

Overweight and thinness in 7-9 year old children from *Florianópolis*, Southern Brazil: a comparison with a French study using a similar protocol

Sobrepeso e baixo peso em crianças de 7 a 9 anos de idade de Florianópolis, Sul do Brasil: uma comparação com estudo francês usando protocolo similar

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ABSTRACT

Objective

To assess nutritional status based on weight and height variables in children aged 7-9-y-old in a city from the South of Brazil (*Florianópolis*) and to compare the prevalence of thinness and overweight and environmental factors between Brazil and France.

Methods

Randomly stratified samples of 7-9 y-old children (*Florianópolis*, n= 2 232; France, n= 1 582). Both studies followed the protocol recommended by the European Childhood Obesity Group. Weight and height were

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recorded according to World Health Organization recommendation. Thinness and overweight were defined using the French references. Physical activity and sedentary behaviors were compared.

Results

Florianópolis children were taller and heavier than the French. The frequency of thinness was lower in *Florianópolis* as compared to France (1.1 vs 3.9%). Overweight frequency was 19.9% in *Florianópolis* as compared to 16.3% in France. French children had a higher level of physical activity. In particular, 66.5% of French children had a regular sport activity compared to 35.7% in *Florianópolis*. In France, daily television and screen viewing time was 2 hours per day as compared to 3.3 hours in Brazil.

Conclusion

Behavioral parameters, particularly sedentary lifestyle, could account for the higher prevalence of overweight in Brazilian children. Strategies to decrease the prevalence of overweight in children should take into account the particularities of each country.

Indexing terms: Brazil; child; France; nutritional status; obesity; overweight.

RESUMO

Objetivo

Avaliar o estado nutricional de crianças de sete a nove anos de idade de *Florianópolis* (Brasil) e comparar a prevalência de sobrepeso e baixo peso com um estudo realizado na França.

Métodos

Os dois estudos comparados consistiram em investigações transversais de amostras aleatórias estratificadas de crianças de sete a nove anos da idade (*Florianópolis*, $n = 2.232$; França, $n = 1.582$), delineados com base no protocolo recomendado pelo European Childhood Obesity Group. As medidas antropométricas (peso e estatura) foram coletadas de acordo com normas recomendadas pela Organização Mundial de Saúde. Na análise da prevalência de sobrepeso e baixo peso (magreza) usou-se a referência francesa. Compararam-se alguns fatores relacionados à prática de atividade física e comportamentos sedentários entre os dois estudos.

Resultados

As crianças de *Florianópolis* foram mais altas e apresentaram maior peso corporal que as francesas. A prevalência de baixo peso foi mais baixa em *Florianópolis*, comparando-se com a França (1.1 vs 3.9%). A prevalência de sobrepeso foi de 19,9% em *Florianópolis* e de 16,3% na França. Certos tipos de comportamentos podem estar contribuindo para uma mais elevada prevalência de sobrepeso em *Florianópolis*, quando comparada à França. As crianças francesas apresentaram mais elevado nível de atividade física: 66,5% das crianças francesas realizavam atividade esportiva regular, quando comparados aos 35,7% das crianças de *Florianópolis*. Na França, o tempo destinado a assistir televisão, jogar vídeo game e utilizar computador foi de duas horas por dia, enquanto no Brasil foi de 3,3 horas diárias.

Conclusão

Alguns fatores comportamentais, tais como nível de atividade física, e sedentarismo podem explicar as diferenças encontradas. As estratégias visando à redução da prevalência do sobrepeso infantil devem levar em consideração as particularidades específicas de cada país.

Termos de indexação: Brasil; criança; França; estado nutricional; obesidade; sobrepeso.

INTRODUCTION

Surveys over the past two decades have consistently shown a dramatic increase in child overweight and obesity in some developed and developing countries¹. The factors responsible for this increase are still not clearly identified.

Therefore there is great interest in carrying out parallel studies in different contexts.

In order to facilitate the development of comparative international studies, the European Childhood Obesity Group (ECOG)² has proposed a protocol for the assessment of overweight

frequency in children. A French study was published to present data based on this protocol in a population of children 7 to 9 years old^{3,4}.

Following this work, and thanking the collaboration between the *Institut National de la Santé et Recherche Médicale* (INSERM), France, and the *Universidade Federal de Santa Catarina*, Brazil, a similar study, using an identical protocol, was carried out with children living in *Florianópolis*, Southern Brazil. The prevalence of thinness, overweight and obesity for 7-10-y-old children from *Florianópolis*, using two different definitions^{5,6} were published previously⁷.

In this article, we presented the prevalence of thinness and overweight for 7-9-y-old *Florianópolis* children, defined on the basis of the French references⁸ for the first time. In addition, behavioral observations were compared between *Florianópolis* and France. Data obtained using a comparable approach in very different contexts can thus be compared directly.

Data from *Florianópolis* provide a basis for comparisons with other regions of Brazil and with more developed countries, since this city has one of the highest Human Development Indices (HDI) of the country⁹.

METHODS

Data and Study population

Florianópolis is the capital of the state of *Santa Catarina*, in the south of Brazil. The city has a total area of 433km²; its demographic density is 760hab/km²; the population is 369,102 inhabitants (urban 94.1%); life expectancy at birth is 72.8 years; infant mortality rate is 18.5/1000 live births^{9,10}.

Data were collected in the year 2002 in a representative sample of 3 516 school children, from private and public elementary schools. The study design is described elsewhere⁷. Briefly, public and private elementary schools were randomly

selected from a list of the schools stratified by geographic area. In each school selected, all classes were included and all the children from first to fourth grades were invited to participate. For comparison purposes with the French study, only *Florianópolis* children aged 7-9-y-old (n=2232) were included in this article.

Parents gave written informed consent to their child's participation in the study which also received approval from the Committee on Human Studies of the Federal University of *Santa Catarina*.

The study in France was conducted in 2000 in similar conditions, with 1 582 children aged 7-9-y-old, following the same ECOG protocol^{2,3}.

Measurements

Body measurements

Anthropometric measurements were taken in each school by trained health personnel and performed using standardized procedures¹¹. Anthropometric measurements were performed in lightly dressed children, without shoes and included weight, height, middle upper arm circumference (MUAC), waist and hip circumferences, and four skinfold thicknesses. In the present article only the weight, height and BMI were analyzed. Height was measured using a metric tape fixed to a wall without a baseboard, with the child standing up, weight being equally distributed on both feet, and head, back and buttock on the vertical land on the height gauge. Weight was measured with calibrated portable scales with a precision of 100g. The body mass index (BMI) was computed as weight in kg divided by height in m².

Definition of thinness and overweight

The Body Mass Index (BMI) is now used worldwide to assess nutritional status. It is based on weight and height which are easily available and reliable measurements, and it is closely correlated with total and percent body fat assessed

by more fundamental measures of body composition. Because BMI varies during growth, BMI references are given by age and sex¹².

Thinness and overweight were evaluated according to the French references. In 1982, based on the French data of the International growth study¹³, the first BMI reference charts were constructed¹⁴. They were subsequently revised in 1991⁸. From these references, thinness (≤ 3 rd centile) and overweight (> 97 th centile) were defined. As opposed to the International Obesity Task Force cut offs⁶, defining overweight and obesity only, the French reference charts provide centile ranges from the 3rd to the 97th centile, allowing one to assess the prevalence of thinness, normal weight and overweight children.

Physical activity and sedentary behaviors

A complementary questionnaire was completed by the parents. It included information about themselves (anthropometric data, age, occupation and education level) and about the child (growth, early feeding, physical activity level, time spent watching TV, playing video games and using a computer). In this article, only data on the child's physical activity and sedentary behaviors were examined. Data on physical activity and sedentary behaviors were obtained for 1780 children aged 7-9-year-old (response rate: 79.7%).

Physical activity was evaluated using three indicators, according to the parent's perception: 1) Active or inactive type of transport between home and school (active transport= walking and/or bike; inactive transport= car, bus, or motorcycle); 2) Sport performed outside school (yes/no) and 3) Child activity level. Parents were asked to rate their child's physical activity level as very active, active, not very active and inactive. For the analyses, activity levels were classified into two groups: active (very active and active) and non-active (not very active and inactive). Sedentary behavior was estimated using time spent watching TV, playing video games and using a

computer. Parents were asked how many hours their children do these activities on a typical weekday.

Analysis

Statistical analyses were performed in children with complete information on age, school grade and anthropometric measurements. Children age < 7.0 y and ≥ 10.0 y were excluded. Three age groups were defined as follows: 7y old (7.0 - 7.9 y), 8 y old (8.0 - 8.9 y) and 9 y old (9.0 - 9.9 y).

Weight, height and BMI are presented as means with standard deviations by gender and age in *Florianópolis* and French studies. Between the studies, differences in mean values of anthropometric measurements were tested by analysis of variance. Values for physical activity indicators according to the parent's perception, were presented as frequencies. Sedentary behaviors (time spent watching TV, playing video games and using a computer) were given by gender and expressed as mean \pm standard deviations [(Mean (SD))], in a typical weekday. Gender differences were examined using the unpaired *t*-test.

Overall frequencies of thinness and overweight were computed by using direct standardization on age and gender. Comparisons of frequencies between ages or between genders were performed using the Mantel - Haenszel method and the chi-square test.

The significance level was set at $p < 0.05$. Data were analyzed with SPSS 10.0 for Windows (SPSS Inc., 1999).

RESULTS

Anthropometric characteristics and nutritional status in children from *Florianópolis*: comparison with French children. Table 1 presents anthropometric characteristics of *Florianópolis* and French children (weight, height, BMI) according to age and gender.

Table 1. Comparisons of weight, height and BMI obtained from *Florianópolis* and French girls and boys aged 7-9-y-old¹. (France, 2000; *Florianópolis*, 2002).

	<i>Florianópolis</i> (Brazil)			France		
	7	8	9	7	8	9
Girls (n)	328	386	372	253	401	142
	Mean (SD)					
Weight (kg)	26.2 (4.9)	29.0 (6.3)	33.0 (7.2)*	25.8 (4.7)	28.2 (5.5)	30.3 (6.7)
Height (cm)	125.3 (5.4)	130.3 (6.8)	136.4 (6.9)*	125.0 (6.0)	130.0 (6.0)	134.0 (6.0)
BMI (kg/m ²)	16.6 (2.2)	16.9 (2.6)	17.6 (2.8)*	16.4 (2.3)	16.7 (2.4)	16.7 (2.9)
Boys (n)	337	385	424	249	385	152
	Mean (SD)					
Weight (kg)	26.9 (4.9)	30.3 (6.6)*	33.2 (7.7)*	26.1 (4.7)	29 (5.7)	26.1 (6.4)
Height (cm)	126.5 (5.9)	131.6 (6.3)*	136.7 (7.0)*	126.0 (6.0)	131.0 (6.0)	134.0 (6.0)
BMI (kg/m ²)	16.7 (2.2)	17.4 (2.8)*	17.6 (2.9)*	16.5 (2.3)	16.8 (2.5)	17 (2.6)

*Significant difference between the studies in a given age group, $p < 0.05$.

In general, children from *Florianópolis* presented higher mean weight, height and BMI compared with French children. Differences increased with age. Florianópolis boys and girls aged 9-y-old were significantly heavier and taller compared to French children of the same age.

Age-standardized frequencies of thinness, normal weight and overweight estimated in 2 232 children from *Florianópolis* and 1 582 French children, according to the French references, are presented in Figure 1. No age or gender differences in the frequencies of thinness or overweight were observed in *Florianópolis'* children.

As a rule, overweight frequencies were higher for *Florianópolis'* children compared with the French sample, while frequency of thinness was higher in France, in all age groups. Differences in the prevalence of overweight were especially higher at age 8 years, for both girls (21.8% in *Florianópolis* "versus" 18.7% in France) and boys (22.6% in *Florianópolis* "versus" 12.7% in France). For thinness frequencies, French values were especially higher at 9-y-old, for both girls (0.5% in *Florianópolis* "versus" 5.6% in France) and boys (1.2% in *Florianópolis* "versus" 5.9% in France).

Table 2 presents mean times (hours/typical weekday) spent in sedentary behaviors (TV viewing, playing video game and using a

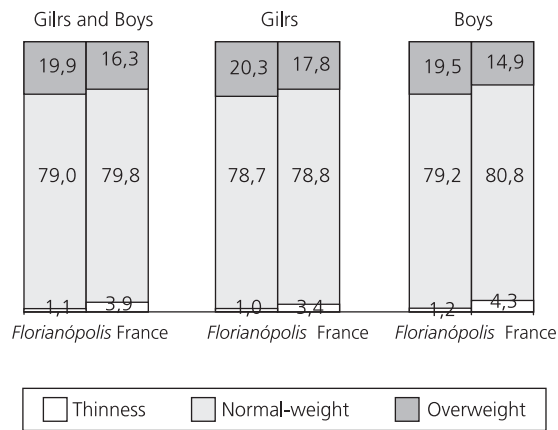


Figure 1. Age- and gender-standardized frequencies of overweight, normal weight and thinness in 7-9-y-old children (girls and boys), and age standardized in girls and boys assessed on the basis of French references⁸, in *Florianópolis* (1086 girls, 1146 boys) and France (796 girls, 786 boys). French data from Rolland-Cachera *et al.*³. (France, 2000; *Florianópolis*, 2002).

Table 2. Patterns of sedentary behaviors in *Florianópolis* schoolchildren by gender. [Mean (SD) hours of TV viewing, playing video games and using a computer in a typical weekday] (*Florianópolis*, 2002).

Sedentary behavior	All children (n=1689)	Girls (n=836)	Boys (n=853)	p
	Mean (SD)			
Television	2.6 (1.9)	2.7 (1.9)	2.6 (1.9)	0.300
Video game	0.4 (1.0)	0.2 (0.6)	0.7 (1.2)	0.000
Computer	0.3 (0.8)	0.3 (0.6)	0.3 (1.0)	0.080
Total	3.3 (2.5)	3.1 (2.2)	3.6 (1.9)	0.000

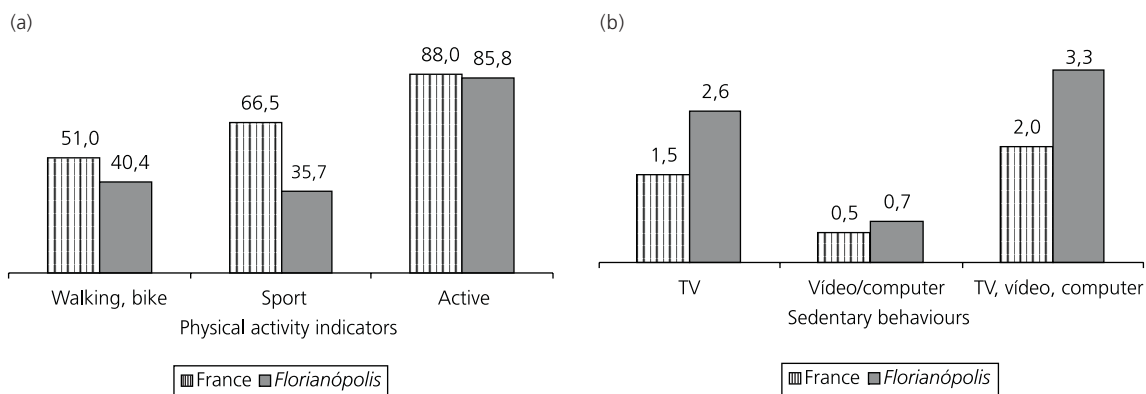


Figure 2. Physical activity indicators and parent's perception of the child's activity (a) and sedentary behaviors (b) (hours/typical weekday) in *Florianópolis* (n=1 689) and French children (n=1 147).

computer) in boys and girls from the *Florianópolis'* study. Boys spent more time playing video game than girls on a typical weekday.

Figure 2 compares the physical activity indicators (2a) and sedentary behaviors (2b) between French and *Florianópolis'* children, according to the parents' perception. A higher proportion of French children go to school walking or/and biking. The frequency of children performing a regular sport activity outside school in France was almost double the proportion observed in *Florianópolis*.

DISCUSSION

In the present study we presented the nutritional status in 7-9-y-old schoolchildren of *Florianópolis* city, using the BMI French references. The main objective was to compare overweight and thinness frequencies in children from *Florianópolis* with data from French children in the same age range, because a similar protocol was used in both studies. Data on physical activity and sedentary behaviors were presented and compared between the studies.

France and Brazil have different contexts in cultural and socioeconomic development and thus some epidemiologic indicators may differ markedly. In addition to the generally favorable rate of cardiovascular diseases, other interesting

aspects of public health in France merit attention. This country has the longest life expectancy in the Western world (second only to Japan among developed countries)¹⁵. One very disturbing fact about the French nutrition and health situation is the recent steep increase of overweight prevalence in childhood. As the French references have been available for a long time, it was possible to compare data from 2000³ with previous values. In a study conducted in the same age range, the prevalence was 5.1% in 1980; 12.5% in 1996¹⁶ and it reached 16.3% in 2000³. Besides, thinness also seems to increase (3.0% in 1965 and 3.9% in 2000)^{4,6}.

In Brazil, the prevalence of overweight in 6-9-y old children tripled in two decades (from 4.9% in 1974 to 17.4% in 1997), whereas underweight decreased (12.3% in 1974 to 6.1% in 1997)¹⁷.

Comparison between the *Florianópolis* and French study

According to the French references, overweight was more frequent in the *Florianópolis* than in the French sample, while frequency of thinness was higher in France. Certain types of behaviors were less favorable in *Florianópolis* than in France and could contribute to this difference. French children had a higher level of physical

activity (more walking, cycling, less television viewing) compared with children from *Florianópolis*. Environmental factors could contribute to some of the differences observed between the studies. First, in France, the school schedule is full time, whereas in *Florianópolis* (like in most Brazilian schools), children attend classes in the morning or in the afternoon. Thus, *Florianópolis* children were more exposed to leisure time on schooldays, and probably this time was often spent watching TV, playing video games and using a computer. Second, in France, public schools must be located preferentially near the children's home, whereas in *Florianópolis* distances from home to school are greater in most cases. Therefore, children spend more time in buses or cars. Third, in France, schoolchildren are encouraged to perform after school physical activities in public facilities. Besides, there are some programs, supported by public and private sectors, aimed at promoting sports activities for schoolchildren on week-ends, holydays and school breaks. In the past, Brazilian children used to play in open spaces around their homes, which are becoming less and less common due to the increased urbanization and overall violence.

Multivariate studies have found that television viewing and playing videogames for longer periods of time, or not participating in sports outside school, promotes obesity, whilst physical activity shows protective effects or no relationship^{18,19}. Cross-sectional and prospective studies conducted with children in the USA²⁰, Portugal²¹, Australia²², Mexico²³ and Greece²⁴ have found that hours of television viewing were closely associated with increased levels of obesity.

Prevalence of overweight and obesity according to the International Obesity Task Force (IOTF) references in children from *Florianópolis*: comparison with other studies

Santa Catarina's population is predominantly of European origin. The prevalence

of overweight and obesity recorded in *Florianópolis*⁷ was compared with those reported for East Germany²⁵, Italy²⁶, Portugal²⁷ and France³, according to the IOTF definition⁶ (Figure 3). The figure also shows the prevalence of overweight and obese children from the city of *Rio de Janeiro*²⁸, the Northeastern and Southeastern Brazilian regions and the United States (NHANES III, 1988-1994)¹⁷. The prevalence of overweight in schoolchildren from *Florianópolis* city was higher than in the city of *Rio de Janeiro*²⁸ and the Northeastern and Southeastern Brazilian regions¹⁷. Portugal, Italy and East Germany presented higher prevalence of overweight and obese children than France, USA and the Northeastern and Southeastern Brazilian regions.

The differences in prevalence of overweight and obesity should be interpreted considering the date of data collection, the study design, socioeconomic, environmental and lifestyle factors in different regions. Data from the city of *Rio Janeiro*²⁸ was collected in the year 1999, in a representative sample of children and adolescents from public schools. Data from the city of *Florianópolis*⁷ was collected in the year 2002, in a representative sample of schoolchildren from public and private schools. In the present study, children from private schools presented higher prevalence of overweight and obesity when compared with children from public schools, according to the IOTF definition (data not shown). These data will be presented in a forthcoming paper. Data from the *Florianópolis*' study was collected five years after the National study¹⁷ and the age range was slightly different between the studies. The Southern Brazilian region presents better living standards than the Northeastern region (included in the National study) and probably eating, physical activities and sedentary behaviors differ between these regions.

CONCLUSION

Obesity frequency increases rapidly in many countries, particularly in children. This trend

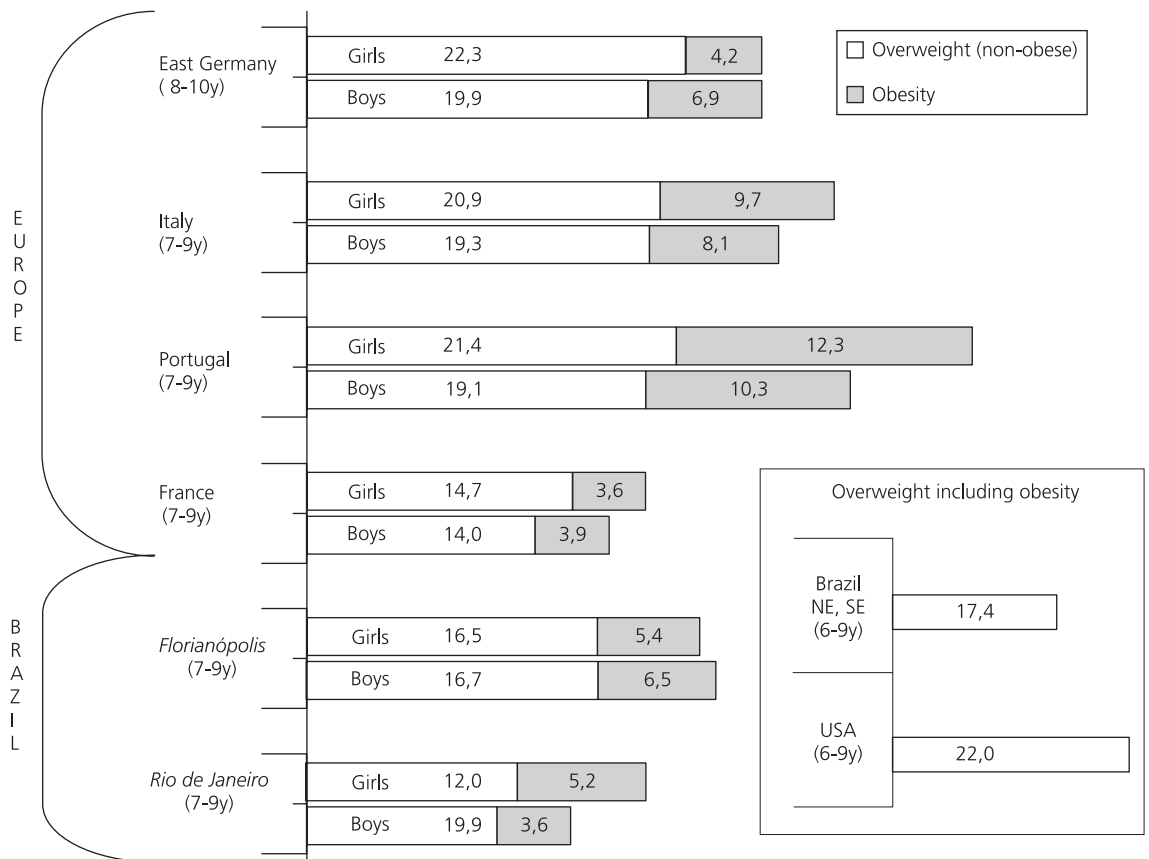


Figure 3. Frequencies of overweight and obese children in Brazil [*Florianópolis* (2002); Rio de Janeiro (1999); Northeastern and Southeastern regions (1997)], France (2000), Portugal (2002-2003), Italy (1993-2001), East Germany (1998-1999) and USA (1988-1994), using the IOTF definition⁶. (Year of data collection).

which appears in developing as well as in developed countries seems to have been accelerating in recent years. Child obesity is more and more often associated with pathologies that, until recently, were observed only in adults¹².

While the increasing frequency of obesity is well established, its causes obviously originate from several changes in lifestyle, and in particular the decrease in physical activity and the change in the food offer. Comparing data obtained using similar methods in widely different contexts might allow risk factors to be identified more clearly.

The recent data on nutritional status in children from *Florianópolis* support the previously reported high frequencies of childhood overweight in developing countries undergoing a nutritional transition. While Brazilian nutrition programs aim at decreasing under-nutrition, Brazil has caught

up with and even exceeded the overweight frequency of some European countries. In France, acknowledging the problem has stimulated reflection and has led to school interventions. Studies such as the present one carried out in a city from southern Brazil should allow a better assessment of current problems and allow adaptation measures to be taken in response to the rapid societal changes. International comparisons and the observation of similarities or differences between countries might lead to hypotheses about the critical factors in different contexts.

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