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Does Behavioral Intention Predict Physical Activity Behaviors Related to Adolescent Obesity?

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Objective: According to the Theory of Planned Behavior, the single best predictor of a person's behavior is their intention to perform that behavior, Predictive factors of intention include attitudes, subjective norms, and perceived behavioral control. The purpose of this study was to examine the extent to which behavioral intention predicted physical activity (PA) and sedentary behaviors linked to childhood obesity**. *Design:*** A convenience sample of 318 middle school students were administered a129-item valid and reliable instrument. Multiple regression was used to establish predictors for each behavior. ***Results:*** The mean BI scores for participating in less than two hours of screen time per day (M = 12.31, SD = 5.42) and at least 60 minutes of PA per day (M = 12.84, SD = 7.18) denoted a moderate intent to participate in the behavior. However, 25% and 33% of students indicated a weak intention to participate in the respective behaviors. Regression showed BI was predictive for screen time among overweight students, and for participation in PA among all students, ($p < 0.05$). ***Conclusion****:* BI was linked to PA and sedentary behaviors related to obesity prevention in adolescents. On average, students reported moderate intention for each of the behaviors; however, weak intentions existed in over 25% of students, and should be considered when evaluating overall likelihood of participating in the relevant behavior. Students who were overweight or obese had lower intentions to participate in less screen time or more PA, which is important to consider when framing behavior change messages for this population

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Key Words: physical activity; sedentary behaviors; theory of planned behavior; modifiable behaviors

INTRODUCTION

The prevalence of overweight and obese people has reached epidemic proportions (21). Globally, more than 1 billion people have been classified as overweight and of those at least 30% are obese (33). More than one-third of U.S. adults, or over 72 million people, were obese in 2007–2008 (12). Yet, the obesity epidemic is not limited to adults; the percentage of children and adolescents who are overweight also continues to increase. Of U.S. children and teenagers aged 2–19 years, an estimated 17% (almost 9 million) are obese (12). Rates of obesity have increased among all age groups between 1976–1980 and 2007–2008; among pre-school children 2–5 years of age rates increased from 5% to 10.4%, from 6.5% to 19.6% among 6–11 year olds, and from 5% to 18.1% among adolescents aged 12–19 (12).

The determinants of overweight and obesity are multifaceted. The reason most often cited is the relationship between an excess in energy consumption and/or inadequate physical activity (5, 20). The plausible relationship between a sedentary lifestyle and obesity has led the U.S. Department of Health and Human Services to recommend that children engage in at least 60 minutes of moderate to vigorous PA, which is developmentally appropriate, enjoyable, and involves a variety of activities, on most days of the week (31). However, most youth are not meeting said guidelines: 61.1% of middle school and high school students did not engage in at least 60 minutes of PA per day for at least five days per week and 17% did not participate in any PA (29). Not only does increased PA

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have the potential to improve incidence of overweight or obesity, but it also reduces the risk of premature mortality, improves strength and endurance, helps build healthy bones and muscles, reduces anxiety and stress, and increases self-esteem (31).

Supported by the American Medical Association (13), behaviors that have the capability of offsetting the development of childhood obesity include participating in at least 60 minutes of moderate to vigorous PA per day, and limiting screen time (TV, video game, and computer use) to less than two hours per day (9). Such unhealthy practices that contribute to childhood obesity are established early in life; young persons having these unhealthy habits tend to maintain them as they age (6). Therefore, adolescents are viewed as an important target population because of the strong link between obesity during that time period and into adulthood (32). Despite the alarming overweight and obesity statistics, adolescents are among the most underserved populations in terms of preventive services (5). In addition, adolescents are able to understand the consequences and influences of their own choices and behaviors. Gaining an understanding of the behavioral choices of adolescents is important when considering determinants which are prevalent, modifiable, and have the capability of offsetting obesity in future generations (13).

The use of theory is vital when trying to gain a comprehensive understanding of health behaviors. The Theory of Planned Behavior (TPB) has become a recognized framework for understanding adolescent health behaviors (3, 4, 5, 7, 8, 11, 16, 19, 24). According to the theory, the single best predictor of a person's behavior is the intention to perform that behavior. Intention is an indication of an individual's readiness to perform a given behavior: considering how hard they are willing to try and how much effort they plan to exert toward initiation of a behavior (1). Behavioral intention is then the immediate antecedent to a behavior: a function of *attitude* (positive or negative) toward performing the behavior; the *subjective norm* that expresses the person's perception of whether relevant others think the person should or should not perform the behavior; and *perceived behavioral control* (PBC), or a person's perception of the ease or difficulty in carrying out a behavior. Ajzen believes the relative importance of each variable for intentions varies among individuals and behaviors (1). Efforts to change behavioral intentions should take into account whether attitudes, subjective norms, and/or PBC carry the most weight in determining intentions and behavior. To develop effective obesity prevention interventions in youth, influences on and determinants of related modifiable behaviors need to be well understood (13). Data from cross-sectional studies of association can help identify potential mediators of PA that can be targeted in future interventions (23).

The purpose of this study was to examine the extent to which BI, and the corresponding theoretical antecedents (attitude, subjective norms, and PBC) predict PA and sedentary behaviors linked to obesity in adolescents**,** with the aim of proposing implications for future obesity prevention and treatment interventions.

MATERIAL AND METHODS

Sampling and Design

A cross-sectional design was used to obtain a convenience sample of 318 students from a middle school in the suburban Midwest. The significance criterion was set at □ = 0.05, power at 0.80, and a population correlation coefficient of 0.15 was assumed. Using standard sample size calculations and statistical tables in relation to the total population of 7^{th} and 8^{th} graders in Ohio, a sample size of 251 subjects was required (22). All 719 students enrolled in the middle school were recruited to participate, of which 395 ultimately participated (318 were included in the analysis).

Instrumentation

A 129-item scale (including behaviors related to nutrition, PA, and sedentary behaviors) was developed and validated (a detailed description of the development and item analysis is reported elsewhere) (14): internal consistency of the TPB subscales and test-retest reliability coefficients for each of the behaviors and the corresponding constructs were found to be more than the a *priori*, 0.70.

Students were asked to self-report the amount of time they participated in PA behaviors (*moderate, vigorous, and strength training/flexibility*) during the past 24 hours (weekday) as well as how often they participated in the past seven days. They were also asked to self-report their participation in sedentary behaviors (i.e., screen time), including TV watching, time on the computer, and playing video games, during the past 24 hours.

Behavioral intention was measured through a 3-item seven-point Likert scale, which measured intent to participate in less than two hours of sedentary behaviors a day OR intent to participate in PA for at least 60 minutes a day (*I intend/will try/plan to*…). Attitudes were comprised of two components which worked together: behavioral beliefs (*If I participate…I will be healthier/have more energy/have more confidence/lose or maintain weight/have less stress*) and outcome evaluations (*How important is it that by*

Table 1. Summary of the Demographics of the Middle School Participants (n = 318)

Variable	*Subgroups*	*Frequency*	*Percentage*
Gender	Boy	141	44.30
	Girl	177	55.70
Grade	7^{th}	165	51.90
	8^{th}	153	48.10
Age	12	57	18.30
	13	148	47.60
	14	102	32.80
	15	3	1.00
	17	1	0.30
Race	White	295	92.80
	Asian	6	1.90
	Hispanic	4	1.20
	Black/African American	6	1.90
	Other/Mixed	7	2.20
Eligible for Free/Reduced	Yes	20	6.30
Price Lunch	No	192	60.30
	Don't Know	106	33.30

participating …you will be healthier/have more energy/have more confidence/lose or maintain weight/have less stress). Behavioral beliefs were measured through a 5-item seven-point Likert scale, as were outcome evaluations. Subjective norms consisted of two components which worked in interaction: normative beliefs (*My friends/family/teachers/the media influence me…*) and motivation to comply (*What my friends/family/teachers/the media think/encourage me to do is important to me*.). Normative beliefs were measured through a 4-item seven-point Likert scale, as was motivation to comply. Perceived behavioral control consisted of two components: control beliefs (*beyond my control, boring, find it difficult, lack of support*) and influence of control beliefs. Control beliefs were measured through a 4-item seven-point Likert scale, as was influence of control beliefs.

Protection of human subjects

Approval by the University's Institutional Review Board was obtained before starting the research study. Both the researchers completed CITI training to ensure compliance with all ethical considerations in the handling of informed consent, participant interactions and data collection and analysis.

Data collection

Permission was granted by the principal and the health teacher of the middle school. Data were collected during the 2008–2009 school year. Parental consent and child assent were required to be included in the study. The instruments were completed confidentially, as the students were required to write their school codes on the instrument, for subsequent matching to the Body Mass Index measurements.

To calculate BMI, stature and body mass were measured by the PI using a calibrated Seca® 700. BMI was calculated as $wt(kg)/ht^2$, and the BMI calculations were then interpreted using the appropriate BMI-for-age-and-gender growth chart for children, which defines the following categories: underweight (< 5^{th} percentile), healthy weight (5^{th} to < 85^{th} percentile), overweight (85^{th} to < 95^{th} percentile), and obese (> 95^{th} percentile) (28).

Missing Data and Data Screening

Prior to analysis, all variables were analyzed for accuracy of data entry, missing values, and normality of distribution. Those who had more than 20% of the responses missing from their completed instrument were deleted (n = 77). In order to detect outliers, each

Table 2. Summary of Physical Activity and Sedentary Behaviors in Middle School Participants (n = 318).

Item	*N*	*Min*	*Max*	*Mean*	*Std. Deviation*
In the past 24 hours, how many hours/minutes did you exercise or take part in vigorous physical activity?	317	0	330	120.50	80.32
On how many of the past seven days did you exercise or take part in vigorous physical activity for at least sixty minutes?	318	0	7	4.56	1.97
In the past 24 hours, how many hours/minutes did you exercise or take part in moderate physical activity?	307	0	360	96.12	74.31
On how many of the past seven days did you exercise or take part in moderate physical activity for at least sixty minutes?	317	0	7	4.04	2.43
In the past 24 hours, how many hours/minutes did you exercise to strengthen or tone your muscles?	307	0	245	51.90	58.87
On how many of the past seven days did you do exercises to strengthen or tone your muscles?	317	0	7	3.29	2.22
During the past 12 months, on how many sports teams run by your school did you play (not including PE class)?	310	0	4	1.13	1.099
During the past 12 months, on how many sports teams run by organizations outside of your school did you play?	311	0	5	1.23	1.11
During the past 12 months, in how many other organized physical activities did you participate?	305	0	5	0.93	1.13
In the past 24 hours, how many hours/minutes did you watch TV or movies?	315	0	360	107.24	80.67
In the past 24 hours, how many hours/minutes did you spend on the computer?	306	0	240	52.54	53.75
In the past 24 hours, how many hours/minutes did you spend playing seat-based video games?	310	0	180	22.64	45.48
In the past 24 hours, how many hours/minutes did you spend playing interactive video games?	306	0	130	13.04	27.49
Total Screen Time in the past 24 hours	287	0	570	187.42	120.75

variable was analyzed. Cases with z-scores greater than 3.29 ($p < .001$) were deleted from analysis (26). Those values which were considered outliers were random, so case-by-case deletion was selected.

Data Analysis

All data were analyzed by the Statistical Package for Social Sciences (SPSS), Version 16.0 and AMOS 5.0. Descriptive statistics (means, standard deviations, and frequencies) were summarized for all demographic variables. In establishing the predictors for each of the behaviors, stepwise multiple regression was used. The a priori criteria of probability of F to enter the predictor in the model was chosen as less than or equal to 0.05 and for removing the predictor as greater than or equal to 0.10. A priori level was set at 0.05 to establish significance.

RESULTS

The total sample included 318 7^{th} and 8^{th} graders. Students were between 12 and 17 years old (M = 13.18, SD = 0.756). Students' BMI classification included 4.8% (n = 14) of the students defined as underweight (< 5^{th} percentile), 70.4% (n = 207) considered healthy weight (5^{th} percentile to < 85^{th} percentile), 15 % (n = 44) overweight (85^{th} to < 95^{th} percentile), and 9.8% (n = 29) obese (≥ 95^{th} percentile). Demographics are summarized in Table 1.

Physical Activity and Sedentary Behaviors

A summary of PA and sedentary behaviors can be found in Table 2. Students self-reported an average of 120.50 minutes of vigorous PA, 96.12 minutes of moderate PA, and 51.90 minutes of strengthening/toning muscles in the past 24 hours

Table 3. Summary of Theory of Planned Behavior Constructs in Middle School Participants (n = 318)

Item	*N*	*Possible Range*	*Observed Range*	*Mean*	*Std. deviation*
SCREEN TIME BEHAVIORS					
Behavioral Intentions	318	3.00 – 21.00	3.00 – 21.00	12.31	5.42
Behavioral Attitudes	309	-105.00 – 105.00	-14.00 – 84.00	41.67	26.38
-*Behavioral Beliefs*	314	5.00 – 35.00	5.00 – 35.00	24.54	7.38
-*Outcome Evaluations*	306	-35.00 – 35.00	-11.00 – 18.00	9.12	5.49
Subjective Norms	318	-84.00 – 84.00	-72.00 – 84.00	5.51	23.37
-*Normative Beliefs*	314	-28.00 – 28.00	-12.00 – 12.00	-0.16	5.03
-*Motivation to Comply*	314	4.00 – 28.00	5.00 – 28.00	17.00	4.58
Perceived Behavioral Control	313	-84.00 – 84.00	-17.00 – 63.00	19.15	17.32
-*Control Beliefs*	314	3.00 – 21.00	3.00 – 21.00	12.80	3.96
-*Influence of Control Beliefs*	309	-21.00 – 21.00	-7.00 – 9.00	3.18	3.35
PHYSICAL ACTIVITY					
Behavioral Intentions	315	3.00 – 21.00	3.00 – 21.00	12.84	7.18
Behavioral Attitudes	288	-105.00 – 105.00	0 – 105.00	77.22	26.96
-*Behavioral Beliefs*	291	5.00 – 35.00	16.00 – 35.00	31.38	3.94
-*Outcome Evaluations*	306	-35.00 – 35.00	-11.00 – 18.00	9.12	5.49
Subjective Norms	317	-84.00 – 84.00	-54.00 – 84.00	14.65	23.09
-*Normative Beliefs*	313	-28.00 – 28.00	-12.00 – 12.00	1.71	4.92
-*Motivation to Comply*	314	4.00 – 28.00	5.00 – 28.00	17.00	4.58
Perceived Behavioral Control	316	-84.00 – 84.00	-63.00 – 84.00	-5.71	17.67
-*Control Beliefs*	313	4.00 – 28.00	4.00 – 28.00	9.39	5.01
-*Influence of Control Beliefs*	312	-28.00 – 28.00	-12.00 – 12.00	-2.89	5.04

(weekday). Students reported participating in vigorous and moderate PA for at least sixty minutes for 4.56 and 4.04 of the past seven days respectively, and participating in exercises to strengthen or tone their muscles 3.29 days in the past week. There was a significant difference between gender for minutes of moderate PA: girls reported more minutes (M = 105.10, SD = 76.49) than boys (M = 85.92, SD = 70.20); p = 0.023. Boys reported participating in more sports teams organized by the school (M = 1.32, SD = 1.13) as compared to girls (M = 0.95, SD = 1.02); p = 0.003. However, girls reported participating in other organized physical activities (M = 1.04, SD = 1.09) more than boys (M = 0.78, SD = 1.17); p = 0.046. Healthy weight students reported participating in other organized physical activities (M = 0.99, SD = 1.17) more than those who were overweight or obese (M = 0.50, SD = 0.72); p = 0.005.

Students reported an average of 107.24 minutes watching TV or movies in the past 24 hours. They also spent an average of 52.54 minutes on the computer and 33.99 minutes playing video games. The total average screen time reported by the students in the past 24 hours was 187.42 minutes. There was a significant difference between genders: boys reported more minutes (M = 118.74, SD = 85.27) of watching TV than girls (M = 98.62, SD = 76.67); p = 0.032. Boys reported more total minutes playing video games (M = 54.30, SD = 64.13) than girls (M = 17.79, SD = 36.98); p = 0.00. Boys also had more total screen time

Table 4. Correlations between the Theory of Planned Behavior Constructs and Physical Activity Behaviors.

	Screen Time	***Behavioral Intentions***	***Attitudes***	***Subjective Norms***
Behavioral Intentions	-0.073			
Attitudes	-0.111	0.046		
Subjective Norms	-0.182**	0.048	0.369**	
Perceived Behavioral Control	0.217**	-0.018	0.013	-0.280**
	Physical Activity	***Behavioral Intentions***	***Attitudes***	***Subjective Norms***
Behavioral Intentions	0.043			
Attitudes	-0.078	-0.088		
Subjective Norms	0.172**	0.208**	-0.343**	
Perceived Behavioral Control	0.107	0.012	-0.163**	0.255**

***p < 0.01*

minutes (*M* = 211.27, *SD* = 16.50) than girls (*M* = 169.08, *SD* = 20.35); *p* = 0.003. Significant differences between BMI classification also existed: overweight and obese youth reported more minutes (*M*= 167.41, *SD* = 91.52) watching TV than healthy weight students (*M* = 101.85, *SD* = 78.17); *p* = 0.001. Overweight or obese students also reported more total screen time minutes (*M* = 238.41, *SD* = 119.14) than healthy weight students (*M* = 118.52, *SD* = 7.65); *p* = 0.036.

Theory of Planned Behavior – Construct Subscales

Mean BI for screen time was 12.31 (*SD* = 5.42), designating a moderate intent to participate in less than two hours of screen time per day. There was a significant difference between healthy weight students (*M* = 13.16, *SD* = 5.30) and overweight or obese students (*M* = 11.1, *SD* = 5.26); t(289) = -2.768, *p* = 0.006, with overweight or obese students having less intention to decrease their participation in screen time. Mean BI score for PA was 12.84 (*SD* = 7.18), indicating a moderate intent to participate in PA at least 60 minutes a day. There was a significant difference between healthy weight students (*M* = 13.69, *SD* = 7.19) and overweight or obese students (*M* = 11.58, *SD* = 6.88); t(286) = -2.175, *p* = 0.03), with obese students having less intention to meet recommended PA levels.

Mean behavioral attitudes for screen time behaviors (*M* = 41.67, *SD* = 26.38) indicated a moderate but favorable attitude toward participating in less than two hours of screen time per day. There was a significant difference in the attitude scores for screen time between boys (*M* = 36.05, *SD* = 26.23) and girls (*M* = 45.46, *SD* = 25.75); t(304) = -3.146, *p* = 0.002. Mean behavioral attitudes for participation in PA (*M* = 77.22, *SD* = 26.96) indicated a strong but favorable attitude toward participating in at least 60 minutes of PA per day. There was a significant difference in the attitude scores for PA between boys (*M* = 71.6, *SD* = 29.17) and girls (*M* = 80.64, *SD* = 24.71); t(282) = -2.803, *p* = 0.005.

Mean subjective norm scores for screen time behaviors (*M* = 5.51, *SD* = 23.37) suggested a weak social pressure among the groups to participate in less than two hours of screen time per day. There was a significant difference in subjective norm scores for screen time between boys (*M* = 1.86, *SD* = 20.72) and girls (*M* = 7.69, *SD* = 24.15); t(312) = -2.261, *p* = 0.02. Mean subjective norm scores for participation in PA (*M* = 14.65, *SD* = 23.09) indicated a weak social pressure amongst the groups to participate in at least 60 minutes of PA per day.

Mean PBC for screen time (*M* = 19.15, *SD* = 17.32) indicated a weak perception of control over participating in less than two hours of screen time per day. Mean PBC for participation in PA (*M* = -5.71, *SD* = 17.67) indicated a weak perception of not being in control of participating in at least 60 minutes of PA per day. There was a significant difference in PBC for PA between healthy weight students (*M* = -4.54 , *SD* = 13.65) and overweight/obese students (*M* = -10.08 , *SD* = 17.26); t(284) = -2.768, *p* = 0.006, with overweight and obese students having a lower perception of control.

Multiple Regression – Screen Time and Physical Activity

Correlations between the constructs of the TPB and screen time, as well as between the TPB constructs and PA are summarized in Table 4. Regression models and coefficients are summarized in Table 5: there were several significant models. A significant model was

Table 5. Parameter Estimates from the Final Regression Models for Physical Activity Behaviors.

		Unstandardized Coefficients	*Standard Error*	*Standardized Coefficients Beta*	*t*	*p-Value*
Screen Time						
Constant		165.919	11.113		14.930	0.000
Perceived Behavioral Control		1.421	0.444	0.195	3.203	0.002
Subjective Norms		-0.685	0.318	-0.131	-2.154	0.032
Constant		13.658	0.698		19.556	0.000
Behavioral Intent		-0.069	0.052	-0.078	-1.319	0.188
Normal	Constant	230.790	20.213	11.418		0.000
	Behavioral Intent	-3.644	1.473	-0.168	-2.475	0.014
Overweight/	Constant	59.487	60.187		0.988	0.335
Obese	Behavioral Intent	14.262	4.489	0.579	3.177	0.005
Physical Activity						
Constant		0.123	0.009		14.424	.000
Subjective Norms		0.001	0.000	0.197	3.345	.001
Constant		8.802	.356		24.739	0.000
Behavioral Intent		30.686	12.536	.883	.741	0.014
Normal	Constant	0.127	0.024		5.284	0.000
	Subjective Norm	0.001	0.000	0.189	2.495	0.013
	Attitude	0.000	0.003	-0.007	-0.091	0.928
	Perceived Behavioral Control	-0.001	0.004	-0.023	-0.298	0.766
Overweight/	Constant	0.079	0.114		0.688	0.500
Obese	Subjective Norm	0.001	0.002	0.219	0.686	0.501
	Attitude	0.005	0.016	0.113	0.304	0.764
	Perceived Behavioral Control	0.008	0.028	0.137	0.294	0.772

found (F 2,272 = 9.91, p = *0.000*) predicting BI to participate in less than two hours of total screen time as predicted by the TPB constructs; PBC and subjective norms accounted for 6.8% of the variance. A significant model was evident, predicting total screen time based on BMI classification, with BI a significant predictor for both healthy weight and overweight/obese groups, accounting for 2.8% and 30.5%, respectively.

A significant model emerged (F 2,278 = 11.190, p = *0.001*) predicting BI to participate in at least 60 minutes of PA as predicted by the TPB constructs; subjective norms accounted for 3.9% of the variance. A significant model was evident (F 2,299 = 0.550, p = *0.014*) using BI to predict PA, accounting for 77.4% of the variance. A significant model was also found (F 3,200= 2.74, p = *0.05*) predicting BI to participate in at least 60 minutes of PA as predicted by the TPB constructs for healthy weight students; subjective norms accounted for 4.0% of the variance.

DISCUSSION

Adolescents are an important target population because of the strong link between obesity during this time period and into adulthood (13). Many of the behaviors formed at this point in their lives are likely to continue into adulthood. Gaining an understanding of the behavioral choices of adolescents is important when considering determinants which are prevalent, modifiable, and have the capability of offsetting obesity among future generations (32).

The United States Department of Health and Human Services recommends that youth engage in at least 60

minutes of moderate to vigorous PA on most or, preferably, all days of the week (31). This group of adolescents reported high levels of PA, with the averages meeting and exceeding the USDHHS recommendations; 120.50 minute of vigorous PA, 96.12 minutes of moderate PA, and 51.90 minutes of strengthening/toning muscles in the past 24 hours. Although this should be encouraging, students may have overestimated or been dishonest when reporting their total minutes of PA, as the ranges were quite vast and do not appear to be realistic for a general population of students. These results may indicate that students had difficulty remembering the number of minutes they participated in physical activity in the past 24 hours, as noted in similar studies (15). Finding more reliable and practical means to assess participation in PA in children and adolescents should be undertaken (15, 23).

Healthy weight students reported participating in other organized physical activities more often than overweight or obese students. This was similar to results found by Lioret and colleagues in 2007, in which obese children reported involvement in significantly fewer community organizations promoting PA (17). Self-efficacy for PA has been directly correlated to participation in activities, and thus could be a factor when students are deciding to become involved in various organizations promoting PA (25, 27). Community activities popular among boys and girls and those who are overweight or obese should be further investigated to promote those activities which are enjoyable within each subgroup. Individuals are more likely to continue participation in PA if they deem it to be fun and something they enjoy (29, 31, 32), thus promoting a lifestyle of PA.

Although students reported high levels of PA, they also reported excessive minutes of screen time. Screen time was defined as sedentary behaviors including watching TV, playing video games, and spending time on the computer. The total average screen time reported by the students in the past 24 hours was 187.42 minutes, exceeding the recommendations to limit screen time to less than 1–2 hours a day (13). Boys and students who were overweight or obese reported more screen time. An increase in sedentary behaviors has been considered to be an important contributing factor to childhood obesity (25). More specifically, it has been reported that the duration of TV watching (screen time) for more than two hours per day was positively associated with obesity in youth (9). Although on average students reported three hours of screen time per day, there was a significant difference among those who were overweight or obese, indicating this population may need support to improve this behavior.

Overall, students reported a moderate intent to participate in PA at least 60 minutes a day. Similarly, in 2007, Martin and colleagues found adolescents ages 9–12 years had strong intentions related to PA (18). However, it is important to consider that 33.8% of the students in this study expressed weak intentions to participate in PA for at least 60 minutes a day. Students who were at a healthy weight had higher intentions of participating in PA as compared to students who were overweight or obese. Behavioral intention to participate in PA was significant among all students, predicting 77.4% of the behavior, and students with greater intentions to participate in PA reported more PA compared to students who expressed weaker intentions. This supports findings from a comprehensive review of PA correlates among adolescents, in which intentions were correlated to participation in PA (23). Therefore, it is important to gain a true understanding of what factors contribute the most to adolescents' behavioral intentions toward participating in physical activity.

Adolescents designated a moderate intent to participate in less than two hours of screen time per day. There was a significant difference in BI for screen time between healthy weight students and students who were overweight or obese, with the latter group reporting decreased intention to participate in less than two hours of screen time per day. Although BI did not predict participation in screen time when looking at the entire student population, it was a significant predictor for those students who were overweight/obese, accounting for 30.5% of the behavior. Considering that duration of TV watching (screen time) has been directly linked to obesity in youth (9), improving the intention of those who are overweight/obese should be an important focus of behavioral change strategies.

Limitations

The results of the study were based on self-reporting, which could have included participant bias, dishonesty, or lack of understanding. Self-reporting has the potential for dishonest responses, both deliberate and unconscious. To measure PA and screen time behaviors, a one-day recall was used (weekday), which may not be representative of a typical day. Multiple-day recall was an option, but due to classroom time constraints and an attempt to simplify the instrument, a one-day recall was chosen. The data lacked normality in almost all of the variables. This could have been indicative of extremely varied behaviors among the population at hand, or it could have been related to the students' inability to accurately respond to questions regarding individual behaviors. Self-reporting of PA behaviors has been considered problematic, and potentially leads to overestimation (15). This study was confined to one middle school in a suburban area in the Midwest; thus,

results may not necessarily be generalizable to all adolescents and/or communities.

CONCLUSIONS

Obesity is one of the most widespread health threats facing children and adolescents (10). The strong link between obesity in adolescence and adulthood cannot be ignored, as behaviors which are related to obesity prevention decline during this time period (29, 30).

Moreover, the development of healthy lifestyle habits that persist into adulthood has a long-term impact on the health and well-being of future generations (30). Improving PA behaviors among youth is imperative if strides are to be made toward decreasing the prevalence of obesity in this country (13). To develop more effective obesity prevention interventions in youth, the influences on and determinants of PA need to be more fully understood (9).

According to the TPB, the single best predictor of a person's behavior is the intention to perform that behavior (1). Attitudes, subjective norms, and perceived behavioral control are all potential predictive factors of intention to engage in a certain behavior. Results from this study indicated that using the TPB was beneficial in determining behavioral antecedents related to adolescents' participation in PA. Students who were overweight or obese had lower intentions to participate in less screen time or achieve recommended PA levels. These are important considerations when framing future behavior change messages. Recommendations for future research should incorporate these lessons into tailored interventions using an experimental design to test the effectiveness of using such a framework.

It is understood there is no single "answer" to the childhood obesity epidemic. Focusing on improving physical activity levels and decreasing sedentary behaviors at the individual level is one part of the potential solution. Addressing modifiable behaviors and those behaviors that adolescents express interest in changing is imperative for successful obesity prevention and treatment initiatives (9, 13). Just as the determinants of obesity are complex and multifaceted, so will be the path to improvement, yet each contribution to the current evidence base ensures we are headed in the right direction.

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