Trends in screen time on week and weekend days in a representative sample of Southern Brazil students

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ABSTRACT

Background Economic and technological improvements can help increase screen time use among adolescents, but evidence in developing countries is scarce. The aim of this study was to examine changes in TV watching and computer/video game use patterns on week and weekend days after a decade (2001 and 2011), among students in Santa Catarina, southern Brazil.

Methods A comparative analysis of two cross-sectional surveys that included 5 028 and 6 529 students in 2001 and 2011, respectively, aged 15–19 years. The screen time use indicators were self-reported. 95% Confidence intervals were used to compare the prevalence rates. All analyses were separated by gender.

Results After a decade, there was a significant increase in computer/video game use. Inversely, a significant reduction in TV watching was observed, with a similar magnitude to the change in computer/video game use. The worst trends were identified on weekend days.

Conclusions The decrease in TV watching after a decade appears to be compensated by the increase in computer/video game use, both in boys and girls. Interventions are needed to reduce the negative impact of technological improvements in the lifestyles of young people, especially on weekend days.

Keywords adolescent behavior, developing countries, questionnaires, sedentary behavior, TV watching

Introduction

Recent evidence indicates that sedentary behaviors are an important risk factor for individual health,\(^1,2\) and screen time use (i.e. TV watching or computer/video game use) has been the main indicator of these behaviors.\(^3,4\) Screen time use has been associated with several adverse health outcomes in adults\(^5,6\) and with obesity, low physical fitness, low self-esteem and low pro-social behavior among young people.\(^4\) Therefore, studies on the epidemiology of screen time use in young people are relevant to public actions that aim to promote a healthy lifestyle during youth.

Studies indicated that economic and technological changes contributed to the increasing sedentary behaviors among the young population in the late 1990s and early 2000s, mainly due to access to computers and other electronic entertainment technologies.\(^7\)–\(^11\) However, most evidence was obtained in developed countries, with the exceptions of some studies conducted in China that showed an increase in screen time use in the early 2000s.\(^12\)–\(^14\) A follow-up study was conducted in adolescents from 11 (in 2004) to 15 (in 2008) years of age in Pelotas, Brazil and an increase in the screen time use was also observed.\(^15\) However, the above-mentioned study used combined data from TV watching and computer/video game use,\(^15\) which did not allow to identify whether changes over time varied according to the screen time indicator (e.g. if the TV watching decreased but the computer use increased).
In Brazil, the major economic and social evolution occurred in the 2000s, starting with a better income distribution and a consequent increase in the purchasing power of assets in the general population (e.g. purchases of TVs, computers, cell phones and other technology). However, studies analyzing changes in behavioral variables among Brazilian adolescents during that period are scarce. Additionally, particular attention should be given to sedentary behaviors among adolescents from American countries. Data from the 2003 to 2007 Global School-based Student Health Survey of 34 countries showed that adolescents (aged 13–15 years) from American countries had the highest screen time use estimates. Therefore, studies on the changes in the screen time use among Brazilian youth are key to direct public policies to promote health.

Trends in screen time use may vary according to sedentary components (i.e. the use of TV or computer/video games). A separate analysis according to the screen time use indicator is suitable for observing changes in behavioral patterns among young people. Distinctions between screen time use on weekdays and weekend days and between boys and girls were observed in previous studies. Moreover, the association between screen time use and cardiometabolic risk (i.e. accumulation of high blood pressure, obesity and other risk factors) varied according to the screen time indicator, gender and period of the week. Therefore, evaluating whether secular changes occur differently according to these variables is important. Studies on this direction will point toward the main interventions among young people. Additionally, these studies can indicate the necessity of interventions focus on a specific gender or period of the week.

Based on the mentioned premises, the aim of this study was to compare the patterns of screen time use indicators (TV watching and computer/video game use) according to gender and period of the week between two representative surveys (2001 and 2011) of high school students from public schools in the Santa Catarina state, southern Brazil.

Methods

This study is a secondary data analysis from a repeated cross-sectional and school-based survey entitled ‘Lifestyle and risk behaviors of youth from Santa Catarina, Brazil (Comportamentos de Risco à Saúde dos Adolescentes Catarinenses)—the COMPAC project’. The target population was high school students aged 15–19 years in Santa Catarina state, southern Brazil. The data were collected from August to November in 2001 and from August to October in 2011.

The sample design and methodological procedures used in 2001 were also used in the 2011 survey and were described in a previous publication. Given the statistical established criteria (a prevalence rate of different outcomes of 50%, a 95% confidence interval (CI), a maximum error of two percentage points, a design effect of 2.0 and a percentage for possible losses or refusals of 25%), the sample size was estimated to be 5,932 individuals in each survey.

All six geographic regions of Santa Catarina state comprised the sampling strata. The sample unit selection occurred in two stages: (1) schools were stratified by size (large: ≥500 students, medium: 200–499 students and small: <200 students) and (2) classes were selected considering the period of study and grade level. All students in the selected classes who were present in the classroom were collected, and the respondents were considered to be eligible if they were 15–19 years of age. In 2001, a total of 211 schools were included in the primary sampling unit (PSU), with 240 classes constituting the secondary sampling unit (SSU). In 2011, these figures were 76 PSU and 344 SSU. Additional information on the sample characteristics can be obtained from a recent publication.

The questionnaire used in the two surveys was developed based on other international instruments that were used in young populations. Information on screen time use was collected using two questions: ‘How many hours per day do you watch TV?’ and ‘How many hours per day do you use the computer/video games?’ The questions were asked for weekdays (Monday to Friday) and weekend days (Saturday and Sunday) separately. Open responses were obtained in 2001 and five response options (1, 2, 3, 4 or more hours/day) were used in 2011. The responses in 2001 were collected with open response options (continuo value), which we were grouped into the same categories used in 2011.

We estimated the prevalence of each category, which were compared using 95% CIs from each proportion rate. Prevalence trends were considered to be statistically significant if the 95% CIs did not overlap ($P < 0.05$). All analyses incorporated procedures for studies with complex methodologies (i.e. adding the prefix ‘svyset’ to incorporate strata, conglomerates and sample weight), with the use of available resources in STATA version 11 (Stata Corp, College Station, TX, USA).

Both surveys were approved by the Ethics Committee on Human Research of the Federal University of Santa Catarina (protocol number: 064/2000 in 2001 and 1029/2010 in 2011). All students (or their guardians, in the case of students under 18 years of age) provided written informed consent for participation in this study.
Results

In 2001, 5463 students responded to the questionnaire but 5083 students were considered eligible (380 students were outside of interest age group). Fifty-five eligible students were removed for incorrect completion of the questionnaire, remaining 5028 students (59.6% of girls). In 2011, 7077 students responded to the questionnaire and 6569 were eligible students (508 students were outside of interest age group). Forty eligible students were removed for incorrect completion of questionnaires (n = 6529, 57.8% of girls). For the TV-watching variable, >80% of adolescents of all groups studied (gender and week period) responded this question. However, the computer/video game use variable was filled by 68% in 2001, with variability between categories from 55 to 75%. In 2011, >95% of the students completed this question.

Fig. 1A and B show a trend for a decreased amount of TV watching on weekdays and weekend days from 2001 to 2011 among both boys and girls. These trends are more apparent when we examined the category that represents the highest screen time use (≥4 h daily). For example, the prevalence rate of boys who watched TV for ≥4 h on weekdays decreased significantly between the surveys [from 31.4% (95% CI: 27.9, 34.8) in 2001 to 12.2% (95% CI: 10.4, 14.1) in 2011]. A decline in TV watching among girls was also observed, but the differences between the surveys had smaller magnitudes, especially on weekdays (Fig. 1B).

Figure 2A indicates a significant decrease in the prevalence rate of computer/video game use for 1 h or less on weekdays among boys [from 62.6% (95% CI: 59.2, 65.9) to 44.3% (95% CI: 41.1; 47.5)]. Conversely, there was a significant increase in the prevalence of computer/video game use in the other categories (there was no overlap of the 95% CIs between the prevalence rates obtained in 2001 and 2011). The data from the category of computer/video game use for ≥4 h per day showed that the largest discrepancies between 2001 and 2011 were obtained if we examined the computer/video game use on weekend days. The prevalence rate of boys who used computer/video games for ≥4 h per day increased from 26.5% (95% CI: 23.9, 29.0) to 42.7% (95% CI: 39.8, 45.5) after a decade. Among girls, the prevalence increased from 14.8% (95% CI: 12.5, 17.0) in 2001 to 31.1% (95% CI: 28.0, 34.2) in 2011 (see Fig. 2B).

We tested whether the changes from 2001 to 2011 were statistically significant considering the screen time indicators combined (TV and computer/video games). In total screen time, the prevalence rate of boys who had ≥4 h on weekend days increased from 67.8% (95% CI: 65.0, 70.6) in 2001 to 75.1% (95% CI: 72.7, 77.5) in 2011. Among girls, these prevalence rates increased on weekdays only from 47.7% (95% CI: 43.8, 51.5) to 56.3% (95% CI: 53.4, 59.3) after a decade. There was an overlap of the 95% CIs between the prevalence rates obtained in 2001 and 2011 for other categories of spent time, independently of gender and period of week (data not shown in figure).

Discussion

Main findings of this study

The prevalence rate of computer/video game use for ≥4 h per day had a relative increase of 44.4–110.1% after a decade, varying according to gender and period of the week. TV watching, in turn, presented an inverse trend between 2001 and 2011. The prevalence rate of students who watched TV for ≥4 h on weekdays presented a relative reduction of 44.4–63.1%. These data demonstrated that there was a change in the screen time-related behavioral patterns among Brazilian students after a decade on week and weekend days.

What is already known on this topic?

The reduction in TV watching and increase in computer/video game use were also observed in developed countries. This evidence indicates a probable replacement of the TV by other electronic entertainment options among young people from these countries. Other studies in developed countries showed that the main change in screen time use among adolescents was a significant increase in computer use. Finally, studies that included Chinese adolescents found an increasing trend of total screen time use (TV, videos and computer combined) but did not analyse these screen time indicators separately. These results suggest that changes in the screen time use among adolescents may vary by country and screen time indicator. Therefore, this evidence justifies the use of country-specific data and the inclusion of different screen time indicators in surveys on the secular trends of sedentary behaviors in young people.

In Brazil, the urbanization and rapid economic and social growth may explain the changes in the behavioral patterns among young people. The years in the 2000s are characterized by a reduction in the social gaps between the rich and poor in Brazil through a combination of unemployment reduction, progressive increases in the minimum wage and expansion of cash transfer programs. This growth contributed to the observed relative increase of 42.2% between 2001 and 2011 in the number of Brazilian households with a TV at home. However, computer acquisition in Brazilian households had a further significant increase. Data on computer acquisition between 2001 and 2011 are not available in Brazil. However, between 2009 and 2011, the prevalence rate of households...
with a computer at home increased from 16.4 to 22.0% (a relative increase of 39.8%). The prevalence rate of households with a TV at home increased from 56.0 to 59.4% (a relative increase of 6.1%) during the same period.23 Based on these findings, changes in the screen time use patterns among the Brazilian youth coincide with a period of improved new technology access and acquisition among the Brazilian population. Therefore, intervention actions to control excessive access to sedentary technologies (mainly computer/video game use during leisure time) should be developed for Brazilian young people. For example, some action strategies may be encouraged such as the parents’ participation in controlling the computer and video games access24 and the interruption of excessive time in front of these devices.25 Still, more research could be made to examine intervention strategies to reduce overall sedentary time, as well as its relation with health status among young people.

Trends in the screen time use occurred similarly between boys and girls. These results were also observed previously.7,12–14,18 The exception was a study of Czech adolescents

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**Fig. 1** Prevalence rate and 95% CIs of TV watching among Southern Brazilian students in 2001 and 2011.
that showed that TV watching had a greater increase in boys than in girls after a decade (from 1998–2000 to 2008–10).\textsuperscript{11} Thus, intervention strategies to reduce screen time use must be similarly focused on girls and boys in Brazil. However, differences in the screen time use between genders exist\textsuperscript{11,19,20} and were also observed in this study (e.g. higher computer use in boys and higher TV watching in girls). These results indicate that strategies for reducing screen time can be focused on different screen time indicators according to gender, and they can be different according to period of the week.

\textbf{What this study adds}

Our results showed that the lowest reductions of TV watching occurred on weekend days (see Fig. 1). In contrast, the use of computer/video games showed a large increase on weekend days. For example, the prevalence rate of boys and girls who spent $\geq$4 h using computer/video games on weekend days had a relative increase of 61.1 and 110.1%, respectively, after a decade (see Fig. 2). The reasons for these changes are unclear and require further research. However, changing family norms, such as unlimited access to a TV and computer in the

\begin{figure}
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\caption{Prevalence rate and 95\% CIs of computer/video game use among Southern Brazilian students in 2001 and 2011.}
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adolescent’s room or home on weekend days, is a common practice.\textsuperscript{19,20} This family norm may contribute to the higher screen time use on weekend days, as shown in our results. Our evidence suggests that actions to guide parents and other family members to reduce screen time use on weekend days were needed and they can significantly contribute to excessive sedentary time in youth. The incorporation of other healthy behaviors in adolescents’ routine (e.g. physical activities and sports leisure) is essential to promoting a healthy lifestyle.

One of the strengths of this study was the large sample to represent the young population from a Brazilian state. This study was one of the first on the secular trends of screen time use in developing countries.\textsuperscript{12,13,15} Another strength of the study was the analysis of two screen time use indicators (TV watching and computer/video game use) and period of the week separately. This analysis showed important evidence that changes in the screen time use among adolescents vary depending on the screen time indicator and manifest differently on weekdays and weekend days.

**Limitations of this study**

The limitations of this study include the inability to extrapolate the results to other populations because the sample selection was only in public schools and in southern Brazil. The low response rate (68\%) for the computer/video game variable also represents a limitation for the estimate rates in 2001. There was alteration in response options in survey in 2001 (continuo value response) and 2011 (categories response), being the data of 2001 grouped in categories. Like any continuous transformation in categorical variable, there is a reduction in accuracy of information, but this still allow analyzing the trends in screen time variables. Finally, the use of self-reported instruments to identify the screen time use was a limitation for the prevalence rates estimated in the present study. However, instruments to measure objectively the screen time use are scarce and they have limited use in large-sample studies.

**Conclusion**

Our results suggest that there was a decrease in the time spent watching TV among students after a decade (from 2001 to 2011), but this decrease appears to be compensated by the increase in computer/video game use in both boys and girls. These changes coincided with a period of greater ease of the acquisition of goods and technologies by Brazilian households. The worst trend of screen time use was observed when considering weekend days. Intervention actions focused on the control of excessive screen time use on weekend days should be encouraged (e.g. limiting computer use and TV watching and encouraging active leisure on these days). Indeed, behaviors performed on weekend days can become constant habits and may have negative impacts on health in youth and later in life.

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