

# Media use and depression: exposure, household rules, and symptoms among young adolescents in the USA

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## Abstract

**Objectives** To determine the longitudinal and cross-sectional associations between different types of electronic media use (mobile phones, TV, computers, video games, and music) and young adolescents' depressive symptoms, and to explore the potential for household media rules to reduce young people's depression.

**Methods** 126 young adolescents were recruited from the Northeastern USA. Each type of media use was assessed using survey questions, time use diaries, and ecological momentary assessment. The Beck Depression Index for Primary Care was administered at baseline and 1 year later as part of a questionnaire that also included items assessing the presence of household rules about TV and video games.

**Results** Baseline use of mobile phones and TV viewing were associated with higher levels of depression 1 year later controlling for demographic information and baseline depression score. Having household rules about TV at baseline predicted lower levels of depression at follow-up.

**Conclusions** Both TV viewing and mobile phone use may contribute to the development of depressive symptoms.

Implementing household rules about the duration and content of TV could help reduce depression in young adolescents.

**Keywords** Media · Depression · Television · Mobile phones · Video games · Adolescents

## Introduction

Depression is the most common mental disorder among children and adolescents and can result in impairments in social skills, diminished cognitive development, reduced academic achievement, and suicide (Brown et al. 2013; Chérif et al. 2012; Guberman and Manassis 2011; Lundy et al. 2010; Ryan 2005). Adolescents use electronic media for approximately 8 h a day (Rideout et al. 2010), and this use has been indicated as a contributor to multiple negative health outcomes and behaviors (Brown and Bobkowsky 2011), with some evidence implicating it as a potential risk factor in the development of depression.

In the early days of the Internet, scholars were concerned that online social interactions would not translate into the type of support that buffers stress and reduces risk of mental health problems (Turkle 1996). Initially, investigations found that time spent online was associated with loneliness, isolation, and depression (Kraut et al. 1998), but follow-up work showed that negative effects diminish over time and demonstrated some positive effects on well-being (Kraut et al. 2002). More recent work has found links between media use and poorer mental health only among people with certain use patterns—very light or very heavy (Bélanger et al. 2011)—and for certain types of use—seeking health information (Bessière et al. 2010). Among adults, there is some evidence that using the Internet for

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communicating with friends and family is protective against depression over time (Bessière et al. 2010). Overall, the evidence implicating computer use in the development of depressive symptoms among adolescents is inconclusive and based primarily on samples of older adolescents and young adults.

Less is known about the impact of mobile phone use on depression, even though these devices are owned by approximately 78 % of 12- to 17-year-olds (Madden et al. 2013). Young adults report a belief that mobile phone use has positive effects on depression by promoting personal relationships and increasing access to social support (Thomé et al. 2010). Theories of social support, however, indicate that communications through mobile phones may not cultivate the strong social bonds that reduce stress and lead to positive psychological outcomes (Cohen et al. 1985). Such bonds traditionally result from face-to-face interactions that involve rich multi-faceted channels of information that are usually missing from texting and mobile phone calls (Cerulo 1997). Supporting the concept of mobile phone use as risk rather than protection, high levels of use are associated with more depressive symptoms (Augner and Hacker 2012; Sanchez-Martinez and Otero 2009; Thomée et al. 2011; Yen et al. 2009). Because most of our knowledge about the impact of mobile phone use comes from work with young adults, the goal of the current study is to examine these links in a sample of young adolescents.

Although TV, video games, and music have been available for substantially longer than the Internet and mobile phones, there are considerable limitations in our grasp of the role these media play in young people's mental health. In a nationally representative US sample, TV viewing, but not radio or video game play, was linked to increased odds of developing depression (Primack et al. 2009). An Australian study, on the other hand, found links between depression/anxiety and video game play, but not other media use (Mathers et al. 2009). Work using ecological momentary assessment (EMA) to measure media use found other conflicting results—increased use of audio-based media was associated with major depressive disorder (Primack et al. 2011). In light of such inconsistent findings, the current study combines longitudinal health outcomes with multiple intensive measures of media use to expand our understanding of how TV, video games, and music use are linked to symptoms of depression.

The development of depressive symptoms is influenced greatly by characteristics of a child's parents as well as features of the parent/child relationship. Children with depressed parents and those whose parents monitor them less are at considerably higher risk for depression than their peers (Bellamy and Hardy 2014; Goodman and Tully 2008). In the modern developmental environment, experts

regularly recommend that parents regulate children's media use (Council on Communications and Media 2013). Restrictive mediation is associated with less use (Rideout et al. 2010), but it is unknown whether the practice protects children from depression as does parental involvement in other realms of their life. The most effective restricting practices are currently unknown, with most research examining the presence/absence of household rules or active mediation through co-viewing (Gentile et al. 2012). Other practices, such as unstated expectations or reactions to problematic behaviors, have not been researched, which may explain the discrepancies between the responses of adults (Gentile et al. 2012)—who are monitoring for problematic behaviors—and children—who might not be aware of the monitoring. This study examines the associations between parental regulation of children's media use, in terms of explicit rules about and responses to different types of use, and children's symptoms of depression.

Overall, the aim of this study is to investigate the associations between different types of media use (both receptive and interactive) and symptoms of depression (both cross-sectionally and longitudinally) in a sample of young adolescents. Using multiple measures of media use, including real-time EMA questionnaires, survey reports, and time use diaries, we increase the likelihood that we accurately represent participants' experience using media. Finally, we test the possibility that parental monitoring of media use can reduce the development of depression in children.

## Method

The data for this study come from the Measuring Youth Media Exposure (MYME) project, which includes a baseline assessment of media use and depression and a follow-up 1 year later. MYME assesses media use through surveys, 24-h time use diaries (TUD), and EMA. Media use estimates from MYME are generally consistent, reliable, and valid (Bickham et al. 2011; Blood et al. 2014).

## Procedure

Participants in grades 7 through 9 (12–15 year olds) who spoke English were recruited from public schools, after-school programs, and summer camps in a small city in the northeastern USA. Consented youth completed an enrollment session where they provided assent, completed a media use and health survey, and received training on the TUD and EMA procedures. EMA measures were collected during the week following enrollment and then, to provide additional data and comparison points to help evaluate the reliability of this approach (Blood et al. 2014), for an

additional week after a hiatus of at least a week. Participants were sampled and completed baseline measures during 2009 and a follow-up health survey approximately 1 year from their enrollment date. Research procedures were approved by the Committee on Clinical Investigation at Boston Children's Hospital.

#### Media use survey questions

A common method of assessing media use is to ask young respondents to estimate the amount of time they spend using media (Gordon-Larsen et al. 1999; Rideout et al. 2010). Following this strategy, participants were asked to report the typical amount of time (within 15 min) on school days and weekends that they used electronic media including television (TV), video games, computers, mobile phones, and music. To calculate the average amount of daily use of each technology, we multiplied the school day estimate by 5 and the weekend estimate by 2, summed the products, and divided the result by 7 (Vereecken et al. 2006).

#### Time use diaries

TUDs have been used in a number of large studies to measure young people's media use, and the current study's instruments were designed to be similar to those that others have employed (Bickham and Rich 2006; Rideout et al. 2010). Participants completed TUDs for a randomly assigned weekday and for the Saturday of the week following their enrollment. These diaries contained a grid of 15-min intervals from the previous 24 h. For each interval, participants reported their activities in free text and indicated via check box whether they had used TV, video games, computers, mobile phones, and music. The number of rows with checked boxes was calculated for each type of medium and multiplied by 15 to calculate use duration for that TUD day. Average daily use was then calculated as described above.

#### Ecological momentary assessment

EMA measures common behaviors in real time by signaling participants throughout the day to complete a series of questions that capture activities, emotions, and context (Shiffman 2000; Shrier et al. 2007). This measure virtually eliminates recall bias, thereby overcoming limitations of other media use measures (Vandewater and Lee 2009). In this study, participants carried a handheld computer running CERTAS software (PICS, Inc., Reston, VA) that delivered four to seven signals a day (with up to two reminders per signal) at random times during waking, out-of-school hours. In response, participants completed a

questionnaire asking about the activities that were receiving their primary, secondary, and tertiary attention, with media options including TV, video games, computers, mobile phones, or music. Mobile phone use could be categorized as texting, talking, sending/receiving photos, or playing games. As in many other studies with adolescents, in which the response rate ranges from 52 to 80 % (Shrier et al. 2007; Whalen et al. 2001), participants responded to 66 % of the signals. Participants' media use assessed through the EMA questionnaires was calculated by summing the number of moments each participant reported using media (Primack et al. 2011).

#### Depression

Participants' depression was assessed using six items from the Beck Depression Inventory for Primary Care (Beck et al. 1997). This brief, self-administered scale assesses sadness, loss of pleasure, pessimism, past failure, self-dislike, and self-criticalness. By request of the community advisory board of this study, we did not include the item asking about suicidality. Scores on this scale are correlated with other, longer self-report measures and is able to distinguish between patients with and without major depressive disorders (Beck et al. 1997). This scale had a high level of internal consistency, with alphas of 0.84 and 0.82 for the baseline and follow-up assessments, respectively.

#### Media rules and regulations

To assess the presence of rules about technology use in participants' homes, we asked six questions about restrictions placed by parents: three for TV and three for video games. Participants were asked yes/no questions to assess whether they have rules in their homes about what, how long, and when they can watch TV and play video games [e.g., There are some shows (video games) that I am NOT allowed to watch (play). There is a time limit for how long I can watch (play)]. The questions were modeled after those used in other studies (Rideout et al. 2010), and evidence indicates that asking children to report on rules is a valid approach (Gentile et al. 2012).

To capture the other types of media regulation, we asked questions that we devised about parents' reactions to specific TV viewing or video game playing patterns. These 6 yes/no questions (3 each for TV and video games) asked participants whether their parents would tell them to shut off the TV or video games in specific situations [e.g., Would your parents tell you to turn off the TV (video game) if... you were watching (playing) for a long time? ...you were watching (playing) something they didn't want you to see (play)?]. Scores on all scales about media

regulations could range from 0 to 3, with each “yes” response contributing 1 point to the summed score.

### Covariates

Parental education, child race, and sex were included as covariates in all analyses. Participant reported maternal education ranging from no high school (0) to finished graduate school (6) was used when available; otherwise, paternal education was used. Additionally, participants reported their sex (male or female) and their race/ethnicity, which were dichotomized to non-white (i.e., African-American, Hispanic/Latino/Latina, Asian, multi-race, other) or white. To determine whether parental rules and regulations about media was a protective factor for depression even in the presence of other parental involvement, a measure of parental monitoring was included as a covariate to the relevant analyses. Parental monitoring was measured with a six-item scale that assesses the regularity with which children talk to their parents about where they are and who they are with (Li et al. 2000).

### Analysis plan

Individual linear regressions were used to examine the associations between each type of media use (TV, music, video games, computer, and mobile phones) at baseline and depression measured at baseline and at the 1-year follow-up while adjusting for gender, white/non-white race, and parental education. Results are presented for the longitudinal analyses that both included and did not include the baseline measure of depression as a control variable. A regression testing the relationships between media use rules and regulations and depression included the four regulation scale scores, the covariates named above, and parental monitoring score.

## Results

### Sample

Different sample sizes were used depending upon the type of media use measurement (recall survey, TUD, or EMA) and time frame (baseline and follow-up). 126 participants completed the baseline questionnaire that included the recall media use questions and depression scale (see Table 1 for descriptive statistics). 125 of these participants (99.2 %) completed the EMA procedure and on average responded to 43.48 signals over the course of the two measurement weeks. 104 youths completed the two TUDs at baseline (82.5 %). The TUD sample contained a lower percentage of non-white participants (41.3 %) than the group who did not complete

the TUD (63.6 %), although this difference only reached the level of a statistical trend ( $X^2 = 3.62$ ,  $p = 0.06$ ). 103 (81.7 %) participants completed the 1-year follow-up measure of depression. Participants who dropped out were older than those who completed both assessments (14.41 vs. 13.96,  $F(1,124) = 6.49$ ,  $p < 0.05$ ). 92 participants (73.0 %) completed both the baseline TUD assessment and the 1-year follow-up depression measure.

### Media use

Table 2 reports the average daily amount of media use reported by the participants on the recall questionnaire and the TUD. The number of EMA moments in which each type of media use was reported is also presented.

### Concurrent depression and media use

Results showed a significant, positive association between mobile phone (measured on the TUD) and depression (see Table 3 for all regression results). There is also some limited evidence that participants' depression scores were related to more time spent listening to music as reported on the questionnaire. This result, however, only reached the level of a trend.

### Baseline media use and follow-up depression

The longitudinal analyses found that the more TV use reported at baseline, the higher participants' depression score was at the 1-year follow-up. While the findings for all TV use measures were in the same direction, only TV use measured by the EMA reached significance.

The more mobile phone use reported at baseline, the higher participants' depression scores were at the 1-year follow-up. When use was measured using the EMA, this relationship was significant while controlling for baseline depression. The recall estimate of mobile phone use approached significance in this model. The TUD measure of mobile phone use was significantly associated with the follow-up depression score ( $\beta = 0.243$ ,  $p = 0.02$ ), but this association was attenuated and no longer reached significance when the baseline measure of depression was included in the model.

### Mobile phone use details

Participants' responses to EMA questions about their mobile phone use verify that they were using the devices to make phone calls and send/receive text messages. The majority of mobile phone use was described as texting (72.5 %) or talking (20.8 %). Other mobile phone activities, such as sending/receiving photos (1.9 %) and playing games (0.8 %), were reported less often.

**Table 1** Sample characteristics—media and depression—USA 2009

	<i>N</i> = 126
Female gender	59 (46.8 %)
Age in years at baseline, mean (range)	14.04 (12.56–15.94)
Non-white race	57 (45.2 %)
Parental education	
% Less than high school	17.4 %
% Completing high school	30.6 %
% At least some college	52.0 %
Depression, baseline, mean (SD)	2.17 (3.09)
Depression, 1-year follow-up, mean (SD)	1.78 (2.49)
Number of EMA reports completed, mean (range)	43.48 (3–85)
Rules about TV, mean (SD)	0.93 (0.84)
Reaction to TV, mean (SD)	1.33 (0.85)
Rules about video games, mean (SD)	0.88 (0.97)
Reaction to VG, mean (SD)	1.25 (0.90)

**Table 2** Media use as reported on three different measures—media and depression—USA 2009

	Average daily use in hours: survey ( <i>n</i> = 126) M (SD)	Average daily use in hours: TUD ( <i>n</i> = 104) M (SD)	Average moments of use over 2 weeks: EMA ( <i>n</i> = 125) M (SD)
Television	1.87 (1.52)	3.09 (2.06)	14.68 (11.67)
Video games	1.06 (1.82)	0.75 (1.19)	2.84 (4.59)
Computers	2.83 (3.09)	0.99 (1.41)	0.82 (4.78)
Mobile phone	3.90 (5.19)	1.68 (2.51)	4.57 (6.30)
Music	2.51 (3.21)	2.37 (2.80)	4.90 (5.37)

### Rules about media use and depression

There is some evidence that having rules in the home about television viewing and video game play is associated with lower levels of depression at the subsequent measurement point. The more rules about TV viewing that a participant reported at baseline, the lower their depression score was at the 1-year follow-up. Similarly, participants whose parents respond to different types of video game play with restrictive behaviors, the lower their depression at follow-up. Associations were observed between rules about video game play and higher levels of subsequent depression, but they did not reach the level of statistical significance.

### Discussion

Using multiple methods of assessing media use, we found that mobile phone use and TV viewing were associated with depressive symptoms, while computer use, music listening, and video game play were unrelated. These findings are consistent with other longitudinal studies that found adolescent TV viewing to predict depression later in life (Primack et al. 2009). Similarly, the mobile phone results correspond with evidence that heavy mobile phone users are more likely to suffer from depression (Augner and Hacker 2012; Sanchez-Martinez and Otero 2009; Thomée et al. 2011; Yen et al. 2009). Considering that longitudinal relationships between TV viewing, mobile phone use, and depression were evident in models controlling for baseline level of depression, this study adds to existing evidence that these activities contribute to development of depressive symptoms.

The stress of constant connectedness afforded by mobile phones has been identified by young adults as a potential mechanism linking their use to depression (Thomée et al. 2010). A review of the limited research in this area reported findings indicating that the ever-present need to “monitor and respond to text messages and alerts” (Sansone and Sansone 2013) can increase personal stress. In the realm of cyberbullying, experts often point to the constant connectivity of mobile phones as a contributor to the intensity of this type of harassment (Law et al. 2012; Ybarra et al. 2007). Being able to disconnect from their peer network, therefore, may provide adolescents with an important refuge and has the potential to reduce stress and diminish the association between mobile phone use and depression. Intervention work that provides young people with the skills to disconnect from their peer network to reduce stress could provide the conclusive evidence necessary to understand how mobile phones contribute to depression.

Nevertheless, the connectivity to a social network afforded by cell phones is seen by young people as being helpful for managing depression (Thomée et al. 2010). Our observed cross-sectional association between mobile phone use and depression could indicate that participants were activating their social network to cope with negative emotions. However, the findings linking baseline mobile phone use to later symptoms of depression seem to indicate that this strategy is not successful. The type of connection needed to protect against depression may not be easily provided through texting (the most popular mobile phone behavior in our sample), as illustrated in work indicating that texting is often used to connect with less-close communication partners (Kim et al. 2007) and that relationships with more texting are perceived as less fulfilling than other

**Table 3** Linear regression using media use and household media rules to predict baseline and follow-up depression—media and depression—USA 2009

	Depression					
	Baseline		1-year Follow-up		Follow-up (controlling for baseline)	
	$\beta$	$p$	$\beta$	$p$	$\beta$	$p$
<b>Television<sup>a</sup></b>						
Recall survey	-0.130	0.15	0.108	0.29	0.129	0.18
Time use diary	0.013	0.90	0.165	0.12	0.147	0.13
EMA	-0.069	0.45	0.206*	0.04	0.205*	0.03
<b>Music</b>						
Recall survey	0.191 <sup>#</sup>	0.05	0.034	0.75	0.020	0.84
Time use diary	0.110	0.23	0.116	0.26	0.117	0.24
EMA	-0.060	0.51	-0.020	0.84	-0.005	0.96
<b>Video games</b>						
Recall survey	0.066	0.47	0.133	0.19	0.112	0.26
Time use diary	-0.070	0.49	0.059	0.59	0.101	0.32
EMA	-0.080	0.39	0.001	0.99	0.004	0.97
<b>Computer</b>						
Recall survey	0.040	0.67	0.013	0.90	0.031	0.75
Time use diary	0.013	0.89	0.001	0.99	0.010	0.92
EMA	0.027	0.76	0.082	0.42	0.081	0.45
<b>Mobile phones</b>						
Recall survey	-0.133	0.15	0.148	0.16	0.177 <sup>#</sup>	0.08
Time use diary	0.197*	0.045	0.243*	0.02	0.148	0.15
EMA	-0.040	0.66	0.223*	0.03	0.220*	0.02
<b>Media rules and regulations<sup>b</sup></b>						
Rules about TV	0.009	0.95	-0.289*	0.04	-0.272*	0.048
Rules about video games	0.073	0.61	0.258	0.11	0.268 <sup>#</sup>	0.08
Reaction to TV viewing	-0.025	0.85	0.212	0.15	0.186	0.19
Reaction to video games	0.022	0.88	-0.274 <sup>#</sup>	0.08	-0.298 <sup>#</sup>	0.050
Parental monitoring	-0.160	0.11	-0.075	0.50	-0.040	0.71

All models control for gender, white/non-white race, and parental education. Each row represents a different regression with the reported betas corresponding to the media use or media use measure included

EMA ecological momentary assessment

\*  $p < 0.05$ , <sup>#</sup>  $p < 0.10$

<sup>a</sup> Each row under a media use header provides betas from three separate analyses corresponding to the specific measurement technique and media use indicated

<sup>b</sup> The results presented for media rules and regulations are from a single regression analysis. Reported associations between media regulation and depression control for parental monitoring

relationships (Angster et al. 2010). Overall, young people may try to cope with negative feelings by reaching out with a tool they see as useful for maintaining social connectivity but that fails to provide the type of social bonds necessary to protect against the further development of depressive symptoms. While this hypothesis is based on findings from our and others' work, additional research will be required to tests it directly.

Our results for TV viewing are consistent with other findings that indicate a longitudinal association between

TV viewing and depressive symptoms (Primack et al. 2009). This link could be explained by exposure to TV content—images from programs and advertising negatively affecting body perceptions—or TV viewing displacing more protective activities (Primack et al. 2009). There is, however, little evidence that TV viewing displaces activities that are protective against depression, such as time with family and friends (Bickham and Rich 2006; Vandewater et al. 2006). Advertising research does indicate that the representation of attractive people leading exciting and

idealized lifestyles may invite social comparison and contribute to dissatisfaction with oneself (Richins 1991). The lack of a direct test of how different types of televised content impacts depression presents an opportunity for researchers. Because violent or anxiety-producing content may contribute to depression while humor may help reduce it (Primack et al. 2009), we must examine the differential effects of different types of content before we can make targeted recommendations.

The pattern of findings across the different measurement types illuminates some of the strengths of more intensive assessments. In both mobile phone use and TV viewing, the longitudinal associations between use and depression were only apparent in the EMA assessments. Considering that EMA eliminates recall and introduces less error than other measures, it is more capable of detecting an association. Furthermore, EMA captures a level of engagement with media in the moment that summary questions and TUDs miss. This engagement may be more predictive of depressive symptoms, as it could represent a higher level of attention to TV content or a higher reliance on mobile phones. While another study that employed EMA to examine links between media use and depression revealed few associations (Primack et al. 2011), the work was cross-sectional and investigated severe depression. Additional research using EMA is necessary to identify which aspects of media use predict later depression.

Our findings provide some preliminary evidence that when parents have rules about TV, their children become less depressed, even when accounting for other elements of parental monitoring. Having rules regarding TV could be a behavior indicative of the parental involvement known to be protective against children's depression (Hamza and Willoughby 2011). The findings also indicate that explicit rules could be more protective against depression than a strategy of reacting to certain types of media use. These conclusions, however, must come with considerable caveats. Aspects of parents' rules about TV that our data do not measure, including the regularity and style of enforcement, are likely to alter their protective qualities. Additionally, the results across the different media types pose more questions than they answer. Rules about video games and reactions toward video games, for example, were associated (at the level of a trend) with higher levels of depression. Research that investigates how rule type and enforcement alter the effect of parental media regulation on psychosocial outcomes will further illuminate the processes at play.

One noteworthy limitation of this study is its small and homogeneous sample. The limited statistical power afforded by the sample may have made it more difficult to detect associations between depression and media use when measured by techniques like TUD and survey

questions, which are more susceptible to bias and recall error. It is worth noting, however, that the associations between depression and the survey and TUD measures of TV and mobile phone use are in the same direction as the associations with the EMA measures. Furthermore, the geographic homogeneity of the sample makes it difficult to generalize the findings to other populations. However, the sample was diverse in terms of the inclusion of youth from minority populations and those with lower levels of parental education. Two other limitations are also worth noting: First, the questions regarding parental rules and reactions to media use, while based on existing questions, were developed for this study. As such, they have not been systematically validated. Measurement limitations may account for the unusual pattern of results linking these items to depression. Second, there are influences on both depression and media use that this study did not measure and that could explain our findings. Parental depression would be especially important to include in future studies of adolescents, as it has been shown to be linked to younger children's TV viewing (Burdette et al. 2003).

This study provides new evidence that mobile phone use is associated with the development of depressive symptoms and supports an established link between TV viewing and depression. Additionally, our findings provide some preliminary evidence that having rules about TV use in the home may serve as a protective factor against depression for adolescents. The use of certain types of electronic media seem to be a risk factor for the development of symptoms of depression, but family-based interventions that build parental skills concerning media may be especially effective at reducing these effects and improving the mental health of young people.

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**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical standard** This research complies with the laws of the USA. All procedures were approved by the Committee on Clinical Investigation at Boston Children's Hospital.

## References

- Angster A, Frank M, Lester D (2010) An exploratory study of students' use of cell phones, texting, and social networking sites. *Psychol Rep* 107:402–404

- Augner C, Hacker GW (2012) Associations between problematic mobile phone use and psychological parameters in young adults. *Int J Public Health* 57:437–441
- Beck AT, Guth D, Steer RA, Ball R (1997) Screening for major depression disorders in medical inpatients with the Beck Depression Inventory for Primary Care. *Behav Res Ther* 35:785–791
- Bélanger RE, Akre C, Berchtold A, Michaud P-A (2011) A U-shaped association between intensity of internet use and adolescent health. *Pediatrics* 127:e330–e335
- Bellamy S, Hardy C (2014) Factors predicting depression across multiple domains in a national longitudinal sample of canadian youth. *J Abnorm Child Psychol* 1–11
- Bessièrè K, Pressman S, Kiesler S, Kraut R (2010) Effects of internet use on health and depression: a longitudinal study. *J Med Internet Res* 12:e6
- Bickham DS, Rich M (2006) Is television viewing associated with social isolation? Roles of exposure time, viewing context, and violent content. *Arch Pediatr Adolesc Med* 160:387–392
- Bickham DS, Ross C, Heymann G, Rich M (2011) Measuring young adolescents' media exposure: comparing estimates from two methods. Paper presented at the Society for Research on Child Development, Montreal, Canada, April, 2011
- Blood EA, Bickham DS, Shrier LA, Rich M (2014) Evaluating multiple intensively collected media use measures: validity and reliability of momentary assessments. *Commun Methods Meas* (in press)
- Brown JD, Bobkowsky PS (2011) Older and newer media: patterns of use and effects on adolescents' health and well-being. *J Res Adolesc* 21:95–113
- Brown HE, Pearson N, Braithwaite RE, Brown WJ, Biddle SJ (2013) Physical activity interventions and depression in children and adolescents. *Sports Med* 43:195–206
- Burdette HL, Whitaker RC, Kahn RS, Harvey-Berino J (2003) Association of maternal obesity and depressive symptoms with television-viewing time in low-income preschool children. *Arch Pediatr Adolesc Med* 157:894–899
- Cerulo KA (1997) Reframing sociological concepts for a brave new (virtual?) world. *Sociol Inq* 67:48–58
- Chérif L, Ayadi H, Boussaid N, Moalla Y, Rekik N, Ghribi F (2012) Depression in adolescent suicide attempters: a cross-sectional comparative study. *Adolesc Psychiatry* 2:253–257
- Cohen S, Mermelstein R, Kamarck T, Hoberman H (1985) Measuring the functional components of social support. In: Sarason I, Sarason B (eds) *Social support: theory, research and applications*, vol 24. NATO ASI Series. Springer, Netherlands, pp 73–94. doi:10.1007/978-94-009-5115-0\_5
- Council on Communications and Media (2013) Children, adolescents, and the media. *Pediatrics* 132:958–961
- Gentile DA, Nathanson AI, Rasmussen EE, Reimer RA, Walsh DA (2012) Do you see what I see? Parent and child reports of parental monitoring of media. *Fam Relat* 61:470–487
- Goodman SH, Tully E (2008) Children of depressed mothers: implications for the etiology, treatment, and prevention of depression in children and adolescents. In: Abela JRZ, Hankin BL (eds) *The handbook of depression in children and adolescents*. Guilford Press, New York
- Gordon-Larsen P, McMurray RG, Popkin BM (1999) Adolescent physical activity and inactivity vary by ethnicity: The National Longitudinal Study of Adolescent Health. *J Pediatr* 135:301–306
- Guberman C, Manassis K (2011) Symptomatology and family functioning in children and adolescents with comorbid anxiety and depression. *J Can Acad Child Adolesc Psychiatry* 20:186
- Hamza CA, Willoughby T (2011) Perceived parental monitoring, adolescent disclosure, and adolescent depressive symptoms: a longitudinal examination. *J Youth Adolesc* 40:902–915
- Kim H, Kim GJ, Park HW, Rice RE (2007) Configurations of relationships in different media: FtF, email, instant messenger, mobile phone, and SMS. *J Comput Mediat Commun* 12:1183–1207
- Kraut R, Patterson M, Lundmark V, Kiesler S, Mukopadhyay T, Scherlis W (1998) Internet paradox. A social technology that reduces social involvement and psychological well-being? *Am Psychol* 53:1017–1031
- Kraut R, Kiesler S, Boneva B, Cummings J, Helgeson V, Crawford A (2002) Internet paradox revisited. *J Soc Issues* 58:49–74
- Law DM, Shapka JD, Hymel S, Olson BF, Waterhouse T (2012) The changing face of bullying: an empirical comparison between traditional and internet bullying and victimization. *Comput Human Behav* 28:226–232
- Li X, Feigelman S, Stanton B (2000) Perceived parental monitoring and health risk behaviors among urban low-income African-American children and adolescents. *J Adolesc Health* 27(1):43–48
- Lundy SM, Silva GE, Kaemingk KL, Goodwin JL, Quan SF (2010) Cognitive functioning and academic performance in elementary school children with anxious/depressed and withdrawn symptoms. *Open Pediatr Med Journal* 4:1
- Madden M, Lenhart A, Duggan M, Cortesi S, Gasser U (2013) *Teens and technology 2013*. Pew Internet & American Life Project. [http://www.pewinternet.org/files/old-media/Files/Reports/2013/PIP\\_TeensandTechnology2013.pdf](http://www.pewinternet.org/files/old-media/Files/Reports/2013/PIP_TeensandTechnology2013.pdf)
- Mathers M, Canterford L, Olds T, Hesketh K, Ridley K, Wake M (2009) Electronic media use and adolescent health and well-being: cross-sectional community study. *Acad Pediatr* 9:307–314
- Primack BA, Swanier B, Georgiopoulos AM, Land SR, Fine MJ (2009) Association between media use in adolescence and depression in young adulthood: a longitudinal study. *Arch Gen Psychiatry* 66:181–188
- Primack BA, Silk JS, DeLozier CR, Shadel WG, Dillman Carpentier FR, Dahl RE, Switzer GE (2011) Using ecological momentary assessment to determine media use by individuals with and without major depressive disorder. *Arch Pediatr Adolesc Med* 165:360–365
- Richins ML (1991) Social comparison and the idealized images of advertising. *J Consum Res* 18:71–83
- Rideout VJ, Foehr UG, Roberts DF (2010) *Generation M2: media in the lives of 8- to 18-year-olds*. Henry J. Kaiser Family Foundation, Menlo Park
- Ryan ND (2005) Treatment of depression in children and adolescents. *Lancet* 366:933–940
- Sanchez-Martinez M, Otero A (2009) Factors associated with cell phone use in adolescents in the community of Madrid (Spain). *Cyberpsychol Behav* 12:131–137
- Sansone RA, Sansone LA (2013) Cell phones: the psychosocial risks. *Innov Clin Neurosci* 10:33–37
- Shiffman S (2000) Real-time self-report of momentary states in the natural environment: computerized ecological momentary assessment. Lawrence Erlbaum, Mahwah
- Shrier L, Shih M-C, Hacker L, de Moor C (2007) A momentary sampling study of the affective experience following coital events in adolescents. *J Adolesc Health* 40:e1–e8
- Thomée S, Dellve L, Härenstam A, Hagberg M (2010) Perceived connections between information and communication technology use and mental symptoms among young adults—a qualitative study. *BMC Public Health* 10:1–14
- Thomée S, Härenstam A, Hagberg M (2011) Mobile phone use and stress, sleep disturbances, and symptoms of depression among young adults—a prospective cohort study. *BMC Public Health* 11:66
- Turkle S (1996) Virtuality and its discontents: searching for community in cyberspace. *Am Prospect* 24:50–57

- Vandewater EA, Lee S-J (2009) Measuring children's media use in the digital age. *Am Behav Sci* 52:1152–1176
- Vandewater EA, Bickham DS, Lee JH (2006) Time well spent? Relating television use to children's free-time activities. *Pediatrics* 117:e181–e191
- Vereecken CA, Todd J, Roberts C, Mulvihill C, Maes L (2006) Television viewing behaviour and associations with food habits in different countries. *Public Health Nutr* 9:244–250
- Whalen CK, Jamner LD, Henker B, Delfino RJ (2001) Smoking and moods in adolescents with depressive and aggressive dispositions: evidence from surveys and electronic diaries. *Health Psychol* 20:99–111
- Ybarra ML, Diener-West M, Leaf PJ (2007) Examining the overlap in internet harassment and school bullying: implications for school intervention. *J Adolesc Health* 41:S42–S50
- Yen C-F, Tang T-C, Yen J-Y, Lin H-C, Huang C-F, Liu S-C, Ko C-H (2009) Symptoms of problematic cellular phone use, functional impairment and its association with depression among adolescents in Southern Taiwan. *J Adolesc* 32:863–873