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Racial/ethnic differences in video game and Internet use among US adolescents with mental health and educational difficulties

Nicholas Carson, MD, FRCPC,

120 Beacon Street, 4th floor, Somerville, MA 02143, Office: (617) 575-5269, Fax: (617) 665-1973, ncarson@charesearch.org

Benjamin Lê Cook, PhD, MPH,

120 Beacon Street, 4th floor, Somerville, MA 02143, (617) 503-8449, bcook@charesearch.org

Chih-Nan Chen, Ph.D., and

Assistant Professor, Department of Economics, National Taipei University, 67, Sec. 3, Ming-shen E. Rd., Taipei, 10478 Taiwan, cnchen@mail.ntpu.edu.tw

Margarita Alegria, PhD

120 Beacon Street, 4th floor, Somerville, MA 02143, (617) 503-8440, malegria@charesearch.org

Abstract

Video game and Internet use can be associated with poor mental health and educational outcomes among adolescents. Racial/ethnic minority youth use these media more than White youth. Video game and Internet use among adolescents with mental health and educational difficulties may therefore differ by race/ethnicity in clinically meaningful ways. We analyzed a representative sample of 8th grade students in the United States from the Early Childhood Longitudinal Survey-Kindergarten (N=6,700). Stratifying by gender, we assessed racial/ethnic differences in the associations between video game and Internet use, mental health, and reading and math achievement. Significant minority-White differences were identified in associations between media use and mental health and educational achievement. Video game use was relatively high among black females with prior mental health diagnoses and Asian-American males with high internalizing symptoms. Understanding video game and Internet use among racial/ethnic minority youth with mental health and educational difficulties may improve clinical practice.

Keywords

adolescent; ethnic groups; Internet; internalizing symptoms; mathematics; mental health; reading; video games

Introduction

As video game and Internet use increase among youth in the United States, a large research effort has explored how these media affect the emotions, behavior, and academic achievement of adolescents. This effort has yet to adequately describe the use of video games and Internet across major racial/ethnic groups of adolescents with significant mental health or educational problems. This may be particularly relevant for mental health clinicians concerned with delivering culturally sensitive care that considers race/ethnicity in

treatment planning. Arguably, because video game and Internet use in adolescence are so common, clinicians may target care more effectively if media use is incorporated into case formulations. To help clinicians better appreciate the impact of video game and Internet use, this paper describes the use of these media in a culturally diverse, nationally representative sample defined by severe mental distress or academic difficulty.

Internet use and video game play among adolescents in the United States are prevalent across racial/ethnic groups and begin early in life (Christakis, Ebel, Rivara, & Zimmerman, 2004; DeBell, 2005). The Kaiser Family Foundation's longitudinal survey of daily media use among youth in the United States showed marked differences by race/ethnicity that have widened over the past ten years (Kaiser Family Foundation, 2010). Although home access to computers and the Internet among Black and Latino youth may be less than that of non-Latino White youth (DeBell & Chapman, 2006; Du, Havard, Yu, & Adams, 2004; Roberts, 2000), minority youth with access are using media at higher rates than non-Latino Whites (Kaiser Family Foundation, 2010). Data from the National Longitudinal Study of Adolescent Health suggest that Black, Latino, and Asian-American youth use significantly more media in a typical day than similar White youth, including computer and video game use (Gordon-Larsen, McMurray, & Popkin, 2000). Black and Latino youth are more likely to have video games in their bedrooms and play them more often than White youth, and older Latino youth may use computers more than Black or White youth (Bickham, et al., 2003; Roberts, 2000). The HomeNetToo project (Jackson, et al., 2007) gathered detailed computer use information on a small sample of low-income youth. It found that Black and non-Latino White children viewed different content online; as did boys and girls, with boys using more video games and girls using more online social networks. Greater Internet use predicted better math and, marginally, reading scores. The above data argue strongly for a consideration of how these racial/ethnic differences in video game and Internet use extend to mental health and educational outcomes.

As suggested by prior research, there are significant associations between media use and psychological and academic outcomes among youth, and these associations differ by gender and which media are studied. The 2010 Kaiser Family Foundation study, noted above, showed positive associations between frequent media use and lower academic outcomes, internalizing problems (e.g., feeling sad or unhappy) and externalizing problems (e.g., getting in trouble a lot). This study used a broad definition of media, including watching television and movies, playing video games, listening to music, using computers, and reading newspapers, magazines and books.

Video game use, mental health and education

Greater video game use has been associated with increased psychological distress and worse physical and psychosocial well-being (Mathers, et al., 2009), as well as problems in attention and hyperactivity (Chan & Rabinowitz, 2006; Swing, Gentile, Anderson, & Walsh, 2010). Playing violent video games has been linked to lower grades (Gentile, Lynch, Linder, & Walsh, 2004), moderated by the duration and intensity of use (Skoric, Teo, & Neo, 2009; Weis & Cerankosky, 2010). One of the few longitudinal studies that looked specifically among racial/ethnic minorities found that pathological video game use among Asian youth

precedes internalizing symptoms (Gentile, et al., 2010), i.e., symptoms of depression and anxiety. An analysis comparing boys and girls found that video game use is more common among boys than girls (Kaiser Family Foundation, 2010).

Internet use, mental health and education

On the contrary, Internet use by youth has been associated with lower odds of psychological distress (Mathers et al. 2009) and has been linked to higher achievement in reading and math (Jackson, von Eye, Witt, Zhao, & Fitzgerald, 2010; Judge, Puckett, & Bell, 2006). Other authors have observed a non-linear ("U-shaped") relationship between adolescent Internet use and depression, where non-users and high users (greater than two hours per day) reported higher depressive symptoms (Belanger, Akre, Berchtold, & Michaud, 2011). Studies of computer use across racial/ethnic groups found that some computer use may be helpful for academic achievement among racial/ethnic minority students (Borzekowski & Robinson, 2005), except when used in great amounts (Chang & Kim, 2009). An analysis comparing boys and girls found that girls use online social networks more than boys (Kaiser Family Foundation, 2010).

Given these findings of increased video game and Internet use by minority youth compared to non-Latino Whites, and the different impact of these media on mental health and educational achievement, it follows that minority children with mental health and educational difficulties may have very different media use than their White counterparts. In this paper we focus on implications for mental health assessment only. Since mental health and academic achievement are closely linked (Kataoka, Rowan, & Hoagwood, 2009), clinicians may make better informed assessments with a more refined understanding of the relationships between mental health, academic achievement, and race/ethnicity. Understanding the "media profiles" of children with mental health problems by racial/ethnic group and gender can increase the amount of clinician information relevant for diagnosis and treatment of adolescents, and thereby reduce clinical uncertainty (Ashton, et al., 2003; Escarce, 2005; van Ryn & Burke, 2000).

In this paper, we describe and compare rates of video game and Internet use among groups that vary by race/ethnicity, gender, and mental health and educational difficulties. Prior research has not adequately explained the magnitude of video game and Internet use among clinical populations, and especially not among racial/ethnic groups. We conclude by discussing clinical implications from the results of these analyses.

Methods

Data

The Early Childhood Longitudinal Survey-Kindergarten (ECLS-K) is a nationally representative, longitudinal assessment of a cohort of students surveyed in kindergarten in the fall of 1998, and subsequently in grades one, three, five, and eight. Our focus is on a sub-sample of the eighth-grade data from 2006–2007, which includes 6,700 students. The average age of the respondents was 14.3 years with a range of 12.3–16.9 years, with 95.8% age 13 or 14. The survey was designed to be representative of the cohort of children who

were in kindergarten in 1998–99 or in first grade in 1999–2000. The kindergarten sample included 19,967 completed child assessments and 18,950 parent interviews, while the 8th grade sample included 9,358 child assessments and 8,950 parent interviews. Attrition was primarily caused by school or parent refusal to participate in follow-up surveys and by difficulty in locating families who had relocated. In addition, to reduce the expense of follow-up, respondents that changed address were sub-sampled in the 1st, 3rd, and 5th grade waves (National Center for Education Statistics, 2009a). Completion rates (percentage of families who completed the survey and were not kindergarten non-respondents nor in schools that dropped out) were highest for non-Latino Whites (80.9%) compared to 71% for Latinos, 66.6% for Blacks, and 60% for Asian-Americans. Survey weights used in this paper adjust for non-response and significantly reduce non-response bias (National Center for Education Statistics, 2009b).

Because of attrition and because the first-grade sample was not refreshed to be nationally representative, the eighth-grade sample is actually representative (after accounting for sample weights) of only approximately 80% of all eighth-graders in 2006–7.

Measures

Media—The ECLS-K measures academic and social-emotional development in the eighth grade, using student, parent, and principal reports. Assessments of video game and Internet use were included in the grade 8 assessment wave. Specifically, the Internet probe asked, “How many hours a day are you on the Internet (for example, emailing/instant-messaging with friends, doing school work, surfing the web)”; the video game probe asked “How many hours a day do you play computer or videogames such as Nintendo, Play Station, or Xbox” (National Center for Education Statistics, 2007). The respondents were asked to report times for weekdays and weekends. We computed the average daily number of hours by summing weekday hours divided by five and weekend hours divided by two. We then divided the number of daily media use hours by 24 to provide a range of 0 to 1 corresponding to the percentage of hours in a day.

Prior Mental Health Diagnosis—We improve upon prior studies by measuring mental health problems from two vantages: prior diagnosis of any mental health disorder and current self-reported and parent-reported measures of mental health problems. Defining the sample by a history of mental health diagnosis makes our findings more relevant to mental health clinicians, since diagnoses imply a level of severity, are amenable to specific treatments as contained in practice guidelines, and are more easily correlated with service use outcomes. On the other hand, self-reported and parent-reported mental health measures give more accurate estimates of mental distress among racial/ethnic minority youth because these youth are much less likely than White youth to be seen by mental health professionals (Garland, et al., 2005; Merikangas, et al., 2011).

To identify a clinical sample within the grade eight ECLS-K cohort, we first used variables indicating whether the parent of the child respondent ever reported a professional diagnosis of emotional, behavioral, learning, or attention disorders. Diagnoses include Attention-Deficit Hyperactivity Disorder (Attention-Deficit Disorder, Attention–Deficit/Hyperactive

Disorder, or Hyperactivity), Affective Disorder (Bipolar Disorder, Depression, Dysthymia, Other Depressive Disorder), and Anxiety Disorder (Panic Disorder, Separation Anxiety Disorder, Social Phobia, Obsessive Compulsive Disorder, Other Anxiety Disorder). Because of small numbers of children in the sample with these specific disorders, we dichotomized this variable and analyzed media use among those with and without mental health disorder ("Any MH"). Data on psychiatric diagnoses were collected through submission of an application for use of the restricted use data set according to procedures established by the National Center for Education Statistics.

Internalizing Symptoms—The ECLS-K includes a continuous scale of self-reported internalizing symptoms that assesses anxiety, loneliness, low self-esteem, and sadness. These items were adapted from the Social Skills Rating System (Gresham, MacMillan, Bocian, Ward, & Forness, 1998) and reworded to reduce cultural bias (Meisels, Atkins-Burnett, & Nicholson, 1996). To align our findings with prior research (Morgan & Farkas, 2009) and to focus on the group at risk for mental health disorder, we use the top 15th percentile on the self-reported internalizing symptom scale.

Strengths and Difficulties Questionnaire—The ECLS-K also includes the parent-report version of the Strengths and Difficulties Questionnaire (SDQ) (Bourdon, Goodman, Rae, Simpson, & Koretz, 2005), which measures the sum of serious mental health difficulties including emotional symptoms, conduct problems, hyperactivity-inattention, and peer relationship problems. The SDQ has been assessed cross-culturally and validated in many racial/ethnic populations (Achenbach, et al., 2008; Warnick, Bracken, & Kasl, 2008) and nationally representative samples (Goodman, 2001). It has also been used to assess psychological problems related to media use in adolescents (Page, Cooper, Griew, & Jago, 2010). Youth scoring at or above the 90th percentile on the SDQ have a 15-fold increase in the likelihood of an independently diagnosed psychiatric disorder (Goodman, Ford, Richards, Gatward, & Meltzer, 2000). The internalizing symptoms scale and the SDQ complement the prior diagnosis measure described above because they yield mental health symptoms for the entire ECLS-K sample, not just children with prior mental health care contact.

Reading and Math—Reading and mathematics achievement were assessed directly in a one-on-one, untimed assessment developed specifically for the ECLS–K. The cognitive battery used a two-stage approach. For reading and mathematics, an overall scale score was determined by combining scores on a first stage "routing" test and a second stage, skill level-appropriate assessment. The eighth-grade reading assessment measured four comprehension skills: forming a general understanding of the text, developing a more complete understanding of what was read, making connections from the text with personal background knowledge, and critically evaluating, comparing and contrasting, and understanding the effect of literary devices or the author's intentions. The eighth-grade mathematics assessment measured skills in number sense, properties, and operations; measurement; geometry and spatial sense; data analysis, statistics, and probability; and pattern, algebra, and functions. Scores for both reading and mathematics were standardized to a mean of 50 and standard deviation of 10 using cross-sectional sample weights, and are

interpreted as a child's performance on each of the domains relative to their peers. The reading and mathematics scales were transformed into two dichotomous variables indicating whether scores on this domain were in the lowest performing 15% of the population.

Demographics—Census categories were used to determine race and ethnicity. Individuals of any race claiming to be of Latino origin were identified as Latino in our study. Other respondents were classified as Black, non-Latino White (referred to as "White" for the remainder of the paper), or Asian-American by responses to the question about race. Sociodemographic variables used as covariates in regression models were gender, poverty status (below federal poverty line [FPL], 100–125% of FPL, 125–200% FPL, 200–400% FPL, and 400%+ FPL), parental education (less than high school degree, high school graduate, some college, college graduate), parent-reported food insecurity (limited availability of nutritious food; determined by a score of greater than 3 on a scale determined by 18 food insecurity questions of the Household Food Security Scale (Bickel, Nord, Price, Hamilton, & Cook, 2000), geographic region (Northeast, Midwest, South, West), and rural area status (rural area, non-rural area).

Statistical Analysis

We first compared the unadjusted rates of video game and Internet use, mental health, educational achievement, and sociodemographic characteristics of Black, Asian-American, and Latino students to those rates of Whites. Student t-tests were used to test the significance of relationships for continuous variables and pairwise chi-square analyses were used to test the significance for dichotomous variables.

We estimated multivariate models of video game and Internet use to understand racial/ethnic differences in their associations with mental health disorder, internalizing symptoms, total SDQ scores, and educational achievement. We estimated four regression models of video game/Internet use that varied by subpopulation (models 1 and 3 were estimated among males and models 2 and 4 among females) and outcome (video game use for models 1 and 2 and Internet use for models 3 and 4). Each model contained the following predictor variables: indicators of racial/ethnic group identification, mental health diagnosis, internalizing symptoms, high SDQ score (and the interactions between race/ethnicity and these mental health measures), math and reading scores (and the interactions between race/ethnicity and math and reading), family income, poverty status, parental education, food insecurity, geographic region and rural/urban status. These models were estimated separately for boys and girls because of previous literature finding significant variance in media use by gender (Kaiser Family Foundation, 2010). Main effects involved in interaction terms were centered on their mean so that regression coefficients on a given characteristic and their significance can be directly interpreted as the difference from the overall mean of that characteristic (Kraemer & Blasey, 2004).

Because number of hours of video game use and Internet are continuous variables with a non-normal distribution (heavy density near hours 0, 1, and 2 and a long right-skewed tail), we chose to fit a generalized linear model (GLM) with quasi-likelihoods (McCullagh & Nelder, 1989). The GLM, a form of nonlinear least squares modeling, improves upon

ordinary least squares regression (OLS) and log-transformed OLS (typically used multivariate regression techniques) because it optimizes the fit and variance structure of the model to account for extreme skewness and outliers and generates coefficients and predictions that are not sensitive to heteroscedasticity and non-normality of residuals (Blough, Madden, & Hornbrook, 1999; Buntin & Zaslavsky, 2004). We used a Park test (Park, 1966) to identify the optimal fit of the GLM, identifying the logit transformation link to best normalize the data, and a binomial distribution of the dependent variable to best estimate the relationship between the mean and the variance. We used the following model simplified for descriptive purposes:

$$E(Y_i) = f[\beta_0 + \beta_1(MH_i) + \beta_2(Race_i) + \beta_3(MH_i * Race_i) + \beta_4(X_i)]$$

where Y_i= proportion of time per day spent playing video games (or using the Internet), *f* is the function of the regression that provides the best functional form for the data, MH_i is a vector of variables indicating any past mental health disorder diagnosis, top 15% of the internalizing symptoms scale, top 10% in serious mental health difficulties (from the SDQ), and indicators of membership in the poorest performing 15% of the population in reading and mathematics, and X_i is a vector of sociodemographic covariates.

Because interaction coefficients in non-linear models are biased representations of the marginal effect of the interaction terms (Ai & Norton, 2003), we focus our interpretation on simulated, or predicted, estimates of media use for each of the race/ethnicity by mental health and race/ethnicity by educational achievement groups. To generate these predictions, we used the "recycled predictions" method (StataCorp, 2008) similar to Grabaurd and Korn (Graubard & Korn, 1999) and used in previous articles (Blewett, Davidson, Bramlett, Rodin, & Messonnier, 2008; Wells, et al., 2008). This method applies model coefficients to create predictions for each racial/ethnic by mental health and educational achievement group, assuming that each subgroup has the average characteristics of the entire population. We use the term "prediction" statistically. It is not our intention to predict the future media use of these groups, but rather to use regression models to describe rates of media use for different racial/ethnic groups at high risk for mental illness and poor educational outcomes, after adjustment for other covariates.

In total, we generated 40 predictions for each dependent variable (four racial/ethnic groups by six mental health categories (any/no mental health diagnosis, greater or less than top 15^{th} percent of internalizing disorder, greater or less than top 10^{th} percent of serious mental health difficulties) and four educational achievement categories (greater or less than bottom 15^{th} percent of reading and math scores). By comparing these predictions, we illustrate both the level and the strength of the associations between media use and mental health and educational achievement by presenting bar graphs depicting minority-White differences on these rates. For brevity, we present only the associations where difference-in-differences are significant at the $p<.05$ level.

All estimates were weighted using Stata 10 SVY commands (StataCorp, 2008) to represent an approximation of the national sample of eighth-graders in 2006–7. Standard errors for model-estimated predicted video game and Internet hours for sub-groups of interest were generated using the bootstrap method (Efron, 1979). 100 samples were randomly drawn

with replacement accounting for the original sampling design of the ECLS-K. Predicted hours were estimated using the recycled predictions method described above and the standard deviation of the 100 estimates serves as a measure of the survey-weighted standard error for the predicted sub-group estimates. Human subjects approval for this research was obtained from the authors' institutional review board.

Results

Unadjusted Rates of Video Game and Internet Use

Racial/ethnic differences in video game and Internet use, mental health and educational achievement, and sociodemographic variables are presented in Table 1. Black students in the eighth grade reported higher daily use of both video games and the Internet as compared to White peers. More racial/ethnic differences were identified when analyzing males and females separately (results not shown). Black males (3.2hrs/day) and females (1.5hrs/day) played more video games than their White counterparts (2.3hrs/day and 0.9hrs/day, respectively, $p<.05$). Latino females also played more video games than White females (1.1 vs 0.9 hrs/day, $p<.01$). Asian-American males used more Internet than White males (2.8 vs. 2.1 hrs/day, $p<.01$), and Black females used more Internet than White females (2.8 vs. 2.4 hrs/day, $p<.05$).

White students were more likely to report any professional mental health diagnosis than all other racial/ethnic minority groups. Frequencies are not included in the table but are presented here. The most common mental health disorders diagnosed in the sample were attention-deficit/hyperactivity disorder (7.9% White, 5.2% Black, 3.5% Asian-American, 3.1% Latino), depressive disorder (1.9% White, 1.1% Black, 0% Asian-American, and 0.7% Latino), and anxiety disorder (1.9% White, 0.7% Black, 0% Asian-American, and 0.4% Latino). The rates for all three diagnostic categories among Asian-American and Latino students were significantly lower than those of Whites ($p<.01$). Conversely, the rates of high internalizing symptoms were similar among White, Black, and Asian-American students, with Latinos higher than Whites. Total SDQ scores were similar for Whites, Blacks, and Latino students, while Asian-American students were less likely to be in the top 10^{th} percentile of the SDQ compared to Whites.

With respect to educational achievement, both Black and Latino students were more often in the lowest 15^{th} percentile for both reading (29% and 23%, respectively) and math scores (29% and 17%, respectively). Asian-American students recorded slightly higher mean math scores relative to Whites.

There were a number of sociodemographic differences among the four ethnic groups. The Asian-American sample included more female students than the White sample. All minority groups tended to have lower incomes, more food insecurity, greater poverty, and less parental education (except for Asian-Americans) when compared to White peers. There were also geographic differences, with Blacks more often living in the South and Asian-Americans and Latinos in the West relative to Whites. All groups of students more often reported living in non-rural areas, particularly Latinos.

Significant correlates of video game and Internet use

Table 2 presents results from multivariate regressions of daily video game and Internet use conditional on race/ethnicity, mental health, educational achievement, and sociodemographic differences. Here, we report significant main effect coefficients in the model to identify significant correlates of media use among this population. We do not describe significant interaction terms because, in non-linear models, they do not represent the marginal effect of the race by mental health and race by education interactions (Ai & Norton, 2003). Instead, the marginal effects of the interaction terms are described using simulated rates of video game and Internet use in Figure 1.

Racial/ethnic group identity was not a significant predictor of video game use for male 8th graders. The one significant negative predictor of hours of video game use for males was being in the highest income category (>400% of the FPL compared to living in a family below the FPL). Significant positive predictors of video game use for females were identifying as Black race, being in the top 10th percentile of serious mental health difficulties, being in the lowest 15th percentile on reading, having a family income between 200 and 399% of the FPL compared to families living below the FPL). A significant negative predictor of video game use for females was living in the West compared to living in the Northeast. Significant positive predictors of Internet use for males were identifying as Asian-American and having family income between 100% and 200% (compared to families with income less than the FPL). Significant positive predictors of Internet use for females was identifying as Black race, being in the lowest 15th percentile on reading, having a family income between 200% and 400% of the FPL compared to below the FPL. Significant negative predictors of video game use for females were living in the South and West compared to living in the Northeast.

Racial/Ethnic Differences in Video Game Use Among Adolescents with Mental Health Difficulties

Figure 1 displays significant predicted differences both *within* and *between* racial/ethnic groups on hours of video game use. Due to space constraints, the full set of predicted media use findings is not presented but is available from the authors. For males, having high internalizing symptom scores predicts more hours of video game use for Asian-American males (4.0 vs. 1.9) than White males (2.2 vs. 2.4). For females, having a diagnosis of a mental health disorder predicts more hours of video game use for Blacks (4.0 vs. 1.2 hours for Black females without a mental health disorder) than Whites (0.8 vs. 0.9). Scoring in the top 10 percent on the SDQ predicts fewer hours of video game use for Latino males (1.9 vs. 2.4) than it does for White males (3.0 vs. 2.3). Likewise, being in the top 10 percent on the SDQ predicts fewer hours of video game use for Black females (0.7 vs. 1.2) than White females (1.5 vs. 0.9).

Racial/Ethnic Differences in Video Game Use Among Adolescents with Educational Difficulties

Scoring among the lowest 15% in reading predicted more hours of video game use for Black males (3.8 vs. 2.7 not in lowest 15%) than White males (1.8 vs. 2.3).

Racial/Ethnic Differences in Internet Use Among Adolescents with Mental Health Difficulties

As seen in Figure 2, Asian-Americans in the highest 15% on internalizing scale scores used more Internet than White males in the highest 15% on internalizing scale scores (5.3 vs. 2.4), a result similar to the greater influence of internalizing symptoms on video game use described above for Asian-American males. Conversely, being in the highest 15% on the internalizing scale predicted fewer hours of Internet use for Black males (1.3 vs. 2.4) than for White males (2.4 vs. 2.1). Being in the highest 10% on the SDQ was a predictor of lower Internet use for Black females (2.0 vs. 2.7) compared to White females (2.7 vs. 2.3).

Racial/Ethnic Differences in Internet Use Among Adolescents with Educational Difficulties

There were no significant difference-in-differences on Internet use across racial/ethnic groups and gender for reading and math scores.

Discussion

The first aim of this study was to examine differences in video game and Internet use across racial/ethnic and gender groups in a nationally representative sample of students. Our results suggest that, when accounting for socioeconomic status and geography, minority youth use video games and the Internet with greater frequency than similar White youth. This information can be helpful when targeting media campaigns to improve mental health of racial/ethnic minority populations (Romer & Kim, 1995).

A second aim was to identify racial/ethnic differences in video game and Internet use among adolescents with a prior mental health diagnoses, high internalizing symptoms, serious mental health difficulties, and low math and reading scores. The inclusion of independently evaluated internalizing and SDQ scores seems justified because they revealed rates of distress across all groups of youth whether or not they accessed the care needed to receive a diagnosis. Our findings reveal several significant racial/ethnic differences across these predictor variables.

One of the most striking findings was that male Asian-American students with high internalizing symptoms consume twice the amount of video games and Internet as similar students in the other racial/ethnic groups. This is consistent with prior cross-national studies among Asian adolescents in China that suggest excessive use of the Internet is causally linked to depressive symptoms (Lam & Peng, 2010). Similarly, emerging longitudinal data from Asian students in Singapore suggests that moderate amounts of video game use can serve as a coping mechanism, but pathological use, as defined by DSM-IV criteria, may be a cause of internalizing disorders (Gentile, et al., 2010). Though there may be other cultural variables that could explain these cross-national findings (such as availability of local area network centers, as discussed in Gentile's study), our results invite the consideration that it may be overuse of video games and Internet that perpetuates internalizing symptoms among Asian-American males. We are limited by the cross-sectional nature of our data to determine direction of causality; this group may prefer to use these media when experiencing internalizing symptoms. Clinicians can use this information to screen these students for

extreme use of video games or Internet and monitor for higher internalizing symptoms, which may go undetected by parents. Considering the opposite causal pathway, it may be that Asian-Americans with high internalizing symptoms are likely to use media as an outlet or a more comfortable area for interacting with peers, suggesting that clinicians may be successful in using treatments that capitalize upon their affinity towards these media (Ceranoglu, 2010; Gelfond & Salonius-Pasternak, 2005).

On the other hand, the presence of psychopathology in other racial/ethnic groups showed an opposite pattern of video game and Internet use. Video games were played *less* by Black females with high internalizing symptoms and Latino males with high SDQ scores. In a survey involving most White students, males and female adolescents endorsed playing video games principally because “it’s fun,” “something to do when bored,” “challenge of figuring things out”, and “like to compete with others and win” (Olson, 2010). Youth with significant mental distress may lack these motivations and thus avoid video games.

Internet use was also *lower* for black males with high internalizing symptoms and for black females with high SDQ scores. While Black males are known to have relatively low Internet use (Jackson, et al., 2008), the presence of psychopathology among these groups seems to work against this use even more. It has been posited that Internet use among Black youth serves an acculturative function (Jackson, et al., 2005), such as learning about one’s culture and history, which may lose salience for Black students with more severe psychological distress. It has also been noted that Black youth, when faced with stress related to discrimination, will use “culturally-relevant coping” strategies that are more collectivistic and spiritual-centered (Gaylord-Harden & Cunningham, 2009). These strategies may take precedence over regular media use. Internalizing symptoms may also have different causes between Black and Asian-American adolescents. For example, Black students are exposed more often to violence, while Asian adolescents are more likely to have immigrated to the United States (Chen, 2009). Video game and Internet use for first or second generation Asian-American youth may be related to coping with acculturative stress. The above hypotheses are best addressed through longitudinal studies that can track the evolution of relationships between mental health and media use over time.

The associations between externalizing behaviors and Internet use among Black and Asian-American females (who used more than White females) and Latino males (who used less) highlight the importance of assessing gender differences even among race/ethnicity comparisons. Some authors have proposed that some youth use avoidant coping styles to tolerate the negative affect that accompanies externalizing behaviors (Daughters, et al., 2009). For such youth perhaps using the Internet is a means of avoiding negative affect. Associations between Internet “addiction” (greater than twenty hours/week with associated dysfunction in this study) and aggressive behaviors have been documented in a very large sample of Taiwanese students, even after controlling for the effects of violent television viewing (Ko, Yen, Liu, Huang, & Yen, 2009).

Finally, associations between low reading and video game play, particularly among Black males, is another concerning finding. Displacement of reading time by game play has been suggested as a possible hypothesis and there is supportive evidence (Cummings &

Vandewater, 2007). The above mentioned data linking video game play to attention difficulties must also be considered in this relationship (Swing, et al., 2010). Inattention may mediate the relationship between video game play and poor reading achievement for Black males (Rabiner & Coie, 2000).

Our study faces several significant limitations. Racial/ethnic categories are limited in their ability to represent cultural differences, and future analyses might focus on the impact of English language proficiency, nativity, immigration status, or other culturally salient factors that may impact media use. For example, filial piety and familism have been shown to be differentially associated with daily email use (Ping, et al., 2005). The study is also limited by the inability of the data to disentangle the *quality* and *content* of the media use (Espinosa, Laffey, Whittaker, & Sheng, 2006; Judge, et al., 2006). This, for example, could contribute to the large difference in hours per day seen among Black and Asian-American students. Asian-American males may find comfort in spending more time online, perhaps speaking with online friends or in solitude. Black males may lose interest in the websites that usually hold interest for them, such as “race support” sites (Jackson, et al., 2007).

Another limitation is the difficulty in teasing out the associations between Internet, video game use, and hours of television watching, given the high correlation between these variables and the importance of these variables in predicting outcomes. While some authors found no correlation between television watching and psychological distress in youth (Mathers, et al., 2009) nor ADHD symptoms (Stevens, 2006), these studies are counter-balanced by others (Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004; Landhuis, Poulton, Welch, & Hancox, 2007; Mistry, Minkovitz, Strobino, & Borzekowski, 2007; Ozmert, Toyran, & Yurdakok, 2002). It was our opinion that controlling completely for television use in the regression models would adjust, or take away, the partial effects due to television of race/ethnicity, mental health, and educational outcomes on media use that are of interest in improving clinical and educational outcomes. In the end, we performed a sensitivity analysis using models that did control for television and found similar significant findings in difference-in-difference results (not reported).

This paper represents an advance in our understanding of the video game and Internet use of adolescents with mental health and educational difficulties and how these patterns vary by race/ethnicity and gender. We found differences across racial/ethnic groups in both the level and strength of association between mental health and educational outcomes and media use, with particularly high levels of use among Asian-American males with high levels of internalizing symptoms and Black females with any mental health diagnosis. These findings invite future study of the contexts for such symptoms, how they may vary between racial/ethnic groups, and how video game and Internet use may act as a therapeutic outlet or as a contributor to symptoms of mental illness, depending on the context.

Biographies

Nicholas Carson MD, FRCPC is an Instructor in Psychiatry at Harvard Medical School and a Research Associate at the Center for Multicultural Mental Health at the Cambridge Health Alliance. He is also a staff child psychiatrist at the Cambridge Health Alliance. Dr. Carson’s

research aims to improve mental health services for multicultural communities, and to explore the impact of mass media and technology on youth development.

Benjamin Lê Cook, PhD, MPH is an Assistant Professor in Psychiatry at Harvard Medical School and a Senior Scientist at the Center for Multicultural Mental Health at the Cambridge Health Alliance. His research interests are in improving methods for measuring disparities, and applying these methods to understanding the mechanisms underlying mental health and substance abuse treatment disparities, the association between acculturation and mental health, and geographic differences in mental health service use disparities.

Chih-Nan Chen, Ph.D., is an assistant professor at the Department of Economics, National Taipei University, Taiwan. He received his Ph.D. from the Department of Economics at Boston University. Dr. Chen's areas of research include Bayesian data analysis and health economics.

Margarita Alegría, PhD, is the director of the Center for Multicultural Mental Health Research at the Cambridge Health Alliance. She is a professor of Psychology in the Department of Psychiatry at Harvard Medical School. Dr. Alegría's published work focuses on the improvement of health care services delivery for diverse racial and ethnic populations, conceptual and methodological issues with multicultural populations, and ways to bring the community's perspective into the design and implementation of health services.

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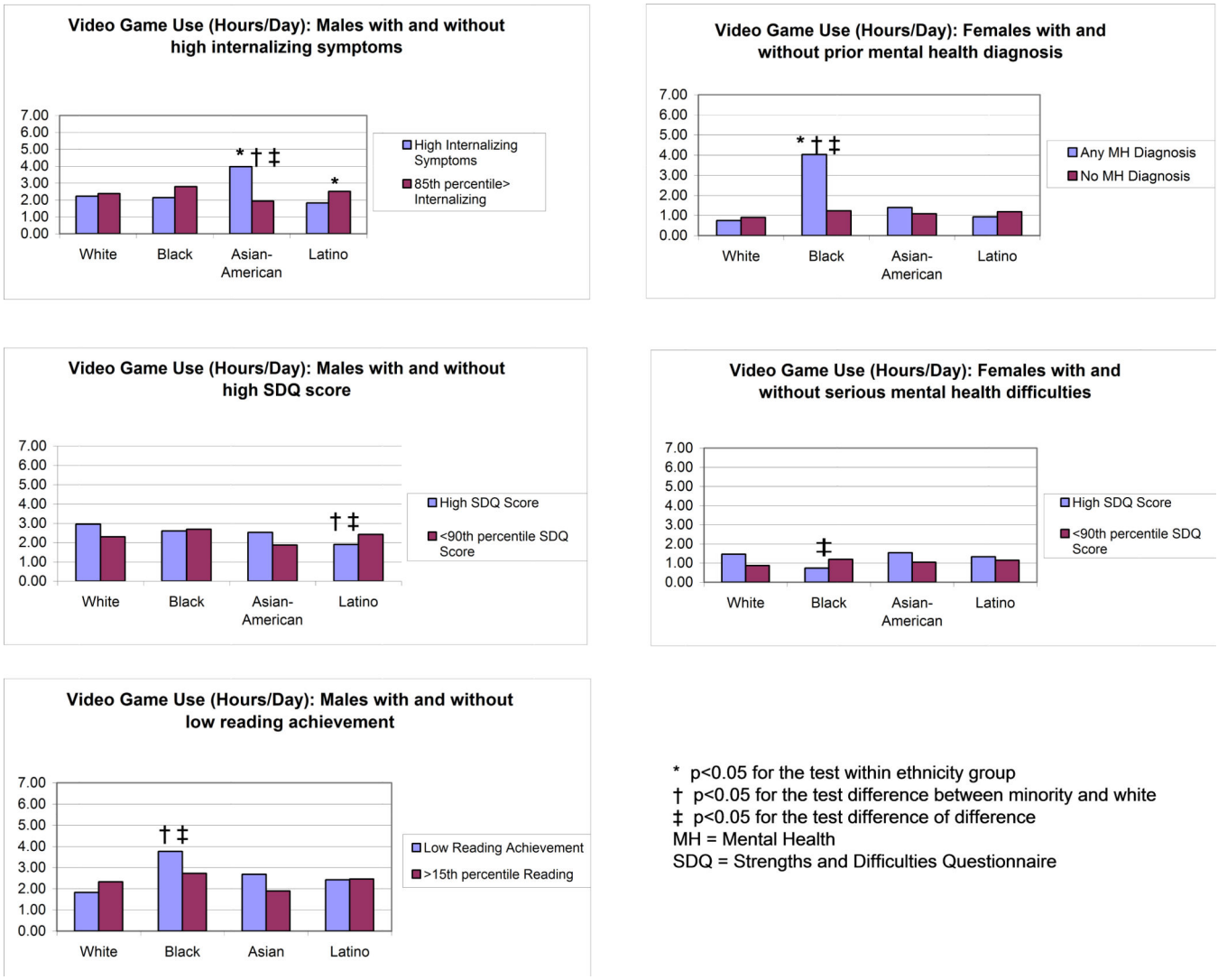
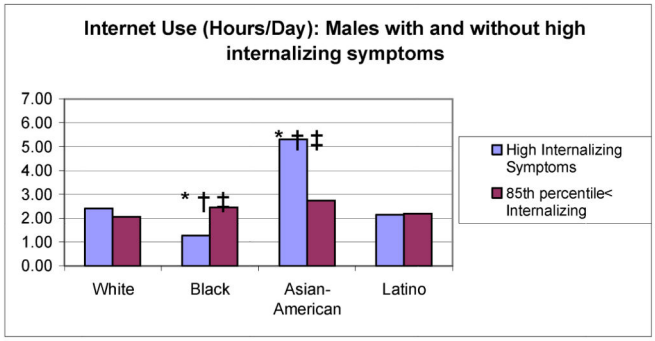
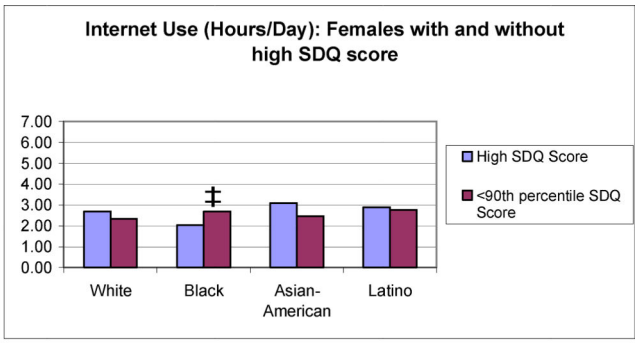


Figure 1.

Predictions of hours of video game use by race/ethnicity, mental health, and educational achievement





* p<0.05 for the test within ethnicity group
† p<0.05 for the test difference between minority and white
‡ p<0.05 for the test difference of difference
SDQ = Strengths and Difficulties Questionnaire

Figure 2.
Predictions of hours of Internet use by race/ethnicity and mental health

Table 1

Weighted, Unadjusted Characteristics of Video Game and Internet Use, Mental Health, Education, and Socio-demographics in the 2007 ECLS-K 8th Grade Sample

Sample Size (N=6,700)		White 4,541		Black 604		Asian-American 426		Latino 1,129	
		%	SE[1]	%	SE[1]	%	SE[1]	%	SE[1]
Video Game and Internet Use[2]									
Average number of hours per day of video game playing		1.59	0.05	2.32	0.16***	1.43	0.09	1.78	0.10
Average number of hours per day of internet use		2.25	0.05	2.64	0.12**	2.54	0.15	2.28	0.10
Mental Health Disorder									
Any professional mental health diagnosis		15.4%	1.1%	10.6%	2.1% *	5.3%	1.8% ***	7.0%	1.3% ***
Internalizing symptoms scale score (self-reported)		2.00	0.01	2.02	0.04	2.12	0.04*	2.12	0.03**
Top 15th percentile in internalize scale		11.9%	0.8%	16.3%	2.9%	17.9%	3.6%	19.1%	2.4%**
Strengths and Difficulties Questionnaire (parent-reported)		11.01	0.15	11.21	0.38	9.77	0.33***	10.97	0.20
Top 10th percentile in SDQ score		10.3%	0.9%	11.2%	2.0%	4.9%	1.4%***	10.3%	1.3%
Educational Achievement									
Reading scores		53.24	0.31	44.80	0.83***	54.26	0.85	47.20	0.45***
Bottom 15th percentile in reading scores		7.3%	0.8%	29.1%	4.7%***	6.2%	1.4%	22.8%	2.1%***
Math scores		53.03	0.31	44.93	0.74***	55.44	0.92*	48.19	0.42***
Bottom 15th percentile in math scores		7.9%	0.9%	28.7%	4.1% ***	8.3%	2.0%	16.5%	1.8%***
Socio-demographic Characteristics									
Male		52.0%	1.2%	50.1%	3.6%	44.1%	3.5% *	50.2%	1.9%
Female		48.0%	1.2%	49.9%	3.6%	55.9%	3.5% *	49.9%	1.9%
Food insecurity		8.3%	0.8%	16.8%	2.3%***	12.0%	2.3%	14.5%	1.7%**
% Federal Poverty Level	<FPL	12.6%	1.1%	38.9%	4.7% ***	22.7%	3.1% **	34.5%	2.0% ***
	100–124% FPL	2.6%	0.3%	7.6%	1.8% **	2.5%	0.8%	8.7%	1.2%***
	125–199% FPL	13.9%	0.8%	18.7%	2.5%	19.6%	2.9%	21.9%	1.6%***
	200–399% FPL	32.1%	1.1%	26.7%	3.1%	27.1%	2.8%	21.3%	2.1%***

Sample Size (N=6,700)		White 4,541		Black 604		Asian-American 426		Latino 1,129	
		%	SE[1]	%	SE[1]	%	SE[1]	%	SE[1]
	400%+ FPL	38.7%	1.5%	8.2%	1.7%***	28.2%	3.3%**	13.7%	1.4%***
Parent's Education	<HS	3.0%	0.5%	7.2%	1.7%*	7.2%	1.8%*	23.8%	1.9%***
	HS Grad	14.7%	1.0%	29.1%	2.7%***	15.7%	2.4%	23.1%	1.6%***
	Any College	32.8%	1.3%	44.5%	2.7%***	28.3%	3.5%	33.4%	2.0%
	College Grad	49.6%	1.5%	19.3%	2.3%***	48.8%	4.0%	19.7%	1.8%***
Region	Northeast	21.1%	1.4%	12.7%	2.6%**	20.5%	3.9%	10.8%	1.7%***
	Midwest	32.2%	2.2%	14.3%	2.8%***	18.8%	3.6%**	10.4%	1.8%***
	South	33.9%	2.0%	66.8%	3.9%***	20.5%	3.5%**	31.0%	3.3%
	West	12.8%	1.3%	6.1%	1.8%**	40.2%	4.7%***	47.7%	3.5%***
Urbanicity	Rural	29.2%	1.7%	21.0%	7.2%	21.7%	3.4%	10.5%	4.0%***
	Non-Rural	70.8%	1.7%	79.0%	7.2%	78.3%	3.4%	89.5%	4.0%***

Significantly different from Whites,

*** at the $\alpha<.001$ level,

** at the $\alpha<.01$ level,

* at the $\alpha<.05$ level

[1] Standard errors take into account sampling weights and stratification used to make ECLS-K sample representative of U.S. population

[2] The media use is trimmed to 12 hours if reported more than 12 hours

SDQ = Strengths and Difficulties Questionnaire

Table 2

Models of average daily media use conditional on race/ethnicity, mental health, and educational achievement

		Video Game Use (Hours/Day)				Internet Use (Hours/Day)			
		Males		Females		Males		Females	
		Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Black		0.15	0.11	0.37	0.13 **	0.09	0.12	0.18	0.09 *
Asian-American		−0.07	0.12	0.15	0.13	0.34	0.08 ***	0.04	0.08
Latino		0.00	0.09	0.18	0.12	−0.01	0.07	0.10	0.08
Any Mental Health Diagnosis		0.06	0.10	0.05	0.16	0.08	0.11	−0.05	0.09
High Internalizing Scale Score		−0.12	0.09	0.01	0.11	0.02	0.10	−0.02	0.06
High SDQ Score		0.14	0.09	0.31	0.14 *	0.07	0.09	0.07	0.11
Low Reading		−0.10	0.11	0.72	0.18 ***	0.02	0.15	0.27	0.13 *
Low Math		0.20	0.13	0.08	0.19	0.08	0.14	−0.10	0.12
Food insecurity		0.18	0.11	0.13	0.11	−0.04	0.13	0.15	0.08
% Federal Poverty Level (FPL)	<FPL (referent)								
	100–124% FPL	0.06	0.15	0.15	0.15	0.38	0.17 *	0.15	0.11
	125–199% FPL	0.02	0.11	0.16	0.15	0.37	0.13 **	0.10	0.09
	200–399% FPL	−0.17	0.13	0.23	0.11 *	0.19	0.13	0.26	0.09 **
	400%+ FPL	−0.29	0.13 *	−0.06	0.14	0.18	0.12	0.35	0.11 ***
Parent's Education	<High School (HS) (referent)								
	HS Grad	0.06	0.14	−0.05	0.14	−0.05	0.14	0.03	0.11
	Any College	0.14	0.15	−0.05	0.16	−0.03	0.13	0.02	0.12
	College Grad	−0.10	0.15	−0.30	0.18	−0.08	0.14	−0.16	0.14
Region	Northeast (referent)								
	Midwest	0.11	0.09	0.03	0.12	−0.08	0.08	−0.12	0.08
	South	0.12	0.07	0.10	0.10	0.01	0.07	−0.15	0.05 **
	West	−0.03	0.10	−0.27	0.13 *	−0.14	0.09	−0.34	0.07 ***
Urbanicity	MSA>=250,000 (referent)								
	Rural	0.00	0.08	−0.07	0.10	−0.05	0.08	−0.04	0.06
Constant		−2.22	0.14 ***	−3.08	0.17 ***	−2.41	0.16 ***	−2.16	0.11 ***

Any MH=Any prior mental health diagnosis; Coeff. = Coefficient; SDQ = Strengths and Difficulties Questionnaire; SE = Standard Error; MSA = Metropolitan Statistical Area Hours of daily media use were divided by 24 to provide a range of 0 to 1 corresponding to the percentage of hours in a day

Generalized Linear Model (with logit link and binomial variance distribution) coefficients and standard errors take into account sampling weights and stratification used to make ECLS-K sample representative of U.S. population

Interaction terms of race/ethnicity with mental health and educational achievement were entered into the model to improve model fit. These variables were centered around their means so that regression coefficients can be directly interpreted as a comparison by race from the overall mean of the characteristic. Interaction coefficients are not presented here because, in non-linear models, they are biased representations of the marginal effect of the interaction term.

Data Source: 8th Grade Wave of ECLS−K (2007)