

Effectiveness of a school-based intervention regarding screen time in high school students

Efetividade de uma intervenção de base escolar sobre o tempo de tela em estudantes do ensino médio

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Abstract – Few interventions to reduce sedentary behavior in youth have been successful and have had only subtle effects. The aim of the study was to assess the effectiveness of a school-based intervention to promote physical activity and healthy eating habits on screen time indicators in students. This was a randomized controlled intervention study of high school students (15–24 years of age) who attended evening classes in the public schools of 2 Brazilian capital cities, Florianópolis and Recife. Data collection was performed via a questionnaire at the beginning (March) and end (December) of the 2006 school year. Students who reported spending 2 or more hours per day watching television or playing videogames/using the computer on weekdays or weekend days were considered exposed to screen time. Logistic regression analyses were performed. Among the 2,155 students included in the baseline sample, 989 were evaluated during the post-intervention period. The intervention group showed significantly reduced exposure to videogame/computer time on weekend days compared with the control group (29.8% vs. 35.6%; $p=0.004$). After adjusting for potential confounding factors, the results showed that the intervention had no significant effect on reducing the exposure to screen time in the surveyed students. The intervention model adopted in the Saúde na Boa project was not effective in reducing the screen time exposure of high school students.

Key words: Sedentary lifestyle; Students; Intervention studies; Brazil.

Resumo – Embora os efeitos sejam pequenos, algumas intervenções para a redução do comportamento sedentário em jovens têm sido bem sucedidas. O objetivo do estudo foi verificar a efetividade de uma intervenção de base escolar para promoção da atividade física e hábitos alimentares saudáveis sobre indicadores de tempo de tela em escolares. Trata-se de um estudo de intervenção randomizado e controlado com estudantes (15 a 24 anos) do ensino médio do período noturno de escolas públicas de duas capitais brasileiras: Florianópolis e Recife. A coleta de dados foi realizada no início (março) e ao final (dezembro) do ano letivo de 2006, mediante aplicação de um questionário. Os estudantes que relataram despende duas ou mais horas por dia assistindo televisão ou jogando videogame/usando o computador em dias de semana ou em dias do fim de semana foram considerados expostos ao tempo de tela. Estas análises foram conduzidas mediante utilização de regressão logística. Dos 2.155 escolares incluídos na linha de base, 989 foram avaliados no período pós-intervenção. Observou-se que o grupo intervenção reduziu significativamente a exposição ao tempo de videogame/computador nos dias de fim de semana quando comparado ao grupo controle (29,8% vs 35,6%, respectivamente; $p=0,004$). Após ajustamento para potenciais fatores de confusão, verificou-se que a intervenção não teve efeito significativo na redução da exposição ao tempo de tela nos escolares investigados. O modelo de intervenção adotado no projeto Saúde na Boa não foi efetivo em reduzir o tempo de tela de estudantes do ensino médio.

Palavras-chave: Estilo de vida sedentário; Estudantes; Estudos de intervenção; Brasil.

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INTRODUCTION

Currently, more effective interventions to promote healthy behaviors among youth populations are needed. Systematic review and meta-analysis studies have demonstrated that school-based intervention strategies can effectively promote physical activity^{1,2}, reduce exposure to sedentary behavior³⁻⁴, and increase healthy food intake among children and teenagers⁵.

In the Brazilian context, studies have indicated that interventions to promote physical activity in the school environment can effectively reduce the prevalence of physical inactivity among teenagers⁶ and can modify eating habits, physical activity levels, and the time spent on sedentary activities in children⁷. These results are encouraging and support the hypothesis that simple actions based on information, social support, and environmental modification strategies might be useful to combat the high prevalence of risky health behaviors in teenagers^{8,9}.

Although some interventions to reduce sedentary behavior (defined as watching television, playing videogames, using computers, and reading, among others) were shown to be effective, the observed effects were subtle³⁻⁴. It is therefore important to evaluate the strategies for reducing the time spent in sedentary activities, especially given the association between the exposure time to sedentary activities and the occurrence of negative health outcomes¹⁰⁻¹³.

The results of a meta-analysis¹⁴ suggested that prolonged periods of television watching were associated with increased risks of type 2 diabetes, cardiovascular disease, and all-cause mortality. Studies performed on children and youth have shown that exposure to sedentary behavior might be associated with a higher risk of being overweight^{15,16}, hypertension¹⁷, and depression symptoms¹⁸.

Although a reasonable number of studies on factors associated with sedentary behavior are available, little is known on the effectiveness of the interventions available to reduce the so-called “screen time.” Thus, the aim of this study was to assess the effectiveness of a school-based intervention to promote physical activity and healthy eating habits on indicators of screen time in high school students attending evening classes in two Brazilian capital cities: Florianópolis and Recife.

METHODOLOGICAL PROCEDURES

This was a randomized, controlled school-based intervention study and was titled the “Saúde na Boa” project. The purpose of this intervention was to promote physical activity and healthy eating habits among high school students who attended evening classes in the public schools of 2 Brazilian capital cities, Florianópolis (South) and Recife (Northeast). These cities were intentionally selected, and their selection was justified by the existing environmental and sociocultural differences. More details about this program and the intervention model applied were provided in previous studies^{6,19}.

The target population comprised high school students who attended evening classes in public schools of both cities. In 2006, this population was estimated to include approximately 13 thousand students in Florianópolis (25 schools) and 75 thousand students in Recife (114 schools). The decision to restrict the target population to public school students and those attending evening classes was because approximately 70% of all high school students in Brazil were enrolled in the public schools, and nearly half of these students attended school in the evenings²⁰.

Initially, all of the schools in each city were matched according to the geographic location and school size. Next, 10 schools were randomly selected in each city, of which 5 were included in the experimental group and 5 in the control group. All students aged 15–24 years who were attending evening classes in the selected schools were invited to participate in the study. Nine months after the beginning of the intervention, a second set of data was collected. The sample lost to follow-up was presented in the first article of this supplement²¹. Other information regarding the sampling process can be found in a previous publication¹⁹.

Data were collected at the beginning (March) and at the end (December) of the 2006 school year via the application of a previously validated questionnaire²². This questionnaire addressed the following 5 areas: personal information; physical activity and sedentary behaviors; eating habits; body weight control; and preventive behaviors. This questionnaire was tested and was found to demonstrate high levels of reproducibility (intraclass correlation coefficient [ICC]) for the variables related to screen time (the ICC values ranged from 0.84–0.94).

This instrument was applied in the classroom by a previously trained team. Students in selected classes were asked to complete the questionnaires in their own rooms during regular classes.

The dependent study variables were the indicators related to screen time. Students who reported spending 2 or more hours per day watching television or playing videogames/using the computer on weekdays or weekend days were considered exposed to screen time²³.

The following variables were considered as potential confounders: gender (girls, boys), age group (14–16 years, 17–19 years, 20–24 years), employment status (employed, unemployed), city (Florianópolis, Recife), physical activity level (active, insufficiently active), and the variable screen time at baseline.

The statistical analyses were performed with SPSS for Windows (version 17; SSPS Inc., Chicago, IL, USA). Descriptive analyses were performed based on the frequency distributions. Comparisons of the control and intervention groups were performed with the Chi-square test. Comparisons of the control groups (baseline versus post-intervention) and of the intervention groups (baseline versus post-intervention) were performed with the McNemar test.

The effectiveness of the “Saúde na Boa” program was tested considering the intention to treat (last-observation-carried-forward imputation

method) and considering only those students who remained enrolled until the end of the study (only collected data). These analyses were performed separately for each of the dependent variables (indicators of screen time) using a logistic regression. The results were expressed as odds ratios (OR) and respective confidence intervals (95% CI).

In accordance with the Brazilian Ethical Guidelines for research involving human beings, this study protocol was approved by the Ethics Committees of the Mother and Child Institute of Pernambuco (Instituto Materno Infantil de Pernambuco; protocol No 587/2005) and the Federal University of Santa Catarina (Universidade federal de Santa Catarina, protocol No 031/2005). All students aged 18 years or older signed an informed consent form, while a parental consent form was used for individuals under 18 years of age.

RESULTS

The initial “Saúde na Boa” project evaluation included 2,155 teenagers, aged 15–24 years. The mean age was 18.4 years (standard deviation (SD) = 2.3). The majority of students were female (55.7%), lived in Florianópolis (53.6%), and were unemployed (53.1%). Overall, 1,059 (49.1%) individuals were included in the intervention group.

In the post-intervention period, 989 students (45.9%) were reevaluated to assess the impact of the intervention. With the exception of employment status, most students exhibited demographic characteristics similar to those observed at the initial evaluation. Table 1 shows the sociodemographic characteristics of the students at baseline according to the city of origin. Other characteristics of the sample are available in the other articles in this supplement.

Table 1. Sociodemographic characteristics of the control and intervention groups at baseline, stratified by city.

Variable	Florianópolis (n=1,156)				Recife (n=999)			
	Control		Intervention		Control		Intervention	
	n	%	n	%	n	%	n	%
Gender								
Boys	250	44.6	236	40.0	265	49.9	201	43.1
Girls	310	55.4	354	60.0	266	50.1	265	56.9
Age (completed years)								
14–16	248	44.0	169	28.5	66	12.4	59	12.6
17–19	249	44.1	281	47.5	245	46.1	246	52.7
20–24	67	11.9	142	24.0	221	41.5	162	34.7
Employment status								
Employed	294	52.3	311	53.1	231	43.8	169	36.2
Unemployed	268	47.7	275	46.9	297	56.2	298	63.8

Using an error probability (α) of 0.05, a power of 80%, and the relative frequency of outcomes among the youth who participated in the entire intervention, statistically significant differences ranging between 7.2 and 8.9 percentage points could be observed (for total screen time on weekends and TV time on weekdays, respectively).

Tables 2 and 3 show the analytical results regarding the effectiveness of the intervention on the variables related to exposure to screen time, considering the imputed data and data from students that remained enrolled in the study, respectively. With the exception of exposure to videogame/computer time on weekend days ($p < 0.001$), no significant differences were observed with regard to the indicators of exposure to screen time when the control and intervention groups were compared at the baseline. Additionally, the results showed that the time of exposure to videogames/computers on weekend days was higher in girls (28.2% versus 16.8%; $p < 0.001$) and in students from Florianópolis (41.2% versus 28.5%; $p < 0.001$) in the control group compared with those in the intervention group. Similarly, the time of exposure to videogames/computers on weekdays (32.6% versus 22.4%; $p < 0.001$) was higher in the control group of teenagers from Florianópolis.

Table 2. Analysis of effectiveness considering the intention to treat of the “Saúde na Boa” Project on indicators of exposure to screen time among high school students from public schools of Florianópolis and Recife in 2006.

Variables	Baseline				Post-intervention				p-value			
	Control		Intervention		Control		Intervention		Control vs. Intervention (baseline)	Control vs. Intervention (post-intervention)	Control vs. Control (baseline vs. post-intervention)	Intervention vs. Intervention (baseline vs. post-intervention)
	n	%	n	%	n	%	n	%				
Exposure to TV time on weekdays												
<2 hours	415	38.0	397	37.6	437	39.9	419	39.6	0.845	0.885	0.101	0.086
≥2 hours	677	62.0	659	62.4	657	60.1	638	60.4				
Exposure to TV time on weekend days												
<2 hours	292	26.8	309	29.3	302	27.6	301	28.5	0.207	0.662	0.600	0.497
≥2 hours	797	73.2	747	70.7	791	72.4	756	71.5				
Exposure to videogame/computer time on weekdays												
<2 hours	812	74.6	814	77.7	788	72.2	797	75.7	0.091	0.063	0.021	0.059
≥2 hours	276	25.4	233	22.3	304	27.8	256	24.3				
Exposure to videogame/computer time on weekend days												
<2 hours	729	67.2	781	74.5	703	64.4	740	70.2	<0.001	0.004	0.012	<0.001
≥2 hours	356	32.8	267	25.5	389	35.6	314	29.8				
Exposure to total screen time on weekdays												
<2 hours	332	30.5	311	29.8	333	30.5	322	30.6	0.705	0.943	1.000	0.504
≥2 hours	755	69.5	733	70.2	759	69.5	729	69.4				
Exposure to total screen time on weekend days												
<2 hours	219	20.3	240	23.0	216	19.8	220	20.9	0.129	0.522	0.631	0.033
≥2 hours	862	79.7	805	77.0	875	80.2	832	79.1				

Note: P-values for the comparisons between the control and intervention groups were derived from the Chi-square test. P-values for the comparisons of the control groups and of the intervention groups were derived from the McNemar test.

Table 3. Analysis of effectiveness when considering only data collected from the “Saúde na Boa” Project regarding the indicators of screen exposure time among high school students from public schools of Florianópolis and Recife in 2006.

Variables	Baseline		Post-intervention				p-value					
	Control		Intervention		Control		Intervention		Control vs. Intervention (baseline)	Control vs. Intervention (post-intervention)	Control vs. Control (baseline vs. post-intervention)	Intervention vs. Intervention (baseline vs. post-intervention)
n	%	n	%	n	%	n	%					
Exposure to TV time on weekdays												
<2 hours	415	38.0	397	37.6	205	40.0	205	43.2	0.845	0.295	1.000	0.086
≥2 hours	677	62.0	659	62.4	308	60.0	269	56.8				
Exposure to TV time on weekend days												
<2 hours	292	26.8	309	29.3	130	25.4	131	27.8	0.207	0.412	0.600	0.497
≥2 hours	797	73.2	747	70.7	381	74.6	341	72.2				
Exposure to videogame/computer time on weekdays												
<2 hours	812	74.6	814	77.7	357	69.9	339	71.7	0.091	0.534	0.021	0.059
≥2 hours	276	25.4	233	22.3	154	30.1	134	28.3				
Exposure to videogame/computer time on weekend days												
<2 hours	729	67.2	781	74.5	314	61.1	301	63.8	<0.001	0.385	0.012	<0.001
≥2 hours	356	32.8	267	25.5	200	38.9	171	36.2				
Exposure to total screen time on weekdays												
<2 hours	332	30.5	311	29.8	146	28.6	149	31.5	0.705	0.326	1.000	0.504
≥2 hours	755	69.5	733	70.2	364	71.4	324	68.5				
Exposure to total screen time on weekend days												
<2 hours	219	20.3	240	23.0	87	17.0	85	18.1	0.129	0.663	0.631	0.033
≥2 hours	862	79.7	805	77.0	424	83.0	385	81.9				

Note: P-values for the comparisons between the control and intervention groups were derived from the Chi-square test. P-values for the comparisons of the control groups and of the intervention groups were derived from the McNemar test.

After 9 months of participation in the project, the intervention group demonstrated a significantly reduced level of exposure to videogame/computer time on weekend days compared with that of the control group (29.8% versus 35.6%, respectively; $p=0.004$), when the intention-to-treat analysis was considered. However, no statistically significant difference between the groups was observed when only the data from students who remained enrolled were analyzed.

When only the control groups were analyzed, the comparison of the baseline with the post-intervention period showed an increase in the proportion of students exposed to videogame/computer time on weekdays and weekend days. Similarly, in a comparison of the baseline with the post-intervention period, the intervention group showed a significant increase in the exposure to total screen time on the weekend days, particularly exposure to videogame/computer time.

Table 4 shows the measurements of the project's effects on the variables related to exposure to screen time after a 9-month intervention. After adjusting for the confounding factors, the results showed that the intervention had no significant effect on reducing the exposure to screen time in the surveyed students. The analytical results regarding the effect measurements using collected data only were similar to those observed when considering the intention-to-treat analysis.

Table 4. Measurements of the effects of the “Saúde na Boa” Project on variables related to screen exposure time after the intervention among students from public schools of Florianópolis and Recife in 2006.

Variables	Intention to treat analysis ^a			Subset efficacy analysis [†]		
	Crude OR (95%CI)	Adjusted OR (95%CI)	p-value	Crude OR (95%CI)	Adjusted OR [‡] (95%CI)	p-value
Exposure to TV time on weekdays						
<2 hours	1	1		1	1	
≥2 hours	1.01 (0.85-1.20)	0.97 (0.75-1.25)	0.814	0.87 (0.68-1.12)	0.87 (0.66-1.15)	0.329
Exposure to TV time on weekend days						
<2 hours	1	1		1	1	
≥2 hours	0.96 (0.79-1.16)	1.01 (0.76-1.34)	0.959	0.89 (0.67-1.18)	0.93 (0.67-1.27)	0.644
Exposure to videogame/computer time on weekdays						
<2 hours	1	1		1	1	
≥2 hours	0.83 (0.69-1.01)	0.92 (0.70-1.21)	0.561	0.92 (0.70-1.21)	0.96 (0.70-1.31)	0.789
Exposure to videogame/computer time on weekend days						
<2 hours	1	1		1	1	
≥2 hours	0.77 (0.64-0.92)	0.97 (0.75-1.27)	0.847	0.89 (0.69-1.15)	1.01 (0.75-1.36)	0.946
Exposure to total screen time on weekdays						
<2 hours	1	1		1	1	
≥2 hours	0.99 (0.83-1.19)	0.94 (0.72-1.22)	0.622	0.87 (0.66-1.15)	0.94 (0.72-1.22)	0.622
Exposure to total screen time on weekend days						
<2 hours	1	1		1	1	
≥2 hours	0.93 (0.76-1.15)	1.05 (0.76-1.43)	0.782	0.93 (0.67-1.29)	1.05 (0.76-1.43)	0.782

[†]With imputed data; [‡]With collected data.

^aAdjusted for gender, age, employment status, city, total physical activity, and variables related to the screen time at baseline.

DISCUSSION

The data from the present study revealed that the intervention model adopted in the “Saúde na Boa” project did not effectively reduce the exposure to screen time among high school students enrolled in the public schools in 2 Brazilian capital cities, Florianópolis and Recife.

However, a few limitations should be considered when interpreting these findings. There was a high loss of students enrolled in this study after the intervention. The main reasons for the high rate of loss to follow-up were school truancy and the absence of students from school during the data collection period. Nevertheless, no differences were observed with regard to variables related to screen time and for most sociodemographic characteristics when the data of students who remained enrolled in the study were compared with the data of those who did not remain enrolled. Another limitation of the present study concerned the collection of information through self-reported measurements, which reduced the accuracy of the measurements and did not allow an analysis of the total time spent by the students in sedentary activities. However, this instrument was tested to minimize this problem and featured good indicators of reproducibility.

Despite these limitations, some positive points should be highlighted. This was among the first studies conducted in Brazil regarding the effectiveness of interventions on sedentary behaviors, and although the study

was only conducted on students who attended evening classes, it was conducted in 2 Brazilian cities with different characteristics. Accordingly, it is important to mention the paucity of randomized interventions in low and middle-income countries. The use of previously tested, standardized, and validated research techniques should also be highlighted. Furthermore, it was possible to evaluate 2 analysis models and perform adjusted analyses, thus allowing more accurate estimates of the measured effects.

This type of scientific study might present different intervention strategies aimed at decreasing the amount of time spent in sedentary activities. Most interventions have focused on actions within the school environment as well as those with multiple components, such as the inclusion of family members or changes in the school environment and rules^{24,25}. The activities included in the logical model of the “Saúde na Boa” project were not planned or specifically directed at reducing screen time. The fact that this project was effective in increasing physical activity levels and not effective in reducing screen time reinforced the hypothesis that different interventions should be used to address low levels of physical activity and high levels of sedentary behavior.

Lonsdale et al.²⁶ tested 4 intervention models that included actions with both teenagers and their teachers aimed at reducing the amount of time spent in sedentary activities among Australian adolescents. The models of “providing choice” and “free choice” reduced the amount of time that the students spent in sedentary activities, while the models of “usual practice” and “explaining the relevance” did not alter the sedentary behaviors. These results are similar to those observed in the present study, as most actions aimed at reducing the amount of time spent in sedentary activities were more informative and educational.

Another intervention study conducted by Cui et al.²⁷ showed that the “peer education” strategy seemed to be a promising intervention for reducing sedentary behaviors among teenagers in urban Beijing, China. This study reported a significant decrease (20 minutes/day after 7 months) in the time spent in sedentary behaviors on weekdays. The authors mentioned that this reduction was primarily due to a 14-minute/day decrease in weekday computer use. Systematic review and meta-analysis studies^{3,4,28,29} have shown that different intervention models for reducing sedentary behavior yielded significant results, although these were of a low magnitude.

In the Brazilian context, the findings of intervention studies have shown positive changes in health behaviors among children and teenagers. A recent study by Ribeiro and Alves⁷ assessed the effectiveness of 2 school-based programs conducted in Belo Horizonte, Minas Gerais for promoting the participation of students in lifestyle changes related to eating habits, physical activity, and sedentary behaviors. The main findings of this study showed significant differences between the pre- and post-intervention periods within the intervention group with regard to the stages of change, thus leading to healthy behaviors related to the consumption of fatty foods, fruits and vegetables, physical activity, and time spent in sedentary activities.

According to the literature, behavioral changes are difficult to implement, and it is difficult to determine significant results³. Television watching appears to be a highly attractive activity, given the wide availability of television programs that specifically target this population. For teens, the opportunity to operate several computer programs, such as those related to music, movies, and even social activities based on Internet chatting, presents another barrier to the success of interventions aimed at reducing the time spent in sedentary activities²³. Therefore, given its complexity and relevance to public policy, this issue should be addressed at a deeper level by field researchers.

CONCLUSION

The results of this study led to the conclusion that the adopted intervention model did not effectively reduce the exposure to screen time of high school students who attended evening classes in the public schools of 2 Brazilian capital cities.

The present study suggests that further studies in this area should include specific strategies for reducing screen time as it is difficult to modify the exposure to such behaviors. The influences of different sedentary activities and those of other “new media” communication technologies (cell phones, iPads, and social media) should be considered in future intervention strategies to reduce sedentary behavior, given the specificities of each sedentary activity. The use of combined objective and subjective methods to assess screen time should also be considered in future interventions. Finally, future studies should monitor teenagers for longer periods after the intervention to assess the persistence of behavioral changes.

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