Journal of Obesity and Chronic Diseases

https://doi.org/10.17756/jocd.2018-012

Brief Report

Open Access

Identifying Technology Associated with Weight Status and Health Problems in Children Referred for Weight Management

Marsha B. Novick[1*], Helen M. Hendy[2], Whitney Adams[3] and Keith Williams[3]

[1]*Department of Pediatrics, Penn State Hershey Children's Hospital, HP 14500 University Drive, Hershey, PA 17033, USA*

[2]*Penn State University, Schuylkill Campus, 200 University Drive, Schuylkill Haven, PA 17972, USA*

[3]*Feeding Program, Department of Pediatrics, Penn State Hershey Children's Hospital, 905 W. Governor Road Hershey, PA 17033, USA*

***Correspondence to:**
Dr. Marsha B. Novick
Department of Pediatrics
Penn State Hershey Children's Hospital
HP 14500 University Drive
Hershey, PA 17033, USA
Tel: 717 531-8674
E-mail: mnovick@pennstatehealth.psu.edu

Received: January 26, 2018
Accepted: March 28, 2018
Published: March 29, 2018

Citation: Novick MB, Hendy HM, Adams W, Williams K. 2018. Identifying Technology Associated with Weight Status and Health Problems in Children Referred for Weight Management. *J Obes Chronic Dis* 2(1): 8-11.

Published by United Scientific Group

Abstract

Objectives: The purpose of this study was to identify possible behavioral targets among children referred to a pediatric weight management clinic to improve weight and health status.

Methods: Parents of 135 children participated by completing a survey which included questions on child demographics and child behaviors. Associations were examined between child behaviors and two clinically relevant outcomes: weight status (BMI z-score) and weight-related health problems.

Results: Controlling for child demographics (age, gender), heavier weight status was associated with child behaviors of less sleep, less physical activity, more screen time, and more fruit and vegetable consumption (R^2 = .32). Follow-up analyses revealed that weight was most associated with cell phone in comparison to other technology such as television, computers, and games (R^2 = .23). Controlling for child demographics, health problems were associated with more screen time (R^2 = .22), with follow-up analyses revealing health problems most associated with cell phone and computer use (R^2 = .23).

Conclusions: Interventions targeting increases in sleep, increased in physical activity, and decreases in screen time (especially cell phone use), may be useful for reducing weight status (BMI z-score) of obese children. Interventions targeting decreases in both cell phone and computer time may be useful for reducing obesity-related health problems in these children.

Background

It is well known that obesity increases the risk of multiple medical problems [1], including coronary artery disease [2] and type 2 diabetes [3]. Numerous risk factors related to the development of childhood obesity are also known and include a sedentary lifestyle [4], a hypercaloric diet [5], and lack of sleep [6].

Over the past four decades, children's sedentary lifestyle has been grossly impacted by the increased use of screen technology, including TV, cell phones, computer entertainment, and video games. Data vary on the amount of time children spend with screen media, but even the most conservative findings have shown that American children between the ages of eight to eighteen years old consume an average 7 hours of screen media per day [7]. Increased exposure of screen time has been suggested to influence other health-related behaviors, such as eating junk food [8] and lack of physical activity [9], which may in turn contribute to obesity [10]. Current research has shown that just two hours a day of screen time is associated with an elevation of blood pressure in children [11] and prolonged TV viewing is associated with increased risk of metabolic syndrome [12].

While evidence shows screen-time is a risk factor for childhood obesity, studies have not investigated which type of screen time has the greatest impact on childhood obesity.

Methods

Participants and procedures

Participants were parents of 135 children from a pediatric weight management clinic (61.5% female; mean age = 10.9 years, SD = 3.5; mean BMI z-score = 2.42, SD = .55), who completed a questionnaire about child demographics, health problems, and child behaviors including sleep, physical activity, screen time, Fruit/Vegetable (FV) consumption, and snack food consumption. Research was approved by the Institutional Review Board of the Penn State College of Medicine, 042914EP.

Measurement of clinically-relevant outcomes

Weight status: Children's weight status was measured as BMI z-scores, calculated from weight and height information obtained by the clinic staff. The BMI z-score was obtained using online software (http://stokes.chop.edu/web/zscore). Each child's BMI z-score is his/her BMI converted into the number of standard deviations it is from the mean BMI for all children of the same gender and age, with a BMI z-score of zero indicating the child's BMI is at the mean for his gender and age, a negative BMI z-score indicating the child is below the mean, and a positive BMI z-score indicating the child is above the mean.

Health problems: Parents were asked to report whether (0 = no, 1 = yes) their children had been diagnosed with each of 15 health problems: migraine, reflux, constipation, thyroid problems, high blood pressure, heart problems, sleep apnea, diabetes, metabolic syndrome, insulin resistance, polycystic ovary disease, menses problems, joint problems, liver problems. The child's score for health problems was the number of these 15 health problems reported by the parent. (Table 1 shows descriptive statistics for child demographics and study variables.)

Measurement of child behaviors

Child sleep (hours/week): Parents were asked "How many hours does your child typically sleep each night?" Sleep was then calculated as the sum of hours reported for the seven days of the week.

Child physical activity (hours/week): Parents were asked "If physical activity is defined as riding a bicycle, running or walking, swimming, playing a team sport, playing a racquet sport, dancing, or going to the gym, how many hours per day?" Physical activity was then calculated as the sum of hours reported for the seven days of the week.

Total child screen time (hours/week): Parents were asked "How many hours does your child spend watching television, being on the computer, playing video games, and using a cell phone per day?' Screen time was calculated as the sum of hours reported for the seven days of the week, with the total screen time calculated as the sum of these sums.

Fruit and vegetable (FV) consumption: Parents reported the number of 41 common fruits and vegetables children consumed at least monthly.

Snack food consumption: Parents reported the number of 10 common sweet and salty snack foods children consumed at least monthly.

Table 1: Descriptive statistics for 135 children referred to a pediatric weight management clinic (Mean Age = 10.85 Years, SD = 3.61).

Variable	**#**	**(%)**
Child Demographics:		
Gender:		
Male	41	(33.1%)
Female	83	(66.9%)
Unknown	11	(8.1%)
Variable	***M***	***(SD)***
Child Behaviors:		
Sleep (hours/week)	59.7	(7.8)
Exercise (hours/week)	8.5	(9.2)
Total screen time (hours/week)	38.4	(27.3)
Television	18.1	(13.7)
Video games	6.8	(9.3)
Computer	8.7	(11.0)
Cell phone	5.1	(12.1)
FV consumption (# of 41 eaten monthly)	9.8	(6.0)
Snack food consumption (# of 10 eaten monthly)	2.6	(2.6)
Clinical Outcomes:		
BMI z-score	2.42	(.55)
Health problems (# of 15)	0.9	(1.3)

Data Analysis

The first goal for data analysis was to determine whether child behaviors were associated with each outcome variable (BMI z-score, health problems), while controlling for child demographics (age, gender). For each outcome measure, SPSS 23 software was used to conduct hierarchical multiple regression with demographics entered in the first step, then with five child behaviors entered in the second step (sleep, physical activity, total screen time, FV consumption, snack consumption) (Table 2). If total screen time was found significantly associated with an outcome measure (BMI z-score, health problems), the second goal for data analysis was to again use SPSS 23 software to conduct hierarchical multiple regression, with demographics entered in the first step, then with four types of screen time entered in the second step (television, video games, computers, cell phone) (Table 3).

Results

The hierarchical multiple regression analysis for weight status (BMI z-score) revealed that after controlling for child demographics (age, gender), heavier children tended to have less sleep, less physical activity, more FV consumption, and more screen time, with the set of variables explaining

32% of the variance in child weight status (total R^2 = .32) (Table 2). Additionally, follow-up hierarchical multiple regression analysis to examine which type of screen time was most associated with weight status revealed that, again after controlling for child demographics, heavier children tended to have more cell phone use, with the set of variables explaining 23% of the variance in child weight status (R^2 = .23) (Table 3).

Table 2: Hierarchical multiple regression to examine child behaviors associated with outcomes, controlled for child demographics.

BMI Z-Score	***Beta***	***t***	***P* <**	***R² change***
Entered First:				.174
Child age	-.329	3.76	.001	
Child gender (0 = female, 1 = male)	.260	2.97	.005	
Entered Second:				.142
Sleep	-.212	2.43	.02	
Physical Activity	-.186	2.15	.04	
Total screen time	.203	2.28	.03	
FV consumption	.225	2.51	.02	
Snack consumption	-.154	1.69	.10	
	(total R^2 = .32, $F_{(7.103)}$ = 6.78, p < .001)			

Health Problems	***Beta***	***t***	***P* <**	***R² change***
Entered First:				.105
Child age	.319	3.52	.002	
Child gender (0 = female, 1 = male)	.057	.63	.54	
Entered Second:				.115
Sleep	-.041	.45	.66	
Physical Activity	-.005	.06	.96	
Total screen time	.363	3.85	.001	
FV consumption	.036	.38	.71	
Snack consumption	-.022	.23	.83	
	(total R^2 = .22, $F_{(7.115)}$ = 4.20, p < .001)			

The hierarchical multiple regression analysis for health problems revealed that after controlling for the child demographics (age, gender), children with more health problems tended to have more screen time, with the set of variables explaining 22% of the variance in child health problems (R^2 = .22) (Table 2). Additionally, follow-up hierarchical multiple regression analysis to examine which type of screen time was most associated with health problems revealed that, again after controlling for child demographics, children with more health problems tended to have more cell phone and computer use, with the set of variables explaining 23% of the variance in child weight status (R^2 = .23) (Table 3).

Discussion

Our finding that increased BMI z-score is related to less sleep, less physical activity, and more screen time is consistent

Table 3: Follow-up hierarchical multiple regression to examine which type of screen time was most associated with outcomes, controlling for child demographics.

BMI Z-Score	***Beta***	***t***	***P* <**	***R² change***
Entered First:				.186
Child age	-.360	4.27	.001	
Child gender (0 = female, 1 = male)	.245	2.91	.005	
Entered Second:				.047
Television	.022	.25	.81	
Video games	.065	.66	.52	
Computer	.035	.37	.72	
Cell phone	.213	2.28	.03	
	(total R^2 = .23, $F_{(6.111)}$ = 5.60, p < .001)			

Health Problems	***Beta***	***t***	***P* <**	***R² change***
Entered First:				.092
Child age	.293	3.33	.022	
Child gender (0 = female, 1 = male)	.072	.81	.42	
Entered Second:				.133
Television	.011	.12	.91	
Video games	.152	1.56	.13	
Computer	.209	2.21	.03	
Cell phone	.269	2.89	.006	
	(total R^2 = .23, $F_{(6.113)}$ = 5.48, p < .001)			

with numerous other studies [13-15]. Increased BMI z-score was associated with a greater number of fruits and vegetables eaten. Although we predicted children who ate fewer fruits and vegetables would have a higher BMI z-score since fruits and vegetables could be replaced with higher-caloric density foods, other research has found overweight status was not related to intake of fruits and vegetables [16].

Past research has shown not only are the hours of screen time positively related to BMI z-score, but several types of screen time, such as television, digital versatile discs/videos, and video/computer games are also associated with gains in BMI [17]. As far as we are aware, this study is the first in the literature to show that cell phone use rather than other forms of technology is associated with higher weight status and health problems in children with obesity. We found that although children, on average, spent less time on their phones than watching television, playing video games, or on the computer, the cell phone was the only form of screen time that was significantly associated with BMI z-score, with the heaviest children spending the most time on their phones. Because adolescents have even greater access to cell phones compared to this sample of children, future research on the association of adolescents' weight and health status with cell phone use should be examined.

Screen time (both as cell phone and computer use) was the

only child behavior associated with health problems related to obesity. Although increased screen time could contribute to overweight which could lead to the health problems associated with overweight, it could also be the case that as children develop more health problems, they spend more time engaged in sedentary activities such as various forms of screen time. Weaknesses of this study include small sample size and unconfirmed parent reporting of child medical conditions and behaviors.

Conclusions

Even in this clinical sample in which all the children were either overweight or obese, child behaviors (less sleep, less physical activity, more screen time) were predictive of weight status and health problems in children with obesity. These behaviors would be appropriate targets for intervention to improve clinically-relevant outcomes in children with obesity, a suggestion consistent with previous studies [18-19]. We also found that the heaviest children, and children with the most health problems tended to spend the most time on their cell phones. A growing number of phone applications have been developed to address child overweight, but future research is needed to determine whether any of them are effective interventions for child obesity [20].

Conflicts of Interest Statement

The authors declare that the research was conducted in the absence of any conflict of interest.

References

1. Reilly JJ, Methven E, McDowell ZC, Hacking B, Alexander D, et al. 2003. Health consequences of obesity. *Arch Dis Child* 88(9): 748-752. https://doi.org/10.1136/adc.88.9.748
2. Artham SM, Lavie CJ, Milani RV, Ventura HO. 2009. Obesity and hypertension, heart failure, and coronary heart disease—risk factor, paradox, and recommendations for weight loss. *Ochsner J* 9(3): 124-132.
3. Day C, Bailey CJ. 2011. Obesity in the pathogenesis of type 2 diabetes. *Br J Diabetes Vasc Dis* 11(2): 55-61. https://doi.org/10.1177/1474651411407418
4. Faghri P, Stratton K, Momeni K. 2015. Sedentary lifestyle, obesity, and aging: implication for prevention. *J Nutr Disorders Ther* 5: e119. https://doi.org/10.4172/2161-0509.1000e119
5. St-Onge MP, Keller KL, Heymsfield SB. 2003. Changes in childhood food consumption patterns: a cause for concern in light of increasing body weights. *Am J Clin Nutr* 78(6): 1068-1073. https://doi.org/10.1093/ajcn/78.6.1068
6. Daniels SR. 2008. The internet, poor sleep and obesity. *J Pediat* 153(5): A2. https://doi.org/10.1016/j.jpeds.2008.09.034
7. 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, CA, USA.
8. Ray M, Jat KR. 2010. Effect of electronic media on children. *Indian Pediatr* 47(7): 561-568. https://doi.org/10.1007/s13312-010-0128-9
9. Altamimi RI, Skinner GD, Nesbitt KV. 2015. A position paper on managing youth screen time versus physical activity. *GSTF J Comput* 4(2): 10-16. https://doi.org/10.7603/s40601-014-0003-y
10. Karnik S, Kanekar A. 2012. Childhood obesity: a global public health crisis. *Int J Prev Med* 3(1): 1-7.
11. Gopinath B, Baur LA, Wang JJ, Hardy LL, Teber E, et al. 2011. Influence of physical activity and screen time on the retinal microvasculature in young children. *Arterioscler Thromb Vasc Biol* 31(5): 1233-1239. https://doi.org/10.1161/ATVBAHA.110.219451
12. Mark AE, Janssen I. 2008. Relationship between screen time and metabolic syndrome in adolescents. *J Public Health* 30(2): 153-160. https://doi.org/10.1093/pubmed/fdn022
13. Chaput JP, Brunet M, Tremblay A. 2006. Relationship between short sleeping hours and childhood overweight/obesity: results from the 'Quebec en Forme' Project. *Int J Obes (Lond)* 30(7): 1080-1085. https://doi.org/10.1038/sj.ijo.0803291
14. Janssen I, Katzmarzyk PT, Boyce WF, Vereecken C, Mulvihill C, et al. 2005. Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary patterns. *Obes Rev* 6(2): 123-132. https://doi.org/10.1111/j.1467-789X.2005.00176.x
15. Strasburger VC, Jordan AB, Donnerstein E. 2010. Health effects of media on children and adolescents. *Pediatr* 125(4): 756-767. https://doi.org/10.1542/peds.2009-2563
16. St-Onge MP, Wolfe S, Sy M, Shechter A, Hirsch J. 2014. Sleep restriction increases the neuronal response to unhealthy food in normal-weight individuals. *Int J Obes (Lond)* 38(3): 411-416. https://doi.org/10.1038/ijo.2013.114
17. Falbe J, Rosner B, Willett WC, Sonneville KR, Hu FB, et al. 2013. Adiposity and different types of screen time. *Pediatr* 132(6): e1497-e1505. https://doi.org/10.1542/peds.2013-0887
18. Peña MM, Taveras EM. 2011. Preventing childhood obesity: wake up, it's time for sleep! *J Clin Sleep Med* 7(4): 343-344. https://doi.org/10.5664/JCSM.1184
19. Steinbeck K. 2005. Childhood obesity. Treatment options. *Best Pract Res Clin Endocrinol Metab* 19(3): 455-469. https://doi.org/10.1016/j.beem.2005.04.010
20. Schoffman DE, Turner-McGrievy G, Jones SJ, Wilcox S. 2013. Mobile apps for pediatric obesity prevention and treatment, healthy eating, and physical activity promotion: just fun and games? *Transl Behav Med* 3(3): 320-325.