

Spring 5-2019

THE ASSOCIATION OF CELL PHONES WITH ADOLESCENTS' ACADEMIC PERFORMANCE, SLEEP, TIME SPENT WITH FRIENDS, AND CYBERBULLYING EXPOSURE

JOHANNA E. PEYTON
UTHealth School of Public Health

Follow this and additional works at: https://digitalcommons.library.tmc.edu/uthsph_dissertsopen



Part of the [Community Psychology Commons](#), [Health Psychology Commons](#), and the [Public Health Commons](#)

Recommended Citation

PEYTON, JOHANNA E., "THE ASSOCIATION OF CELL PHONES WITH ADOLESCENTS' ACADEMIC PERFORMANCE, SLEEP, TIME SPENT WITH FRIENDS, AND CYBERBULLYING EXPOSURE" (2019). *UT School of Public Health Dissertations (Open Access)*. 74.
https://digitalcommons.library.tmc.edu/uthsph_dissertsopen/74

This is brought to you for free and open access by the School of Public Health at DigitalCommons@TMC. It has been accepted for inclusion in UT School of Public Health Dissertations (Open Access) by an authorized administrator of DigitalCommons@TMC. For more information, please contact digitalcommons@library.tmc.edu.

THE ASSOCIATION OF CELL PHONES WITH ADOLESCENTS' ACADEMIC
PERFORMANCE, SLEEP, TIME SPENT WITH FRIENDS, AND CYBERBULLYING
EXPOSURE.


by

JOHANNA E. PEYTON, BBA

APPROVED:



ALEXANDRA VAN DEN BERG, PHD, MPH



NALINI RANJIT, PHD, MS

Copyright
by
Johanna E. Peyton, BBA, MPH candidate
2018

DEDICATION

To Norma Louise Cary

THE ASSOCIATION OF CELL PHONES WITH ADOLESCENTS' ACADEMIC
PERFORMANCE, SLEEP, TIME SPENT WITH FRIENDS, AND CYBERBULLYING
EXPOSURE.

by

JOHANNA E. PEYTON
BBA, Texas Christian University, 2005

Presented to the Faculty of The University of Texas

School of Public Health

in Partial Fulfillment

of the Requirements

for the Degree of

MASTER OF PUBLIC HEALTH

THE UNIVERSITY OF TEXAS
SCHOOL OF PUBLIC HEALTH
Houston, Texas
May, 2019

PREFACE

Attaining my Master of Public Health is a gift to myself in honor of my mother, Linda Fae Graue, and grandmother, Norma Louise Cary, who both earned their masters during a time much less favorable toward the advancement of women. My hope is that by extending the legacy of educational achievement, I am creating an example for my children, Ainsley Louise Peyton, George Bailey Peyton VI, and Caroline Elizabeth Peyton, that they too can accomplish whatever they set their intentions on.

ACKNOWLEDGEMENTS

The journey of completing my Master of Public has been a lengthy and unique one, beginning in 2010, pausing for the birth of my son in 2011, some health issues in 2012, the birth of my second daughter in 2013 and beginning again in 2018. Throughout this process, I have been influenced by several individuals that helped make this milestone possible and I would like to acknowledge and thank them here.

When I began the program in 2010, Dr. Alexandra van den Berg was my academic advisor. She helped guide my experience academically and advised me personally on how to manage school, motherhood, and family-life. She was an immense encouragement to me through the reapplication process in 2017 and has been my champion as I finished the remaining requirements of the program. This thesis would not have been possible without her continued assurance and support. I am sure that she shows all her students the same genuine care but for me, it felt like she took an extra vested interest in seeing me succeed and for that I will be forever grateful.

Additionally, I would like to thank Dr. Nalini Ranjit who was instrumental in helping make the technical aspects of this thesis possible. Her guidance, abounding patience, and knowledge helped sustain me throughout the analysis process of this thesis. I am beyond appreciative of her assistance.

On a personal note, I would like to acknowledge the unwavering love and nourishment given to me by my husband, George Bailey Peyton V. He helped make my schoolwork a priority within our family schedule, has listened endlessly to my brainstorming, and lifted me up when I needed a boost. I am so thankful to have him as my life partner.

THE ASSOCIATION OF CELL PHONES WITH ADOLESCENTS' ACADEMIC
PERFORMANCE, SLEEP, TIME SPENT WITH FRIENDS, AND CYBERBULLYING
EXPOSURE.

Johanna E. Peyton, MPH, BBA
The University of Texas
School of Public Health, 2019

Thesis Chair: Alexandra van den Berg, PHD, MPH

This study examined the association between owning or having access to a cell phone with or without internet access and adolescent academic performance, whether they met the guidelines for recommended nightly sleep, the amount of time spent with friends outside of school and the presence and frequency of cyberbullying experienced by 8th and 11th grade participants in the 2015-2016 SPAN study in Texas. This study also examined the association between gender of the adolescent and the above-mentioned outcomes.

The study group consisted of 5,421 adolescents from 8th grade and 3,635 from 11th grade. The 8th grade sample contained 51.4% males (48.6% females) and were 51.7% Hispanic, 35.8% White and 12.5% African-American. The 11th grade sample contained 50.6% males (49.4% females) and were 50% Hispanic, 37.4% White and 12.5% African-American. The school's socioeconomic status was measured as a percent of economically disadvantaged indicated by the percent of students within the school eligible for free or reduced lunch.

The analytic methods employed were linear and logistic regression models with predictive margin analyses for all the main variables. Stratified logistic regression and

predictive margins analyses were performed to determine gender differences within the sample. All models were adjusted for the confounders of grade level, sex, ethnicity, and school socioeconomic status.

The results indicated that overall, 92.77% of students reported owning or having access to a cell phone and 90.82% reported that their phone could access the internet. Having internet access on phones tended have more significant outcomes, rather than just owning or having access to a cell phone alone. The predicted mean grade point average for students who have internet access on their phones was 3.22, compared to 3.03 for those students without internet access ($p<0.05$). The predicted probability of adolescents with access to internet on their phones who experience higher frequencies of cyberbullying was 18.9% compared to 25.9% ($p<0.05$) among adolescents who do not have internet-enabled phones.

The findings related to time spent with friends suggested statistically significant associations for both phone status and internet access. 45% of adolescents who own or have access to phones reported higher frequencies of spending time with friends outside of school compared to adolescents without phones (33%, $p=0.05$). In addition, 46% of adolescents who have phones with internet access report high frequencies of spending time with friends outside of school compared to only 28% ($p<0.05$) of those without internet-enabled phones.

In conclusion, the majority of adolescents have phones with internet access and by 8th and 11th grade it might serve as an advantage in slight boosts in academic performance, increased time spent with friends and reduced frequency of cyberbullying experience. However, this is a cross sectional study and further longitudinal studies are needed to determine causal relationships.

TABLE OF CONTENTS

DEDICATION	iii
PREFACE	v
Acknowledgements	vi
Table of Contents	i
List of Tables	i
List of Appendices	ii
Background	1
Smartphone Use and the Internet	1
Smartphone Use and Academic Performance	2
Smartphone Use and Sleep Quantity	4
Smartphone Use and Time Spent with Friends	5
Smartphone Use and Cyberbullying	7
Public Health Significance	11
Research Aim and Hypothesis	13
Methods	15
Study Design & Sampling Frame	15
Study Setting	16
Study Subjects	16
Sample Size Calculation	17
Independent Variable Measures	17
Outcome Measures	18
Covariates	20
Data Analysis	21
Results	23
Demographics	23

Hypothesis One Analyses	25
Hypothesis Two Analyses.....	34
Discussion and Future Directions	39
Strengths and Limitations	44
Conclusion	46
Appendix.....	47
Table 8 Survey Stratified Regression of Gender and Academic Performance Score Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity.....	47
Table 9 Survey Stratified Regression of Gender and Meeting Sleep Recommendations Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity.....	47
Table 10 Survey Stratified Regression of Gender and Time Spent with Friends Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity.....	48
Table 11 Survey Stratified Regression of Gender and Cyberbullying Experience Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity.....	48
References.....	49

LIST OF TABLES

Table 1 Participant Demographic Frequency (Weighted Survey Proportions).....	24
Table 2 Survey Regression of Academic Performance Score Against Phone Status and Internet Access, Adjusted for Grade, Gender, School Socioeconomic Status and Ethnicity.....	25
Table 2a Predicted Means from Adjusted Linear Regression Models of Academic Performance Score by Phone Status and Internet Access.....	25
Table 3 Survey Regression of Meeting Sleep Recommendations Against Phone Status and Internet Access, Adjusted for Grade, Gender, School Socioeconomic Status and Ethnicity.....	27
Table 3a Predicted Probabilities from Adjusted Logistic Regression Models of Meeting Sleep Recommendations by Phone Status and Internet Access.....	27
Table 4 Survey Regression of Time Spent with Friends Against Phone Status and Internet Access, Adjusted for Grade, Gender, School Socioeconomic Status and Ethnicity.....	30
Table 4a Predicted Probabilities from Adjusted Logistic Regression Models of Time Spent with Friends by Phone Status and Internet Access.....	30
Table 5 Survey Regression of Cyberbullying Experience Against Phone Status and Internet Access, Adjusted for Grade, Gender, School Socioeconomic Status and Ethnicity.....	32
Table 5a Predicted Probabilities from Adjusted Logistic Regression Models of Cyberbullying Experience by Phone Status and Internet Access.....	33
Table 6 Predicted Means from Adjusted Stratified Regression Models of Gender and Academic Performance Score by Phone Internet Access.....	35
Table 7 Predicted Probabilities from Adjusted Stratified Regression Models of Gender and Meeting Sleep Recommendations, Time Spent with Friends and Cyberbullying Experience by Phone Internet Access.....	36

LIST OF APPENDICES

Appendix Tables**Error! Bookmark not defined.**

Table 8 Survey Stratified Regression of Gender and Academic Performance
Score Against Phone Internet Access, Adjusted for Grade, School
Socioeconomic Status and Ethnicity.....**Error! Bookmark not defined.**

Table 9 Survey Stratified Regression of Gender and Meeting Sleep
Recommendations Against Phone Internet Access, Adjusted for Grade,
School Socioeconomic Status and Ethnicity.....**Error! Bookmark not defined.**

Table 10 Survey Stratified Regression of Gender and Time Spent with Friends
Against Phone Internet Access, Adjusted for Grade, School
Socioeconomic Status and Ethnicity.....**Error! Bookmark not defined.**

Table 11 Survey Stratified Regression of Gender and Cyberbullying Experience
Against Phone Internet Access, Adjusted for Grade, School
Socioeconomic Status and Ethnicity.....**Error! Bookmark not defined.**

THE ASSOCIATION OF CELL PHONES WITH ADOLESCENTS' ACADEMIC
PERFORMANCE, SLEEP, TIME SPENT WITH FRIENDS, AND CYBERBULLYING
EXPOSURE.

Johanna E. Peyton, BBA, MPH
The University of Texas
School of Public Health, 2019

Thesis: Johanna E. Peyton, BBA, MPH

BACKGROUND

Smartphone Use and the Internet

The first cell phone with internet access was released to the public in 1999 in the form of a Blackberry that enhanced the technology of a two-way pager to gain the ability to send an email (Ziegler, 2018). However, the current ease of internet access now experienced on phones did not become available until the introduction of the iPhone, announced by Steve Jobs in January of 2007 along with the widespread availability of wireless internet (Ritchie, 2018).

Since then the smartphone has become a staple in the purse or pocket of most Americans, including our youth. In 2015, 73% of teens had or had access to a smart phone (Lenhart & Page, April 2015). In 2018, that number jumped up to 95% of teens aged 13 to 17-years-old who have or have access to a smart phone (Anderson & Jiang, May 2018) which represents a 22% increase of smart phone ownership or access in only three years. In

2018, 45% of teens reported using the internet, defined as any online activity outside what is required for school work, “almost constantly” with 44% of teens saying they are online several times a day. Again, this is a dramatic increase from 2015, where only 24% of teens said they used the internet “almost constantly.” (Anderson & Jiang, May 2018).

But is such high frequency of smartphone usage a good thing? Many are not so sure. According to Common Sense Media, 50% of adolescents feel like they are addicted to their mobile devices and 72% report feeling the need to immediately respond to texts, social networking messages and other notifications (Howard, 2017).

A 2016 study showed that the younger a child is given a smartphone, the greater the risk of cell phone addiction, with the greatest number of future problematic overuse behaviors being seen when children younger than 13 years old are given smartphones (De-Sola Gutiérrez, Rodríguez de Fonseca, & Rubio, 2016). The data from this study are particularly alarming since the national average age in which a child receives their first smartphone is currently approximately 10 years old and continually trending downwards (Howard, 2017).

Smartphone Use and Academic Performance

The growing impact and importance that adolescents place on their phone is clear - however, the effects that this connection to technology has on academics is a rising topic of concern. Some feel that “kids these days” literally have the world at their fingertips including all the associated benefits. Yet, research tells another story. In a 2013 study of college students, those who refrained from using their mobile phones during lectures wrote

down 62% more information in their notes, noted more details, were able to recall more specific information, and earned a full letter grade and a half higher on a multiple choice test following the lecture than those students who were engaged in using their phones (Kuznekoff & Titsworth, 2013). Another 2013 study reported that 90% of university students admitted receiving text messages during class with 86% admitting to sending texts from class with both groups responding confidently in their ability to follow the lecture and text at the same time (Clayson & Haley, 2013). However, contradicting the student's belief, the study showed that those who texted during classes received lower grades within the course (Clayson & Haley, 2013).

A 2017 Ward et al. study introduced the term "brain drain" in reference to the presence of a smartphone. Their study showed that the mere presence of one's own smartphone occupied limited-capacity cognitive resources within one's brain. This resulted in reduced resource availability for other brain functions, such as weakened cognitive performance, anytime a phone is present. Even when individuals are maintaining constant concentration on a particular task and avoiding checking their phone, the sheer presence of their phone reduces cognitive capacity. Their study also showed that students performed more poorly on cognitive tasks based on the visibility of their friend's phone at the desk next to them. This experience of "brain drain" is highest for those with the most smartphone dependence (Ward, Duke, Gneezy, & Bos, 2017).

Supporting these findings, a report published in the UK, found that after schools banned mobile phones, test scores of students aged 16 years old improved by 6.4% of a standard deviation (Beland & Murphy, 2015). The economists behind this report estimate

that increase is equivalent to adding five additional days to the school year (Beland & Murphy, 2015).

Smartphone Use and Sleep Quantity

The National Sleep Foundation (NSF) recommendation of more than eight hours of sleep per night is achieved by only 10% of high school adolescents in the United States (Tashjian, Mullins, & Adriana, 2019). The regular occurrence of insufficient sleep duration in adolescence has been associated with vast negative outcomes including mood instability, poor academic performance, behavioral problems, substance use and abuse, and obesity (Owens, Judith; Adolescent Sleep Working Group; Committee on Adolescence, 2014). Recognizing insufficient sleep as a serious health risk, Sleep Health objectives were added as a new category in Healthy People 2020 with the specific relevant objective being: “SH-3: Increase the proportion of students in grades 9 through 12 who get sufficient sleep” (defined as eight or more hours of sleep on an average school night) (Sleep Health, 2019).

As children mature into young adults’ various natural biological changes have been linked to decreased sleep duration including shifts in circadian rhythm and slowing of sleep homeostatic pressure (Tashjian, Mullins, & Adriana, 2019). However, there are ample environmental influences that contribute as well including increased autonomy, social reorientation, amplified importance of peers, as well as technology consumption (Tashjian, Mullins, & Adriana, 2019).

It has been shown through numerous studies that increased internet usage is associated with shorter sleep duration, staying up later and sleeping in longer, and increased daytime sleepiness in adolescents (Garby, Nyberg, & Jakobsson, 2012; Pea et al., 2012; Van den Bulck; Woods & Scott, 2016). Aside from just general internet use, social media is uniquely harmful to sleep because it involves continual incoming messages and alerts which both interrupt sleep and create an anxious atmosphere where adolescents struggle with the fear of missing out (Woods & Scott, 2016). Adolescents who reported excessive social media use, particularly Facebook, showed decreased number of hours slept and increasing number of nightly interruptions as compared to those who reported less frequent social media usage (De-Sola Gutiérrez, Rodríguez de Fonseca, & Rubio, 2016). These effects are amplified considering that 86% of adolescents admit to sleeping with their phones in their bedrooms, often either in their hand or under their pillow (Lenhart, Ling, Campbell & Purcell, 2010; Woods & Scott, 2016). Among these statistics, there is a growing body of scientific evidence supporting the connection between poor sleep and internet and social media usage – however, there are no known studies that specifically examine the effects that phones with and without internet have on sleep.

Smartphone Use and Time Spent with Friends

With virtual access to friends in the palm of adolescents' hand, many are disincentivized to come out from behind their screens and interact face-to-face with peers. The Pew Research Center's national survey of teens between 13 and 17 years old, reported in 2015 that while a large majority of youth (95%) spend some time with friends in person

outside of school, only 25% report that these face-to-face interactions occur daily (Lenhart, Smith, Anderson, Duggan, & Perrin, 2015). This is compared to more than twice as many teens (55%) who text daily with friends and 88% who communicate with friends via text at least occasionally (Lenhart, Smith, Anderson, Duggan, & Perrin, 2015). As teens opt to spend more time socializing through technology, the parameters of friendship are changing with 58% of teens reporting that they spend time with their closest friends at someone's house rivaled closely by 55% of teens who spend time with their closets friends through an online forum such as social media or gaming sites (Lenhart, Smith, Anderson, Duggan, & Perrin, 2015). A combined 69% of teens reporting that text messaging (49%) or social media (20%) is their platform of choice when communicating with their closest friend (Lenhart, Smith, Anderson, Duggan, & Perrin, 2015).

Further, the type of phone that an adolescent carries has been shown to alter their communication practices with peers. Again, the Pew Research Center reported that 73% of teens have access to smartphones which is referred to in this study as phones with internet access (Lenhart, Smith, Anderson, Duggan, & Perrin, 2015). Teens with smartphones are more actively involved in texting in contrast to teens without smartphones who are more likely to utilize social media and make phone calls to interact with their close friends (Lenhart, Smith, Anderson, Duggan, & Perrin, 2015).

This shift in communication style is not without a heavy transaction cost – face-to-face interaction. A study conducted with sixth grade students from a public school in Southern California removed screen media for a five-day period and replaced it with increased face-to-face social interaction time. The study reported that the group of children

improved significantly in their ability to read facial emotion, demonstrating an increased understanding of nonverbal emotional cues. This was tested using the Diagnostic Analysis of Nonverbal Accuracy (DANVA) testing tool, where the students decreased pre and post test scores by 4.61 errors (decreased testing errors which represents an increase in overall score). This was compared to the children in the control group, who resumed their typical media exposure for the same five-day time span and reported no change between pretest and posttest results (Uhls, et al., 2014). Additionally, a 2016 study reported that eighth graders who spent more time in front of screen and less time engaging in interpersonal activities reported having lower psychological well-being measured by self-esteem, life satisfaction, and happiness (Bose, et al., 2016).

Smartphone Use and Cyberbullying

The near constant adolescent usage of smartphones and social media has been so closely linked to another distressing behavior that it even coined the name – cyberbullying. Cyberbullying was first recognized in 1998 (Merriam Webster, 2018) and is currently defined as bullying that occurs through digital devices such as cell phones, computers, and tablets and “includes sending, posting, or sharing negative, harmful, false, or mean content about someone else,” (U.S. Department of Health and Human Services, 2018). Incidents of cyberbullying tend to begin around 14 years of age, as children increase time spent on mobile phones and social networking platforms (John, et al., 2018). A 2015 study found that the emergence of cyberbullying was dependent upon the general themes of ability to use

technology, access to internet, social media and technology, and external factors including outside influences on children such as older siblings or peers (Monks, Mahdavi, & Rix, 2015). It poses unique challenges when compared to traditional bullying because due to its electronic nature, the perpetrators are afforded a degree of anonymity, the victims can be targeted at any point of time or location, and the victimization has greater exposure and scale (John, et al., 2018). Compounding the effects, one study indicates that over 85% of youth who experience cyberbullying are the victims of traditional bullying as well (Juvonen & Gross, 2008).

In a 2018 study, bullying and rumor spreading was listed as the largest of five reasons why 24% of adolescents said that social media had a mostly negative effect on their life, with the second largest reason being harmful to relationships or lack of in-person contact (Anderson & Jiang, May 2018). The 2017 Youth Risk Behavior Surveillance System from the Centers for Disease Control and Prevention reported that approximately 14.9% of high school students experienced electronic bullying in the 12 months before the survey (U.S. Department of Health and Human Services, 2018).

A metanalyses including 26 independent studies (encompassing 33 articles) that examined the mental health implications of cyberbullying found that youth “who have experienced cybervictimization are 2.35 times as likely to self-harm, 2.10 times as likely to exhibit suicidal behaviors, 2.57 times more likely to attempt suicide, and 2.15 times more likely to have suicidal thoughts than nonvictims,” (John, et al., 2018). Additionally, the study reported that perpetrators involved in cyberbullying were also 1.21 times more likely to

display suicidal behaviors when compared to non-perpetrators indicating that cyberbullying produces negative effects both ways (John, et al., 2018).

Smartphone Use and Gender

Gender affects much of how one thinks and what one does and in the area of smartphone use, this is no different. In the United States over the past decade, there has been a larger increase in adult women who own smartphones than males (Smith, 2011; Pew Research Center, 2018). This rise in smartphone adoption among women has been linked to the increase of social capabilities and applications that have been introduced during this time, including social media, messaging, shopping, and camera apps (Ferrer, 2018). Socializing and sustaining relationships is the primary driver of women smartphone usage while men tend toward leisure, entertainment and coordination (Ferrer, 2018).

The 2018 Pew study on adolescent phone use reported that compared to their male peers, females reported a slightly higher percent of having or having access to smartphones at home, 97% versus 93% (Anderson & Jiang, May 2018). In addition to higher phone ownership and access, 50% of teenage females report near-constant use of online technology compared to 39% of their male peers (Anderson & Jiang, May 2018). But it is not just quantity of usage that is influenced by gender, but also *how* adolescents are spending time with this technology. Female adolescents are more likely than males to report Snapchat is their most frequented site (42% versus 29%) while males spent the majority of their time on YouTube (39% versus 25%) (Anderson & Jiang, May 2018).

Summary

With the clear increased prevalence of cellphone and portable internet access and the increasing dependence and importance being placed on such technology, this generation is unknowingly being exposed to multiple risks of unidentified magnitude including: the risk of increased classroom distraction and reduced academic performance; the risk of increased sleep disturbances and inability to attain enough sleep to sustain emotional regulation; the risk of reduced quantity and quality of face-to-face social interaction with peers; and the risk of increased experience of cyberbullying along with the negative mental health implications that follow.

That said, the rapid technological advancements within this space, leaves scientific and empirical evidence working hard to play catch-up. As it stands now, there are still numerous gaps in the research which leaves many unanswered questions. Few studies have been done with large sample sizes. Few studies have included participants with diverse socioeconomic and ethnic backgrounds. And within this literature search, no studies were found that examined phone and internet access in conjunction with academic performance, sleep quantity, social interaction, and cyberbullying exposure.

The purpose of this study is to fill in some of these research gaps by providing empirical support to help quantifying the beforementioned risks. This study provides a unique piece to the puzzle as it examines a dataset that involves 9,056 participants spanning across rural and urban areas of Texas, who represent a wide range of ethnicities and who are living in poverty, affluence and everywhere between.

PUBLIC HEALTH SIGNIFICANCE

As stated earlier, current research indicates that as of May 2018, 95% of adolescents ages 12-17 have or have access to smart phones (cellphones with internet access) which has been linked to increase rates of depression, anxiety and cyber-bullying, and a decrease in sleep, academics performance, sense of well-being and time spent with friends. (Alfano, Zakem, Cosya, Taylor, & Weems, 2009; Anderson & Jiang, May 2018). In addition to the disturbing nature of these statistics, the technological advances within this space are evolving at a rapid pace and the research in this field is struggling to keep up. With this prolific and unprecedented technology, parents worry about raising their children in this uncharted territory. Nonprofits, new sources, and leading parent advocates have encouraged parents to delay giving their children smartphones or to give them simple flip phones without internet access as a compromise between providing a means of portable communication between family and friends while also protecting their children from the harmful effects detailed above. However, based on an extensive literature search, these suggestions have not been empirically tested.

This analysis looks to provide a more complete understanding of the effect that smartphones with internet access have on adolescents, specifically when compared to adolescents without access to cell phones or whose cell phones do not have internet access. The rationale for this research is to gain a scientific understanding of the effect that this prolific, yet unprecedented, technology has on adolescents as a means of informing public

health advice, school policy, and parental guidelines. It is the intent of this study that the outcome will help fill a gap within current scientific research.

RESEARCH AIM AND HYPOTHESIS

Research Aim

This study aims to determine the relationship between owning or having access to a cell phone with or without internet access, or not owning a cell phone, have on adolescent academic performance, whether or not they meet the guidelines for the amount of recommended nightly sleep, the amount of time spent with friends outside of school and the presence and frequency of cyber bullying experienced by 8th and 11th grade participants in the 2015-2016 SPAN study. Lastly, this study aims to determine the relationship between adolescent gender and the above-mentioned outcomes.

Hypothesis 1

Adolescents who own or have access to a cellphone with internet will have decreased academic performance, less likely to meet the guidelines for the recommended amount of nightly sleep, decreased amount of time spent with friends outside of school and increased presence and frequency of cyber bullying, as compared to those adolescents who do not have a cellphone or who have a cellphone without internet access.

Hypothesis 2

Female adolescents who own or have access to a cellphone with internet will experience more profound negative outcomes as compared with male adolescents who own or have access to a cellphone with internet, including decreased academic performance, less

likely to meet the guidelines for the recommended amount of nightly sleep, decreased amount of time spent with friends outside of school and increased presence and frequency of cyber bullying.

METHODS

Study Design & Sampling Frame

This study was performed using a cross-sectional analysis of the 2015-2016 data from the Texas School Physical Activity and Nutrition (SPAN) survey results from 8th and 11th graders in statewide Texas schools. The SPAN survey operates as a surveillance system, surveying participants in 2nd, 4th, 8th, and 11th grade about factors that might underlie obesity to recognize and monitor trends over time. Within the survey, Texas public school students are questioned about nutritional knowledge, behavior and attitudes, physical activity, perceptions of self, and screen (phone, tablet, computer, television) time usage (Perez, Hoelscher, Frankowski, Day, & Lee, 2010; University of Texas Health Science Center at Houston, School of Public Health, 2012).

SPAN used a multistage probability-based complex sampling design to produce a representative sample of students. Both adjustments for control totals and basic sampling weights were determined through the utilization of proportional probability of school enrollment selection (Perez et al., 2010). The Institutional Review Board (IRB) of The University of Texas Health Science Center at Houston, The Texas Department of State Health Services IRB and the local school district review committees each provided approval for the SPAN study (HSC-SPH-18-0432). The sampling frame included a list of eligible school districts in Texas for the first stage of sampling with the second stage including lists of schools within each district (Michael & Susan Dell Center for Healthy Living, University of Texas School of Public Health, Austin Regional Campus, 2015-2016). Parent consent

and student assent were obtained prior to survey administration. The 2009-2011 survey took approximately 35 minutes to complete.

Study Setting

The SPAN student surveys were administered in classrooms in 362 schools representing 71 districts from across the state of Texas (Michael & Susan Dell Center for Healthy Living, University of Texas School of Public Health, Austin Regional Campus, 2015-2016).

Study Subjects

The 2015-2016 SPAN survey collected data from 17,553 students across the state of Texas in the 2nd, 4th, 8th, and 11th grade representing an overall student population of 1,295,316 (School Physical Activity and Nutrition (SPAN) Survey 2015-2016). The sample included 5,421 for 8th and 3,635 for 11th grade representing a population of 347,620 and 311,668 respectively (Michael & Susan Dell Center for Healthy Living, University of Texas School of Public Health, Austin Regional Campus, 2015-2016). The 8th grade sample included 51.4% males (48.6% females) and were 51.7% Hispanic, 35.8% White and 12.5% African-American. The 11th grade sample included 50.6% males (49.4% females) and were 50% Hispanic, 37.4% White and 12.5% African-American (Michael & Susan Dell Center for Healthy Living, University of Texas School of Public Health, Austin Regional Campus, 2015-2016).

Sample Size Calculation

Sample size calculations for SPAN were optimized to maximize representativeness at the State level, as well as by Boarder regions and Health Service Regions (HSR). The broader level Health Service Region sample was recruited and analyzed for the state as well as at the regional level. The state sample size selection number to recruit was 2,176 8th graders and 2,744 11th graders. The Health Service Region sample size selection number to recruit was 5,424 8th grade participants and 6,738 11th grade participants.

Independent Variable Measures

Phone Status & Internet Access

Adolescent phone and internet status served as the two independent variables for this analysis. Responses to the following question were analyzed to assign phone status to study participants. “Do you have a cell phone? Examples: flip phone, iPhone®, Smartphone®, Android®.” There are three categorical response options including: “No, I do not have a cell phone.” “Yes, I have a cell phone that is my own.” and “Yes, I have a cell phone that I can use to call my family when I am not at home (for example, while I am at a friend’s house).” For the analysis purposes of this study, the two “yes” responses will be combined into a category of *owning or having access to a cell phone*.

Adolescent phone status was further refined by their phone’s internet accessibility with the question, “Can you access the internet with your cell phone?” This question offers four categorical response options including: “I do not have a cell phone.” “No, I cannot access the internet with my cell phone.” “Yes, but I can only access the internet in some

places (for example, at home).” and “Yes, I can access the internet anywhere.” Again, for the analysis purposes of this study, responses were collapsed into two categories, separately combining the results of the two “no” answers and the results of the two “yes” answers.

Outcome Measures

Academic Performance

Adolescent academic performance serves as one of this study’s four dependent variables and was self-reported by the question: “During the past 12 months, how would you describe your grades in school?” Seven categorical responses are given and include: “Mostly As” “Mostly Bs” “Mostly Cs” “Mostly Ds” “Mostly Fs” “None of these grades” and “Not sure.” These responses were scored as 0-4, with 0 representing “mostly Fs” and 4 representing “mostly As”. The remaining two category responses were treated as missing for these analyses.

Sleep

Adolescent sleep was determined by the self-reported response to “On an average school night, how many hours of sleep do you get?” Seven response categories include: “4 or less hours” “5 hours” “6 hours” “7 hours” “8 hours” “9 hours” and “10 or more hours.” The American Academy of Sleep Medicine and the American Academy of Pediatrics recommend that children age 13-18 years regularly sleep 8-10 hours a night for optimal health (Jenco, 2016). Based on this endorsement, adolescent sleep status was collapsed into *meets sleep recommendation* (including responses of 8 hours, 9 hours, and 10 or more hours

of sleep) and *does not meet sleep recommendation* (including responses of 7 and few hours of sleep) and was treated as a binary variable in analyses.

Face-to-Face Social Interaction

Assessment of adolescent face-to-face social interaction was measured with the question: “How often do you hang out with your friends during your free time, like before or after school, at night, or on the weekends?” The four self-reported categorical responses include: “Almost never” “sometimes” “often” and “almost always.” These responses were combined into two categories with “Almost never” and “sometimes” representing low frequency of social interaction and the responses of “often” and “almost always” representing high frequency. These categories were assigned numeric values of 0 and 1 respectively for low and high frequencies.

Cyberbullying

The final dependent variable to be analyzed by this study was the presence and frequency of cyberbullying as determined by the question: “Other kids say mean things to me or threaten me by sending me an email, online posting, text, or through other social media...” The response range included: “Everyday” “Once or twice a week” “Once or twice a year” and “Never.” These responses were regrouped by frequency with “Never” representing no cyberbullying exposure and were assigned a numerical 0. “Everyday” “Once or twice a week” and “Once or twice a year” responses were regrouped as having cyberbullying exposure and were assigned a numerical 1.

Covariates

For this study, grade level (8th and 11th grade), gender, ethnicity, and socioeconomic status were identified as additional variables, other than the independent variable, that might correlate with the outcome variables and were thus controlled for within the analyses.

The survey questions which determined the responses were straightforward for grade level and gender. Students were asked “What grade are you in?” in which they responded either “8th” or “11th” to determine grade level. For gender, students were asked “What are you?” with the response choices being “male” and “female.”

To identify ethnicity, the survey asked students “How do you describe yourself?” and asked students to limit their response to just one category. The options were as follows: Black or African-American; Latino, Hispanic, or Mexican-American; White, Caucasian, or Anglo; Vietnamese; Chinese; Indian or Pakistani; Other Asian; American Indian or Alaska Native; Native Hawaiian or Other Pacific Islander; Middle Eastern or North African; More than one race; and Other. For this study, “Black or African-American” and “Latino, Hispanic, or Mexican-American” responses were retained as the original data set, while all the other remaining categories were collapsed into a single group and labeled as “White or Other.”

In addition, all analyses were controlled for socioeconomic status of the school which was determined by the percent of students within the school that qualify for reduced or free school meals. This information was not a question within the survey instrument; rather publicly available data from the Texas Education Agency (TEA) was added to the dataset.

The data were then divided into three-level variables of high, medium or low socioeconomic status based on tertiles of the original data distribution. The tertile with the highest socioeconomic status hereafter referred to as “Highest SES” had, on average, 49.87% (std.dev. 17.98) economically disadvantaged students qualifying for free or reduced meals. The middle tertile of socioeconomic status had 78.86% (std.dev. 3.75) economically disadvantaged students and was referred to as “Middle SES.” Lastly, the group of students with the lowest socioeconomic status was referred to as “Lowest SES” and contained 92.87% (std.dev. 4.51) economically disadvantaged students qualifying for free or reduced meals.

Data Analysis

Regression models were run to analyze each of the hypotheses. The first hypothesis states that adolescents who own or have access to a cellphone with internet will have decreased academic performance, less likely to meet the guidelines for the recommended amount of nightly sleep, decreased amount of time spent with friends outside of school and increased presence and frequency of cyber bullying, as compared to those adolescents who do not have a cellphone or who have a cellphone without internet access. For the continuous dependent variable of academic performance, a linear regression model adjusted for grade, gender, and percent economically disadvantaged was performed. For the dichotomous dependent variables of whether adolescents meet the recommended amount of nightly sleep, amount of time spent with friends outside of school, and presence and frequency of cyberbullying, covariate-adjusted logistic regression models were conducted. Additionally, predicted margins were obtained from these regressions for all outcomes by levels of the key

independent variables. All models were adjusted for confounders such as age, sex, ethnicity, and school socioeconomic status.

For analyses of the second hypothesis that female adolescents who own or have access to a cellphone with internet will experience more profound negative outcomes as compared with male adolescents who own or have access to a cellphone with internet, including decreased academic performance, less likely to meet the guidelines for the recommended amount of nightly sleep, decreased amount of time spent with friends outside of school and increased presence and frequency of cyber bullying, models similar to the first set of models were run. Stratified logistic regression analysis was performed and the magnitude of the odds ratios and predicted marginal probabilities were compared. Because results were obtained from stratified models, tests of statistical significance could not be done. Again, the models were adjusted for age, ethnicity, and school socioeconomic status.

For all the above detailed analyses the significant level was set at 0.05. Models were run using Stata and accounted for the complex weighting of the SPAN survey.

RESULTS

Demographics

Gender and grade level were equally distributed, with 51.06% (n=4,555) of the survey population being male and 48.94% (n=4,501) female and 52.73% (n=5,421) representing 8th graders and 47.27% (3,635) representing 11th graders (weighted percentages). The mean age of the adolescents was 14.76 years. The sample was primarily Hispanic (50.93%, n=6,630) followed by White/Other (36.56%, n=1,810) and then African American (12.51%, n=616). Overall, 92.77% (n=8,081) of students reported owning or having access to a cell phone and 90.82% (n=7,733) reported that their phone could access the internet.

Owning or having access to a phone (identified as phone status) was equally distributed among gender, with 92.70% (n=4,56) of males and 92.84% (n=4,025) of females with phones, as was having a phone with internet access (identified as internet access) with 91.09% (n=3,831) and 90.53% (n=3,902) of males and females, respectively, having internet access on their phones. Both phone status and internet access differ by an approximate 5% increase between grade levels with 90.10% (n=4,683) of 8th graders and 95.63% (n=3,398) of 11th graders having or having access to phones and 88.21% (n=4,433) of 8th graders and 93.65% (n=3,300) of 11th graders having internet access on their phones. Phone status showed some slight variation among ethnicity with African Americans reporting lower proportions (89.29%, n=543) of having or having access to phones when compared to their Hispanic (93.46%, n=5,906) or White/Other (92.98%, n=1,632) counterparts. Internet access, however, was evenly distributed among ethnicities with each reporting at

approximately 91% (African American, 91%, n=509; Hispanic, 91%, n=5,655; White/Other, 90.5%, n=1569).

The students within the Highest SES group, indicating the school with the highest affluence or the fewest students qualifying for free or reduced meals, presented the highest proportion of students owning or having access to phones (94.28%, n=2,755) as well as owning phones with internet access (92.68%, n=2,676). Students in the Middle SES and Lowest SES groups both reported 91.3% (n=2,692; n=2,634, respectively) for phone status and 88% (n=2,571) and 89% (n=2,486) respectively for phone internet access. All sample demographics are presented in Table 1, by phone status and internet access respectively.

Table 1. Participant Demographic Frequency (Weighted Survey Proportion)

	Total	Phone Status		Internet Access	
		No Phone	Phone or Phone Access	No Phone or Internet Access	Phone with Internet Access
Grade/Age					
8th Grade	5,421 (52.73%)	510 (9.89%)	4,683 (90.10%)	734 (11.79%)	4,433 (88.21%)
11th Grade	3,635 (47.27%)	151 (4.37%)	3,398 (95.63%)	242 (6.35%)	3,300 (93.65%)
Gender					
Male	4,555 (51.06%)	323 (7.3%)	4,056 (92.70%)	526 (8.91%)	3,831 (91.09%)
Female	4,501 (48.94%)	338 (7.16%)	4,025 (92.84%)	450 (9.47%)	3,902 (90.53%)
Ethnicity					
African American	616 (12.51%)	45 (10.71%)	543 (89.29%)	80 (9%)	509 (91%)
Hispanic	6,630 (50.93%)	503 (6.54%)	5,906 (93.46%)	728 (9%)	5,655 (91%)
White/Other	1,810 (36.56%)	113 (7.02%)	1,632 (92.98%)	168 (9.5%)	1,569 (90.5%)
School Socioeconomic Status (SES)					
Highest SES	3,064 (49.39%)	174 (5.72%)	2,755 (94.28%)	247 (7.32%)	2,676 (92.68%)
Middle SES	2,999 (19.88%)	228 (8.63%)	2,692 (91.37%)	336 (11.92%)	2,571 (88.08%)
Lowest SES	2,993 (30.73%)	259 (8.68%)	2,634 (91.32%)	393 (10.31%)	2,486 (89.69%)
Overall	9,056	661 (7.23%)	8,081 (92.77%)	976 (9.18%)	7,733 (90.82%)

Hypothesis One Analyses

Phone Status/Internet Access and Academic Performance

Table 2 presents the results of the regression of adolescent's academic performance score considering their phone status and internet access. Table 2a presents the predicted mean academic performance score, or grade point average, considering both adolescent phone status and internet access based on the models presented in Table 2.

Table 2. Survey Regression of Academic Performance Score Against Phone Status and Internet Access, Adjusted for Grade, Gender, School Socioeconomic Status and Ethnicity

Variable	Phone Status			Variable	Internet Access		
	Coefficient	Standard Error	P-Value		Coefficient	Standard Error	P-Value
Phone Status				Internet Access			
No Phone	-ref-			No Phone/Phone Without Internet	-ref-		
Phone Ownership/Access	0.009	0.072	0.901	Phone with Internet Access	0.193	0.097	0.049
Grade				Grade			
8th grade	-ref-			8th grade	-ref-		
11th grade	-0.084	0.522	0.109	11th grade	-0.102	0.052	0.052
Gender				Gender			
Male	-ref-			Male	-ref-		
Female	0.114	0.488	0.021	Female	0.106	0.048	0.029
School Socioeconomic Status (SES)				School Socioeconomic Status (SES)			
Highest SES	-ref-			Highest SES	-ref-		
Middle SES	-0.083	0.052	0.113	Middle SES	-0.078	0.053	0.146
Lowest SES	-0.003	0.062	0.966	Lowest SES	-0.006	0.064	0.924
Ethnicity				Ethnicity			
African American	-ref-			African American	-ref-		
Hispanic	-0.067	0.066	0.315	Hispanic	-0.066	0.067	0.321
White/Other	0.155	0.07	0.027	White/Other	0.159	0.07	0.024

Table 2a. Predicted Means From Adjusted Linear Regression Models of Academic Performance Score by Phone Status and Internet Access

Variable	Predicted Mean	Variable	Predicted Mean
No Phone	3.19	No Phone/Phone Without Internet	3.03
Phone Ownership/Access	3.20	Phone with Internet Access	3.22
Difference in Predicted Mean	0.01	Difference in Predicted Mean	0.19
<i>p-value for difference</i>	<i>0.901</i>	<i>p-value for difference</i>	<i>0.049</i>

After adjusting for other potential confounders of grade level, gender, school socioeconomic status and ethnicity, academic performance is comparable (Beta=0.009, SE=0.072, $p>0.05$) across adolescents who have or have access to a cell phone and those that do not, suggesting that cell phone access does not negatively impact academic performance. Other covariates are related to academic performance as follows: academic performance score is significant among females compared to males (Beta=0.11, SE=0.049, $p<0.05$), and among children of White/Other ethnicity compared to African-American children (Beta=0.159, SE=0.07, $p<0.05$). (Table 2)

Controlling for the same covariates, students who have a phone with internet access have a significantly higher academic performance of 0.19 (SE=0.097, $p<0.05$) points when compared to their peers without internet enabled phones. As with phone status, gender is also significantly associated with an academic performance increase of 0.11 (SE=0.048, $p<0.05$). (Table 2)

The predicted mean grade point average for students who own or have access to cell phones is 3.20 while those who did not is 3.19 ($p>0.05$). The predicted mean grade point average for students who have internet access on their phones is 3.22, compared to 3.03 for those students without internet access ($p<0.05$). This suggests that internet access is more strongly associated with academic performance rather than just having a cell phone and that academic performance is higher when students have internet access (Table 2a).

Phone Status/Internet Access and Sleep

Presented in Table 3 are the adjusted regression results of adolescents meeting the American Academy of Pediatrics (AAP) recommendation for nightly sleep across both levels of phone status and internet access. The predicted margins highlighted in Table 3a, show this model's probability of teens attaining the sleep recommendations given phone status and internet access.

Table 3. Survey Regression of Meeting Sleep Recommendations against Phone Status and Internet Access, Adjusted for Grade, Gender, School Socioeconomic Status and Ethnicity

Variable	Phone Status				Internet Access		
	Coefficient	Standard Error	P-Value		Coefficient	Standard Error	P-Value
Phone Status				Internet Access			
No Phone	-ref-			No Phone/Phone Without Internet	-ref-		
Phone Ownership/Access	0.749	0.132	0.102	Phone with Internet Access	1.026	0.182	0.883
Grade				Grade			
8th grade	-ref-			8th grade	-ref-		
11th grade	0.386	0.053	0.000	11th grade	0.379	0.053	0.000
Gender				Gender			
Male	-ref-			Male	-ref-		
Female	0.768	0.052	0.000	Female	0.764	0.052	0.000
School Socioeconomic Status (SES)				School Socioeconomic Status (SES)			
Highest SES	-ref-			Highest SES	-ref-		
Middle SES	0.764	0.108	0.059	Middle SES	0.779	0.112	0.083
Lowest SES	1.073	0.235	0.749	Lowest SES	1.095	0.24	0.679
Ethnicity				Ethnicity			
African American	-ref-			African American	-ref-		
Hispanic	0.775	0.361	0.584	Hispanic	0.770	0.365	0.582
White/Other	0.604	0.234	0.195	White/Other	0.617	0.244	0.224

Table 3a. Predicted Probabilities From Adjusted Logistic Regression Models of Meeting Sleep Recommendations by Phone Status and Internet Access

Variable	Predicted Probability	Variable	Predicted Probability
No Phone	0.473	No Phone/Phone Without Internet	0.406
Phone Ownership/Access	0.406	Phone with Internet Access	0.412
Difference in Predicted Probability	-0.067	Difference in Predicted Probability	0.006
<i>p-value for difference</i>	<i>0.102</i>	<i>p-value for difference</i>	<i>0.883</i>

As shown in Table 3, when adjusted for grade level, gender, socioeconomic status and ethnicity, adolescents who have or have access to a phone have moderately lower odds ($OR=0.749$, $SE=0.132$, $p>0.05$) of attaining the AAP's recommendation for amount of nightly sleep when compared to adolescents who do not have phones, although not at a statistically significant level. In the same model, both grade and gender are also associated with statistically significant lower odds of attaining the recommended amount of sleep. When compared to their younger 8th grade counterparts, students in the 11th grade have slightly lower odds ($AOR=0.386$, $SE=0.053$, $p<0.05$) of meeting sleep requirements. Females also present a statistically significant lower odds ($AOR=0.768$, $SE=0.052$, $p<0.05$) of meeting sleep requirements relative to males.

Overall, adolescents who have or have access to phones with internet have comparable odds ($OR=1.026$, $SE=0.181$, $p>0.05$) of attaining the AAP's recommendation for amount of nightly sleep, relative to adolescents that do not have an internet-connected phone, when adjusted for the same covariates as above. As with phone status, in the same model, both grade and gender are negatively associated with attaining the recommended amount of nightly sleep. Students in 11th grade have lower odds ($AOR=0.379$, $SE=0.053$, $p=0.0$) of attaining the recommended amount of nightly sleep when compared to their 8th grade counterparts. Females present a statistically significant lower odds ratio of 0.764 ($SE=0.052$, $p=0.0$) in meeting sleep recommendations when compared to males.

The predicted marginal probability of meeting sleep recommendations in each of these groups is presented in Table 3a. Among adolescents who own or have access to phones, the predicted probability of meeting sleep recommendations is 40.6% compared to

47.3% ($p>0.05$) among those without phones; while this is a large difference, it is not statistically significant. Unlike phone status, the difference in the predicted probability of meeting sleep recommendations across internet access levels is small. Adolescents with internet access have a 41.2% probability of meeting the recommended sleep guidelines compared to 40.6% ($p>0.05$) of adolescents who do not have internet access on their phones.

Phone Status/Internet Access and Time Spent with Friends

Adolescent's response of the frequency of time spent with friends as related to their phone status and internet access is displayed in Table 4 below. Based on this regression model, the predicted margins shown in Table 4a present the predicted probability of adolescents reporting a high frequency of time spent with friends across both variables of phone status and internet access.

Table 4. Survey Regression of Time Spent with Friends Against Phone Status and Internet Access, Adjusted for Grade, Gender, School Socioeconomic Status and Ethnicity

Variable	Phone Status				Internet Access		
	Coefficient	Standard Error	P-Value		Coefficient	Standard Error	P-Value
Phone Status				Internet Access			
No Phone	-ref-			No Phone/Phone Without Internet	-ref-		
Phone Ownership/Access	1.70	0.462	0.054	Phone with Internet Access	2.233	0.435	0.000
Grade				Grade			
8th grade	-ref-			8th grade	-ref-		
11th grade	1.073	0.126	0.55	11th grade	1.067	0.128	0.587
Gender				Gender			
Male	-ref-			Male	-ref-		
Female	0.633	0.049	0.000	Female	0.633	0.489	0.000
School Socioeconomic Status (SES)				School Socioeconomic Status (SES)			
Highest SES	-ref-			Highest SES	-ref-		
Middle SES	0.862	0.092	0.168	Middle SES	0.893	0.100	0.311
Lowest SES	0.609	0.088	0.001	Lowest SES	0.625	0.092	0.002
Ethnicity				Ethnicity			
African American	-ref-			African American	-ref-		
Hispanic	0.694	0.117	0.032	Hispanic	0.698	0.117	0.032
White/Other	0.842	0.150	0.336	White/Other	0.870	0.152	0.426

Table 4a. Predicted Probabilities From Adjusted Logistic Regression Models of Time Spent with Friends by Phone Status and Internet Access

Variable	Predicted Probability	Variable	Predicted Probability
No Phone	0.329	No Phone/Phone Without Internet	0.279
Phone Ownership/Access	0.451	Phone with Internet Access	0.457
Difference in Predicted Probability	0.122	Difference in Predicted Probability	0.178
<i>p-value for difference</i>	<i>0.054</i>	<i>p-value for difference</i>	<i>0.000</i>

When adjusted for grade level, gender, socioeconomic status and ethnicity, overall adolescents who have or have access to cell phones have moderately higher odds (OR=1.70, SE=0.46, p=0.05) of reporting that they “often” or “almost always” spend time with their friends outside of school, as compared to adolescents who do not have cell phones.

In this same model, gender, school socioeconomic status and ethnicity all reported statistically significant associations. Females have marginally lower odds (AOR=0.63, SE=0.05, p<0.05) of spending time with friends outside of school relative to their male

counterparts. Students from schools within the lowest SES also reported marginally lower odds ($AOR=0.61$, $SE=0.09$, $p<0.05$) of spending time with friends outside of school when compared to students from schools with higher socioeconomic status. Lastly, Hispanic students have marginally lower odds ($AOR=0.70$, $SE=0.12$, $p<0.05$) of spending time with friends outside of school relative to their peers of other ethnicities.

Adjusting for the same confounders as above, Table 4 shows that overall adolescents who have or have access to phones with internet have statistically significantly greater odds ($AOR=2.23$, $SE=0.44$, $p<0.05$) of responding that they “often” or “almost always” spend time with friends during their free time outside of school.

As with the phone status model, this internet access model also reported similar statistically significant negative associations for gender, school socioeconomic status and ethnicity. Females have marginally lower odds ($AOR=0.63$, $SE=0.05$, $p<0.05$) of spending time with friends outside of school relative to their male counterparts. Students from schools within the lowest SES also reported marginally lower odds ($AOR=0.63$, $SE=0.09$, $p<0.05$) of spending time with friends outside of school when compared to students from schools with higher socioeconomic status. Lastly, Hispanic students have marginally lower odds ($AOR=0.70$, $SE=0.12$, $p<0.05$) of spending time with friends outside of school relative to their peers of other ethnicities.

Utilizing this adjusted regression, the predicted probabilities shown in Table 4a depict that adolescents who own or have access to phones have a 45% probability of reporting a high frequency of spending time with friends outside of school while only 33% ($p=0.05$) of adolescents without phones have the probability of reporting the same frequencies. The gap

between the predicted probabilities of time spent with friends outside of school widens further among adolescents with internet access on their phones and those without, when compared to phone status. Adolescents who have phones with internet access have a 46% probability of reporting high frequencies of spending time with friends outside of school compared to only 28% ($p < 0.05$) of those without internet-enabled phones.

Phone Status/Internet Access and Cyberbullying

Table 5 exhibits the results of the regression of adolescent's experience with cyberbullying against their phone status and internet access. Table 5a presents the predicted probability margins of cyberbullying experience considering both adolescent phone status and internet access based on the models presented in Table 5.

Table 5. Survey Regression of Cyberbullying Experience Against Phone Status and Internet Access, Adjusted for Grade, Gender, School Socioeconomic Status and Ethnicity

Variable	Phone Status				Internet Access		
	Coefficient	Standard Error	P-Value		Coefficient	Standard Error	P-Value
Phone Status				Internet Access			
No Phone	-ref-			No Phone/Phone Without Internet	-ref-		
Phone Ownership/Access	0.990	0.319	0.976	Phone with Internet Access	0.660	0.105	0.010
Grade				Grade			
8th grade	-ref-			8th grade	-ref-		
11th grade	0.726	0.113	0.041	11th grade	0.743	0.116	0.057
Gender				Gender			
Male	-ref-			Male	-ref-		
Female	1.116	0.154	0.425	Female	1.108	0.153	0.457
School Socioeconomic Status (SES)				School Socioeconomic Status (SES)			
Highest SES	-ref-			Highest SES	-ref-		
Middle SES	0.971	0.162	0.860	Middle SES	0.951	0.163	0.770
Lowest SES	0.652	0.110	0.012	Lowest SES	0.646	0.114	0.014
Ethnicity				Ethnicity			
African American	-ref-			African American	-ref-		
Hispanic	0.605	0.133	0.024	Hispanic	0.615	0.142	0.036
White/Other	0.914	0.208	0.695	White/Other	0.928	0.218	0.751

Table 5a. Predicted Probabilities From Adjusted Logistic Regression Models of Cyberbullying Experience by Phone Status and Internet Access

Variable	Predicted Probability	Variable	Predicted Probability
No Phone	0.196	No Phone/Phone Without Internet	0.259
Phone Ownership/Access	0.195	Phone with Internet Access	0.189
Difference in Predicted Probability	-0.001	Difference in Predicted Probability	-0.070
<i>p-value for difference</i>	<i>0.976</i>	<i>p-value for difference</i>	<i>0.010</i>

After adjusting for grade level, gender, socioeconomic status and ethnicity, overall adolescents who have or have access to cell phones have marginally lower odds (AOR=0.99, SE=0.32, $p>0.05$) of responding that they experienced cyberbullying “everyday” “once or twice a week” or “once or twice a year” relevant to their peers without phones, although not at a statistically significant level. Students from schools within the lowest SES reported marginally lower odds (AOR=0.65, SE=0.11, $p<0.05$) of cyberbullying exposure when compared to students from schools with higher socioeconomic status. Hispanic students also have marginally lower odds (AOR=0.60, SE=0.13, $p<0.05$) of cyberbullying exposure compared to their peers of other ethnicities.

Holding the same covariates constant, adolescents who have internet access on their phones have statistically significant marginal lower odds (AOR=0.66, SE=0.11, $p<0.05$) of responding that they experienced cyberbullying within the past year (ranging from daily to once or twice a year) relevant to their peers without access to the internet on their phones. As with the phone status model, this internet access model also reported similar statistically significant negative associations for school socioeconomic status and ethnicity. Students from schools within the lowest SES of socioeconomic status reported marginally lower odds

(AOR=0.65, SE=0.11, $p<0.05$) of cyberbullying exposure when compared to students from schools in the middle SES and highest SES groups. Hispanic students also have marginally lower odds (AOR=0.61, SE=0.14, $p<0.05$) of cyberbullying exposure compared to their peers of other ethnicities.

In Table 5a, a wider spread was seen between predicted probabilities when adolescents have internet-enabled phones, as compared to the difference seen between the predicted probabilities of phone status alone. The predicted probabilities of cyberbullying exposure are comparable between adolescents' who have phones and those who do not, 19.5% and 19.6% ($p>0.05$) respectively. The probability of adolescents with access to internet on their phones who experienced cyberbullying is predicted to be 18.9% compared to 25.9% ($p<0.05$) when adolescents do not have internet-enabled phones.

Hypothesis Two Analyses

Stratified Gender Analysis

Males and females report comparable high proportions of owning or having access to cell phones with means of 92.7% (SE=0.012) and 92.8% (SE=0.011) respectively. Males and females also report comparable proportions of internet access with just slightly more males reporting access with means of 91.09% (SE=0.010) versus 90.53% (SE=0.011) of females. Since the majority of adolescents have cell phones that are internet-enabled, phone status and internet access are closely linked. Because of this, to determine how phone status and internet access interact with gender, just data about internet access was further examined.

To address to second hypothesis and analyze what influence gender has on adolescent academic performance, whether or not they meet the guidelines for the amount of recommended nightly sleep, the amount of time spent with friends outside of school and the frequency of cyber bullying experienced, stratified logistic analyses were performed. Full regression analyses results are shown in Table 8 through Table 11 in the Appendix. Predicted margin results based on those models are presented in the Tables below.

Table 6. Predicted Means From Adjusted Stratified Regression Models of Gender and Academic Performance Score by Phone Internet Access

Variable	Females	Variable	Males
No Phone/Phone Without Internet	2.993	No Phone/Phone Without Internet	3.070
Phone with Internet Access	3.281	Phone with Internet Access	3.157
Difference in Predicted Means	0.288	Difference in Predicted Means	0.087
<i>p-value for difference</i>	<i>0.048</i>	<i>p-value for difference</i>	<i>0.409</i>

Adjusted for the covariates of grade level, school socioeconomic status, and ethnicity, Table 6 presents the predicted means from the stratified regression models of gender and academic performance, considering phone internet access (Table 8 in Appendix). Females with internet access on their phones have higher predicted grade point averages (mean=3.281, $p<0.05$) than their female counterparts without phones or internet-enabled phones (mean=2.993, $p<0.05$) and their male counterparts both with internet access (mean=3.157, $p>0.05$) and without (mean=3.070, $p>0.05$). The difference in the predicted means for females is an increase of 0.228 ($p<0.05$) in academic performance score with an internet-enabled phone, compared an increase of only 0.087 ($p>0.05$) for males.

Table 7 highlights the predicted probabilities determined by the stratified logistic regression models adjusted for grade level, school socioeconomic status, and ethnicity, and run for the remaining response variables of interest, including: meeting sleep recommendations, time spent with friends and cyberbullying experience. The full regression analysis results can be found in Table 9 through Table 11 in the Appendix.

Table 7. Predicted Probabilities From Adjusted Stratified Regression Models of Gender and Meeting Sleep Recommendations, Time Spent with Friends and Cyberbullying Experience by Phone Internet Access			
Meeting Sleep Recommendations			
Variable	Females	Variable	Males
No Phone/Phone Without Internet	0.372	No Phone/Phone Without Internet	0.431
Phone with Internet Access	0.381	Phone with Internet Access	0.442
Difference in Predicted Probability	0.009	Difference in Predicted Probability	0.011
<i>p-value for difference</i>	<i>0.865</i>	<i>p-value for difference</i>	<i>0.841</i>
Time Spent with Friends			
Variable	Females	Variable	Males
No Phone/Phone Without Internet	0.272	No Phone/Phone Without Internet	0.283
Phone with Internet Access	0.396	Phone with Internet Access	0.515
Difference in Predicted Probability	0.124	Difference in Predicted Probability	0.232
<i>p-value for difference</i>	<i>0.054</i>	<i>p-value for difference</i>	<i>0.000</i>
Cyberbullying Experience			
Variable	Females	Variable	Males
No Phone/Phone Without Internet	0.264	No Phone/Phone Without Internet	0.255
Phone with Internet Access	0.197	Phone with Internet Access	0.180
Difference in Predicted Probability	-0.067	Difference in Predicted Probability	-0.075
<i>p-value for difference</i>	<i>0.118</i>	<i>p-value for difference</i>	<i>0.023</i>

According to this analysis, both males and females, with and without internet access on their phones, have a less than a 50% probability of meeting the AAP's recommendation for amount of nightly sleep (based on analyses presented in Table 9 in the Appendix). Females with and without phone internet access (38.1% and 37.2%, respectively, $p>0.05$)

have predicted probabilities of meeting sleep requirements that are approximately 6% lower than their male counterparts with and without phone internet access (44.2% and 43.1%, respectively, $p>0.05$), although not statistically significant. The difference in predicted probability between females and males is comparable at 0.9% ($p>0.05$) and 1.1% ($p>.05$), respectively.

Females and males with phone internet access have statistically significant higher predicted probabilities of reporting a higher frequency of spending time with friends outside of school than their counterparts without internet access (based on analyses presented in Table 10 in the Appendix). The predicted probability of reporting higher frequency of spending time with friends outside of school is 39.6% ($p<0.05$) among females with phone internet access, compared to 51.5% ($p<0.5$) among males with phone internet access. Females and males without phone internet access have comparable predicted probabilities of spending time with friends outside of school (27.2% and 28.3%, respectively, $p<0.05$). The difference in predicted probability is approximately twice as much for males (23.2%, $p<0.05$) as compared to females (12.4%, $p<0.05$).

Both females and males with and without phone internet access have comparable predicted probabilities of cyberbullying experience (based on analyses presented in Table 11 in the Appendix). Females with phone internet access have a 19.7% ($p>0.05$) probability of reporting cyberbullying experience relevant to 18% ($p<0.05$) for males with phone internet access. The difference in predicted probability of cyberbullying is greater for males than females, as females showed a decrease of 6.7% ($p>0.05$) and males showed a decrease of 7.5% ($p<0.05$) with phone internet access.

DISCUSSION AND FUTURE DIRECTIONS

Older generations have always been concerned about the negative effects of what the “kids these days” are doing. However, never before have the stakes been so high, and the “new thing” so pervasive in the lives of children. The science in this area is struggling to keep up with the technological advances being developed, heavily marketed, sold, and adopted by millions. The results of this study show that the majority of teens report having phones with internet access in 8th grade and approximately half of those who do not, report having them by 11th grade. The main factor associated with statistically significant results was internet access on phones, specifically with the variables of academic performance, time spent with friends and experience of cyberbullying and tell a story that may not be as threatening as it appears.

The slight increase of adolescent academic performance with the ownership of a phone with internet access is contradictory to other research in this area (Ward, Duke, Gneezy, & Bos, 2017). However, other research in this area has been focused on college students rather than high school or has been specific to school districts that allow phones in classrooms (Kuznekoff & Titsworth, 2013) (Clayson & Haley, 2013) (Beland & Murphy, 2015). The results of this analysis, although minor, add a unique perspective to the literature in this area that perhaps phones with internet access can be used as an educational tool for high school students. More research should be conducted to establish guidelines and best practices.

In the area of sleep, this study showed that overall adolescents’ have a less than 50% probability of reporting that they meet the AAP’s recommended amount of nightly sleep.

These results are comparable to the 2014 National Sleep Foundation results which reported 71% of adolescents between 12-14 years and 45% of adolescents between 15-17 years attained eight or more hours of nightly sleep (National Sleep Foundation, 2014). Teen phone status and internet access failed to produce significant outcomes when associated with meeting sleep recommendations. (In this study, adolescents with phones were shown to have moderately lower odds of meeting sleep recommendations and those with internet access showed comparable odds when compared teens without phones or without internet-enabled phones, respectively, although not at significant levels.) Other studies in this area have found significant associations between teen phone use and decreased sleep quantity and quality specifically when phone use is at a high rate and when usage is around bedtime (Tashjian, Mullins, & Adriana, 2019; Woods & Scott, 2016). Since this study did not have data on the amount of phone usage or timing of the usage, an association between these points might have been missed.

Within this study, time spent with friends was the one variable that produced statistically significant findings with both factors of phone status and internet access. Both adolescents with phones and those with internet access on their phones reported higher frequencies of time spent with friends outside of school. Other studies have indicated that phone and internet access can contribute to teen isolation; however, this study's findings suggest potential changes in social norms (Lenhart, Smith, Anderson, Duggan, & Perrin, 2015). Perhaps those adolescents with phones and internet access are better equipped to stay connected with their friends through group texts, social media, and gaming. This ease of communication could lead to increased face-to-face social interactions and gatherings. Or

perhaps the definition of “time spent with friends” is changing and when answering this question, adolescents included the *online* time spent with friends outside of school as well as that which was spent in-person. Additional research should be done to gain a more complete understanding of how teens view time spent with friends and what role technology plays.

Lastly, adolescents with internet-enabled phones showed statistically significant lower experiences of cyberbullying, which, again, is contradictory to other research in this area (Anderson & Jiang, May 2018; John, et al., 2018; U.S. Department of Health and Human Services, 2018). An early 2005 study from Great Britain reported that 20% of youth 11-19 years old had experienced cyberbullying via mobile phone messaging or email (Kraft, 2006) and more recently, in 2017, approximately 15% of high school students reported that they had experienced electronic bullying within the past year (U.S. Department of Health and Human Services, 2018). These results of reported cyberbullying experience agree roughly with the data presented in this study (predicted probabilities of cyberbullying ranging 19%-26%); however, unlike other studies, which report that a positive correlation between cyberbullying and smartphone/social media usage, the results of this study show a negative association between cell phone ownership and internet access and the experience of cyberbullying (John, et al., 2018; Monks, Mahdavi, & Rix, 2015).

Across the board for all outcomes, the results of this study were contradictory to the study hypotheses and current findings of other researchers. It is proposed that this occurred for one of two reasons. First, each of these outcomes may be associated with individual socioeconomic status. Socioeconomic status has been shown to influence how individuals interact with cell phone technology, specifically college students with low socioeconomic

backgrounds were consistently shown to use approximately 40% more applications in terms of frequency and duration than their more affluent peers (Rahmati, Tossell, Shepard, Kortum, & Zhong, 2012). Students from the lowest socioeconomic status group of users were shown to access their smartphones 50% more frequently than other users and spend a much higher amount of time on social networking and passive entertainment applications. This was thought in part to be due to these students enhanced need to rely on technology for both utilitarian reasons as well as entertainment, perhaps due to limited external opportunities (Rahmati, Tossell, Shepard, Kortum, & Zhong, 2012). These findings suggest clear usage differences based on individual socioeconomic status, however, the dataset utilized for this study relied on schoolwide socioeconomic status as a proxy for that of the student and in addition, did not include data on patterns of usage. Thus, individual socioeconomic status was something that could not have been controlled for and could have led to some confounding within the outcomes.

Second, there may in fact be a causal relationship between cell phone ownership and internet access and these reported outcomes that have not been present among other studies. It is possible that as cell phone usage becomes normative among peer-centered youth, owning a cell phone with internet access makes one more desirable thus increasing friendships, reducing cyberbullying and in turn, improving grades.

The stratified gender results were consistent with the results overall in that adolescents with phone internet access presented higher predicted academic mean grades, increased predicted probability of meeting sleep recommendations, spending time with friends and decreased experience of cyberbullying experience when compared to their peers

without phones or phones without internet access. However, when comparing females with phone internet access to males of the same category, females presented higher predicted mean grades and lower predicted probability of meeting sleep recommendations, spending time with friends, and experience with cyberbullying.

Of note is that the difference in predicted probability of time spent with friends outside of school among adolescents with phone internet access was approximately double for males as compared to females yet was comparable between males and females without phone internet access. This was surprising given the more social nature of females. However, this result could be a product of perception since the measure does not ask for a specific quantity of time spent with friends but rather included four options ranging from “almost never” to “almost always.” With an increased desire to spend time with friends, females could have a lower perception of time actually spent with friends, which could have accounted in a lower score compared to males.

One unrealized goal of this study was that adolescents who had access to a phone but lacked internet access could not be examined. One of the intentions of this study was to be able to provide scientific data to address the recommendation of providing adolescents with cell phones without internet capability as a way of “safe guarding” them from the physical, mental, and emotional risks linked to smartphones, social media, and internet access as addressed within the background of this study (Anderson & Jiang, May 2018). However, the proportion of adolescents within this sample who responded to having phones that lacked internet access was only 3.1%, making it too small to support reliable analysis.

Some current recommendations suggest that parents should wait until at least 8th grade before allowing their child to have a phone enabled with the internet due to the social, emotional and mental maturity that occurs by then. The predicted results of this study might not have been seen due to the fact that data on these variables were only available for adolescents in 8th and 11th grades. Therefore, this study can serve as further support of that recommendation as it shows that by 8th grade students benefit in the areas of academic performance, times spent with friends, and experience of cyberbullying from having access to a phone with internet capability.

Strengths and Limitations

Aside from supporting the high frequency of phone ownership, the results of this study do not line up with that of other findings. This could have been partially due to the fact that this study is a secondary analysis of data collected for the purpose of surveying physical activity and nutritional health of students in Texas public schools. The survey measure utilized was thus not specifically geared toward collecting data about cell phone and internet access and usage. Each dependent variable result was determined by one survey question which might not have been substantial or sensitive enough to capture all the nuances of this topic. For instance, no detail was gathered about factors that other studies have deemed to influence results including how long students have had phones or internet access, how much accessibility or monitoring they have on these devices, their phone and internet usage quantity and patterns throughout the day or their perceptions of their personal phone usage

and that of others. As a result, the impact of adolescent phone status and internet access may have been underestimated or not fully realized.

These measures also relied on adolescent self-reported data which can be subject to recall and bias, especially considering that some of the information gathered could be perceived as implying social desirability, i.e. making good grades, having lots of friends, and being well-liked. In addition, socioeconomic status, was determined at the school level, rather than the individual, and thus could have presented additional confounding which could not be adjusted for.

Lastly, this study examined a cross-sectional data set that was taken at one point in time and can thus not determine any causality in the relationships presented.

Along with these limitations, there are strengths to these results including the utilization of sampling weights, which were determined by proportional probability of school enrollment selection, and survey-based analyses. The sample size is another strength considering that it was large, ethnically and socioeconomically diverse, and representative of the adolescent population of Texas. A strength of this study is that all of the results were adjusted for grade level, gender, socioeconomic status and ethnicity however, there could have been other confounding variable that had an influence on the results that were not accounted for in these adjustments.

CONCLUSION

In conclusion, this study presented findings that the majority of adolescents have phones with internet access by 8th and 11th grade. Aside from that point, the findings of this study were contradictory to much of the current available research, including that having phones with internet access might serve as an advantage with slight boosts in academic performance, increased time spent with friends outside of school, and reduced frequency of cyberbullying experience. In these findings, neither of this study's hypotheses were supported. Recommended next steps would be to perform a longitudinal study specifically examining the nuances around phone ownership and internet access in youth to gain a more complete picture of how these factors effect the outcomes of interest.

APPENDIX

Table 8 Survey Stratified Regression of Gender and Academic Performance Score Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity

Table 8. Survey Stratified Regression of Gender and Academic Performance Score Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity							
Variable	Females			Variable	Males		
	Coefficient	Standard Error	P-Value		Coefficient	Standard Error	P-Value
Phone Internet Access				Phone Internet Access			
No Phone/Phone Without Internet	-ref-			No Phone/Phone Without Internet	-ref-		
Phone with Internet Access	0.287	0.144	0.048	Phone with Internet Access	0.087	0.106	0.409
Grade				Grade			
8th grade	-ref-			8th grade	-ref-		
11th grade	-0.200	0.068	0.004	11th grade	-0.005	0.070	0.946
School Socioeconomic Status (SES)				School Socioeconomic Status			
Highest SES	-ref-			Highest Tertile	-ref-		
Middle SES	-0.009	0.078	0.912	Middle Tertile	-0.149	0.064	0.021
Lowest SES	0.014	0.076	0.854	Lowest Tertile	-0.023	0.085	0.787
Ethnicity				Ethnicity			
African American	-ref-			African American	-ref-		
Hispanic	-0.045	0.102	0.656	Hispanic	-0.087	0.082	0.293
White/Other	0.198	0.123	0.107	White/Other	0.122	0.073	0.094

Table 9 Survey Stratified Regression of Gender and Meeting Sleep Recommendations Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity

Table 9. Survey Stratified Regression of Gender and Meeting Sleep Recommendations Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity							
Variable	Females			Variable	Males		
	Coefficient	Standard Error	P-Value		Coefficient	Standard Error	P-Value
Internet Access				Internet Access			
No Phone/Phone Without Internet	-ref-			No Phone/Phone Without Internet	-ref-		
Phone with Internet Access	1.040	0.238	0.865	Phone with Internet Access	1.047	0.241	0.841
Grade				Grade			
8th grade	-ref-			8th grade	-ref-		
11th grade	0.398	0.049	0.000	11th grade	0.356	0.063	0.000
School Socioeconomic Status (SES)				School Socioeconomic Status			
Highest SES	-ref-			Highest Tertile	-ref-		
Middle SES	0.901	0.145	0.520	Middle Tertile	0.686	0.132	0.052
Lowest SES	1.546	0.26	0.01	Lowest Tertile	0.834	0.227	0.505
Ethnicity				Ethnicity			
African American	-ref-			African American	-ref-		
Hispanic	0.616	0.170	0.08	Hispanic	0.907	0.623	0.887
White/Other	0.616	0.177	0.094	White/Other	0.611	0.338	0.375

Table 10 Survey Stratified Regression of Gender and Time Spent with Friends Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity

Table 10. Survey Stratified Regression of Gender and Time Spent with Friends Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity							
Variable	Females				Males		
	Coefficient	Standard Error	P-Value		Coefficient	Standard Error	P-Value
Internet Access				Internet Access			
No Phone/Phone Without Internet	-ref-			No Phone/Phone Without Internet	-ref-		
Phone with Internet Access	1.772	0.524	0.054	Phone with Internet Access	2.742	0.662	0.000
Grade				Grade			
8th grade	-ref-			8th grade	-ref-		
11th grade	1.008	0.136	0.951	11th grade	1.120	0.165	0.443
School Socioeconomic Status (SES)				School Socioeconomic Status			
Highest SES	-ref-			Highest Tertile	-ref-		
Middle SES	0.987	0.167	0.939	Middle Tertile	0.814	0.102	0.103
Lowest SES	0.647	0.115	0.015	Lowest Tertile	0.603	0.099	0.002
Ethnicity				Ethnicity			
African American	-ref-			African American	-ref-		
Hispanic	0.762	0.147	0.162	Hispanic	0.653	0.138	0.044
White/Other	1.06	0.235	0.792	White/Other	0.728	0.193	0.232

Table 11 Survey Stratified Regression of Gender and Cyberbullying Experience Against Phone Internet Access, Adjusted for Grade, School Socioeconomic Status and Ethnicity

Variable	Females				Males		
	Coefficient	Standard Error	P-Value		Coefficient	Standard Error	P-Value
Internet Access				Internet Access			
No Phone/Phone Without Internet	-ref-			No Phone/Phone Without Internet	-ref-		
Phone with Internet Access	0.678	0.168	0.118	Phone with Internet Access	0.633	0.169	0.132
Grade				Grade			
8th grade	-ref-			8th grade	-ref-		
11th grade	0.799	0.144	0.215	11th grade	0.690	0.169	0.132
School Socioeconomic Status (SES)				School Socioeconomic Status			
Highest SES	-ref-			Highest Tertile	-ref-		
Middle SES	1.055	0.228	0.803	Middle Tertile	0.850	0.185	0.457
Lowest SES	0.678	0.130	0.044	Lowest Tertile	0.608	0.151	0.047
Ethnicity				Ethnicity			
African American	-ref-			African American	-ref-		
Hispanic	0.760	0.192	0.278	Hispanic	0.505	0.203	0.091
White/Other	1.112	0.332	0.714	White/Other	0.785	0.260	0.465

REFERENCES

- Alfano, C., Zakem, A. H., Cosya, N. M., Taylor, L. K., & Weems, C. F. (2009). Sleep Problems and their relation to cognitive factors, anxiety, and depressive symptoms in children and adolescents. *Depression & Anxiety*, 26(6) 503-512.
- Anderson, M., & Jiang, J. (May 2018). *Teens, Social Media & Technology 2018*. Washington: Pew Research Center. Retrieved from http://assets.pewresearch.org/wp-content/uploads/sites/14/2018/05/31102617/PI_2018.05.31_TeensTech_FINAL.pdf
- Andone, I., Blaszkiewicz, K., Eibes, M., Trendafilov, B., Markowetz, A., & Montag, C. (2016). How Age and Gender Affect Smartphone Usage. Bonn, Germany: Research Gate: file:///C:/Users/johanna/Downloads/How_Age_and_Gender_Affect_Smartphone_Usage_final_copyright_embedded.pdf.
- Beland, L.-P., & Murphy, R. (2015). *Ill Communication: Technology, Distraction & Student Performance*. London: Centre for Economic Performance.
- Clayson, D. E., & Haley, D. A. (2013). An Introduction to Multitasking and Texting: Prevalence and Impact on Grades and GPA in Marketing Classes. *Journal of Marketing Education*, 35(1), 26–40. <https://doi.org/10.1177/0273475312467339>.
- Ferrer, E. (2018, 5 17). *Mars and Venus: The Difference Between Male and Female Smartphone Use*. Retrieved from Its Worth More: <https://www.itsworthmore.com/blog/post/male-vs-female-smartphone-usage>
- Howard, J. (2017, December 11). When kids get their first cell phones around the world. *CNN*, pp. <https://www.cnn.com/2017/12/11/health/cell-phones-for-kids-parenting-without-borders-explainer-intl/index.html>.
- Jenco, M. (2016). AAP endorses new recommendations on sleep times. *AAP News and Journals Gateway*.
- John, A., Glendenning, A., Marchant, A., Montgomery, P., Stewart, A., Wood, S., . . . Hawton, K. (2018). Self-Harm, Suicidal Behaviours, and Cyberbullying in Children and Young People: Systematic Review. *Journal of Medical Internet Research*, 20(4):e129.
- Juvonen, J., & Gross, E. (2008). Extending the school grounds?--Bullying experiences in cyberspace. *J Sch Health*, 78(9):496-505.

- Kraft, E. (2006). Cyberbullying: a worldwide trend of misusing technology to harass others. *WIT Transactions on Information and Communication Technologies*, Vol 36, (155-166).
- Kuznekoff, J. H., & Titsworth, S. (2013). The Impact of Mobile Phone Usage on Student Learning. *Communication Education*, 62:3, 233-252, DOI: 10.1080/03634523.2013.767917.
- Lenhart, A., Smith, A., Anderson, M., Duggan, M., & Perrin, A. (2015). *Teens, technology and friendships*. Pew Research Center.
- Lenhart, A., Ling, R., Campbell, S., & Purcell, K. (2010). Teens and mobile phones. Retrieved 18.12.7, from <http://www.pewinternet.org/2010/04/20/teensand-mobile-phones/>
- Merriam Webster. (2018, 11). *Cyberbullying*. Retrieved from Merriam Webster: <https://www.merriam-webster.com/dictionary/cyberbullying#learn-more>
- Michael & Susan Dell Center for Healthy Living, University of Texas School of Public Health, Austin Regional Campus. (2015-2016). *Healthy Children in a Healthy World*. Austin.
- Monks, C. P., Mahdavi, J., & Rix, K. (2015). The emergence of cyberbullying in childhood: Parent and teacher perspectives. *Educational Psychology*, 39-48.
- National Sleep Foundation (NSF). (2019, 1 31). *Sleep in America Poll*. Retrieved from <https://sleepfoundation.org/sites/default/files/2014-NSF-Sleep-in-Americapoll-summary-of-findings-FINAL-Updated-3-26-14-.pdf>, 2014.
- Owens, Judith; Adolescent Sleep Working Group; Committee on Adolescence. (2014). Insufficient sleep in adolescents and young adults: An update on causes and consequences. *Pediatrics*, 134:e921–32.
- Pea, R., Nass, C., Meheula, L., Rance, M., Kumar, A., Bamford, H., et al. (2012). Media use, face-to-face communication, media multitasking, and social wellbeing among 8- to 12-year-old girls. *Developmental Psychology*, 48(2), 327e336.
- Perez, A., Hoelscher, D. M., Frankowski, R. F., Day, R. S., & Lee, E. S. (2010, August). Statistical design, sampling weights and weight adjustments of the School Physical Activity and Nutrition (SPAN) population-based surveillance 2009-2010 study. Paper presented at the 2010 Joint Statistical Meetings, Vancouver, British Columbia, Canada.

- Pew Research Center. (2018). *Mobile Fact Sheet*. Washington.
<https://www.pewinternet.org/fact-sheet/mobile/>: Pew Research Center: Internet & Technology.
- Rahmati, A., Tossell, C., Shepard, C., Kortum, P., & Zhong, L. (2012). Exploring iPhone Usage: The Influence of Socioeconomic Differences on Smartphone Adoption, Usage and Usability. *Rahmati, Ahmad, et al. "Exploring iPhone usage: the influence of socioeconomic differences on smartphone adoption, uProceedings of the 14th international conference on Human-computer interaction with mobile devices and services. ACM, ,*
<http://www.ruf.rice.edu/~mobile/publications/rahmati2012mobilehci.pdf>.
- Ritchie, R. (2018, January 9). *11 years ago today, Steve Jobs introduced the iPhone*. Retrieved from iMore: <https://www.imore.com/history-iphone-original>
- School Physical Activity and Nutrition (SPAN) Survey 2015-2016. (n.d.). *Child Obesity in Texas*. Houston. <https://sph.uth.edu/research/centers/dell/assets/resources-images/SPAN%20Update%204.pdf>: The University of Texas School of Public Health.
- School Physical Activity and Nutrition Survey (SPAN)*. (2018, 12 4). Retrieved from Michale & Susan Dell Center for Healthy Living:
<https://sph.uth.edu/research/centers/dell/project.htm?project=3037edaa-201e-492a-b42f-f0208ccf8b29>
- Sleep Health*. (2019, 1 31). Retrieved from Healthy People 2020 topics and objectives: www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=38
- Smith, A. (2011). *Smartphone Adoption and Usage*. Washington.
<https://www.pewinternet.org/2011/07/11/smartphone-adoption-and-usage/>: Pew Research Center: Internet & Technology.
- Tashjian, S. M., Mullins, J. L., & Adriana, G. (2019). Bedme Autonomy and Cellphone Use Influence Sleep Duration in Adolescents. *Journal of Adolescent Health*, 124-130.
- University of Texas Health Science Center at Houston, School of Public Health. (2012). School Physical Activity and Nutrition (SPAN) project: Student survey. Austin, TX: Author
- U.S. Department of Health and Human Services. (2018, 7 26). *What Is Cyberbullying*. Retrieved from Stopbullying.gov: <https://www.stopbullying.gov/cyberbullying/what-is-it/index.html>

- Uhls, Y. T., Michikyan, M., Morris, J., Garcia, D. S., Zgourou, E., & Greenfield, P. M. (2014). Five days at outdoor education camp without screens improves preteen skills with nonverbal emotion cues. *Computers in Human Health*, 387-392.
- Van den Bulck, J. (2004). Television viewing, computer game playing, and internet use and self-reported time to bed and time out of bed in secondary school children. *Sleep: Journal of Sleep and Sleep Disorders Research*, 27(1), 101e104
- Ward, A. F., Duke, K., Gneezy, A., & Bos, M. W. (2017). Brain Drain: The Mere Presence of One's Own Smartphone Reduces Available Cognitive Capacity. *Journal of the Association for Consumer Research* 2, no. 2 , 140-154.
- Woods, H. C., & Scott, H. (2016). #Sleepyteens: Social media use in adolescence is associated with poor sleep quality, anxiety, depression and low self-esteem. *Journal of Adolescence*, 41-19.
- Ziegler, C. (2018, 12 9). *10 Years of Blackberry*. Retrieved from Engadget: <https://www.engadget.com/2009/12/28/ten-years-of-blackberry/>