need to be a literary scholar to anticipate that this will not bode well for Satan's potential characterization as a hero in Paradise Lost.

The final cultural lens through which Satan will be examined for the purposes of this analysis is that of the contemporary United States of America. While American value systems differ greatly from demographic to demographic within the nation, there are certain heroic virtues that are agreed upon by the vast majority of the country. Though it shares some of its heroic values with the Greek hero-cult

such as bravery, strength, and intelligence, the greatest heroic virtue valued by the American people is individualism. American culture rarely celebrates the collective mind, but rather focuses in on the singular contributions of one individual's part to the whole. This is precisely why when people hear the phrase "Father of Electricity," their minds immediately leap to the simple, sensationalized, and over-publicized story of Thomas Edison's "invention" of the light bulb and overlook the contributions of Benjamin Franklin, Michael Faraday, Nikola Tesla, Thomas Murray, Charles Steinmetz, and others. American culture also rarely celebrates the ordinary or mundane, so a "hero" must be individualistic and easily set apart from a crowd. But there is more to a hero in contemporary American culture than greatness and individuality. In "Making Heroes: The Construction of Courage, Competence, and Virtue," George Goethals and Scott Allison assert that in the United States, heroes are "thought to be competent enough to achieve at a high level" but also "moral enough to do the right thing in difficult situations" (Goethals 184). So while the Greek hero-cult de-emphasizes morality and focuses on feats of strength and shows of wit, heroes according to contemporary American culture must be accomplish great feats while also doing the right thing for the right reasons. This will prove to be something of a grey area as far as the characterization of Milton's Satan is concerned.

In John Milton's Paradise Lost, Satan can be considered a Hellenic hero because he perfectly embodies the virtues of the Greek hero-cult and even compares favorably to other epic Grecian heroes. According to William Herman's "Heroism and Paradise Lost" the Hellenic hero is associated with "qualities of individuality, self-determination, and physical courage that endure alone against what seems to be ineluctable odds. The Hellenic hero is of immense physical strength, superior to all compeers, and it is upon his shoulders that victory or defeat must eventually rest" (Herman 13). Based on Herman's definition, Satan in Paradise Lost could be the poster boy for the Hellenic hero. Satan rises from the ashes of defeat and cements his status as leader among the fallen angels, proudly proclaiming it "better to reign in Hell than serve in Heav'n" and igniting the passionate fires of hatred in their hearts, telling them not to submit to God in defeat but to continue in their defiance of the Creator (Milton 1021). This is an excellent display of Satan's immense pride, a quality that he shares with others in the Greek hero-cult as mentioned previously by Nikolovska. And just as a Hellenic hero should, Satan refuses to yield even having suffered an eternal defeat against an impossibly powerful and literally unbeatable foe, once even calling out "Who can think of submission?" to the hoard of demons in Pandæmonium after a passionate rant about his hatred for God (Milton 1028). Regardless of one's opinion of Satan, his sheer determination to persevere in the face of the insurmountable is admirable. But what really solidifies Satan's identity as a Hellenic hero is what Herman calls his "unrivaled courage." Satan has fought bravely against the Son and the other angels in heaven, faced Sin, Death, and Chaos on his way to Eden, and is literally going up against God himself. To this end, Herman claims that through the lens of the Greek hero-cult, Satan "is defiant rather than disobedient" and certainly deserves to be considered a Hellenic hero (Herman, 15). If Paradise Lost were to have been published in Ancient Greece, it is safe to say that Satan would have been praised as a hero without any equal. Perhaps the best illustration of Satan's status as a Hellenic hero is the fact that he is strikingly similar to Odysseus. Like Odysseus, Satan is a natural leader and a brilliant speaker, as he is able to convince his companions to build Pandæmonium and to continue their defiance of God with ease. If one is to consider the events that transpired before the opening of Book One of Paradise Lost, it quickly becomes apparent that the fallen angels have no reason to follow or even respect Satan. Prior to Satan's rebellion these demons were all glorious angels living in heavenly perfection with God, and it was through choosing to follow Satan that they were cast out of heaven and into a life of damnation in the first place. Because of this, it would make more sense for the fallen angels to loath Satan than to continue to be led by him. But Satan is able to use his rhetoric to enlist the continued support of the demons and to make the most out of his unfortunate situation. And, like Odysseus, Satan is also deceitful and cunning. After his rebellion against God, Satan knows that he will never be able to defeat his foe in battle. Therefore, he undertakes a different form of defiance against the Lord and undertakes the corruption of God's newest creation: mankind. Satan's craftiness is on full display in the Garden of Eden, where he casts doubt into the minds of the naïve first man and woman, Adam and Eve, before tricking them into the sin that would result in the Fall of Man. Thus, Satan in Paradise Lost is a perfect character for analysis in the Greek hero-cult, and he embodies nearly every quality that a proper Hellenic hero should.

But while he may be the perfect example of a Hellenic hero, Satan is undoubtedly the absolute embodiment of everything that a Biblical hero is not. While William Herman claimed that Satan "is defiant rather than disobedient" through the lens of a Hellenic hero, the exact opposite is true through the lens of a Biblical one. Since Biblical heroes are worth their weight in gold only to the extent to which they are obedient and subservient to the will of God, "it is obvious that within the Biblical tradition Satan can lay no claims to heroism" (Herman 15). While Biblical heroes humble themselves and worship the Lord, Satan does the exact opposite, monologuing that "lifted up so high/ [he] 'sdained subjection, and thought one step higher/ Would set [him] highest" (Milton 1051). In other words, Satan actually strove to be greater than God himself, an act of pride and defiance that would absolutely mortify a true Biblical hero. In "Heroic Virtue and the Divine Image in Paradise Lost," John Steadman points out the fault of Satan's motivations and the fraudulent nature of his seemingly heroic traits:

"Satan's seemingly heroic qualities—his superhuman courage, ingenuity, and strength—are all exercised in direct opposition to God… Satan's eminence is ultimately robbed of the quality of true virtue—and ultimately true heroism—because it is manifested in disobedience to divine will, violation of divine law, and disregard of the supreme good" (Steadman 94).

Clearly, this is enough to completely and utterly disqualify Satan from consideration as a Biblical hero. In fact, it is more than enough to allow for Satan to be characterized as the

greatest antagonist in all of Biblical tradition, as he ultimately takes it upon himself to not only disobey God's will, but to corrupt the perfection of God's creation and cause the Fall of Man.

Determining Satan's character in light of contemporary U.S. culture is certainly much trickier and far less clear-cut than the Hellenic and Biblical lenses, but ultimately Satan's selfish motivations and willingness to corrupt innocents in pursuit of revenge make him unfit to wear the title "hero". While Satan definitely embodies virtues that Americans would find to be admirable and even heroic in another context, such as strength, courage, leadership, intelligence, and to a certain extent pride, John Shawcross makes a brilliant point in With Mortal Voice when he asserts that "Satan is hero only if one believes that God has been and is wrong in his treatment of the angels and particularly Satan, and perhaps in His ways toward man" (Shawcross, 33). Because of the focus on doing the right thing for the right reasons, Satan must be justified, not only in his rebellion against God, but also his role in bringing about the Fall of Man. At first, it seems as this is the case, as Satan depicts his struggle with his Creator as a fight for freedom rather than a power-grab. In his speeches to the other fallen angels in hell, Satan characterizes God as a powerful tyrant, proclaiming that "glory never shall His wrath or might/ Extort from me. To bow and sue for grace/ With supplicant knee, and deify His power/ Who, from the terror of this arm, so late/ Doubted His empire" (Milton, 1019). Thus, in this excerpt, God is depicted as a vicious tyrant king who struck down Satan and the rebelling angels out of fear that his empire and reign were in jeopardy. If this is truly the reason why Satan made his daring rebellion against God, then it is safe to say that he would be seen as a hero by the American people who by the virtue of the creation of their own nation do glorify efforts to overthrow the rule of tyrannical monarchical figures. However, upon arriving in Eden to undertake the corruption of mankind Satan admits that "Pride and worse Ambition threw me down" and that "lifted up so high/ I 'sdained subjection, and thought one step higher/ Would set me highest" (Milton, 1051). Thus, whether or not God was justified in his treatment of Satan and the other angels, Satan has made his rebellion for the wrong reasons. And even if God has been wrong in his treatment of Satan and the other angels, how is one to justify Satan's role in the Fall of Man? Adam and Eve have no role in the conflict that took place before Book One of Paradise Lost and are living a peaceful—albeit occasionally boring and mundane—existence in the Garden of Eden, when Satan appears to tempt them to sin. Regardless of whether or not God is good or just in the epic, this is where Satan crosses the line according to the contemporary American definition of a hero. Whatever is happening between God and Satan should remain between God and Satan, as when Satan enters Eden and causes the Fall of Man, he causes great harm to what are essentially innocent and otherwise uninvolved individuals. If Adam and Eve were to become disillusioned with Eden and resentful of God as Satan was, it should have been by their own accord. But Satan essentially makes this decision for them in his pursuit of revenge against his Creator, and by introducing death and sin to humanity Satan has committed a morally reprehensible act against a third party to his war against God. This willingness to harm innocents—along with the fact that Satan is truly rebelling against God in an effort to seize more power for himself—is enough to disqualify Satan from consideration as a hero in contemporary American culture.

So how should Satan be defined as a character in Paradise Lost? Well, the definition or literary archetypal role played by the Lord of Hell largely depends on the cultural lens through which he is viewed, but in any case his complexity as a character is undeniable.

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