Effectiveness of a School-Based Intervention on Physical Activity for High School Students in Brazil: The Saude na Boa Project

Mauro Virgílio Gomes de Barros, Markus Vinicius Nahas, Pedro Curi Hallal, José Cazuza de Farias Júnior, Alex Antônio Florindo, and Simone Storino Honda de Barros

Background: We evaluated the effectiveness of a school-based intervention on the promotion of physical activity among high school students in Brazil: the Saude na Boa project. Methods: A school-based, randomized trial was carried out in 2 Brazilian cities: Recife (northeast) and Florianopolis (south). Ten schools in each city were matched by size and location, and randomized into intervention or control groups. The intervention included environmental/organizational changes, physical activity education, and personnel training and engagement. Students age 15 to 24 years were evaluated at baseline and 9 months later (end of school year). Results: Although similar at baseline, after the intervention, the control group reported significantly fewer d/wk accumulating 60 minutes+ moderate-to-vigorous physical activity (MVPA) in comparison with the intervention group (2.6 versus 3.3, \( P < .001 \)). The prevalence of inactivity (0 days per week) rose in the control and decreased in the intervention group. The odds ratio for engaging at least once per week in physical activity associated with the intervention was 1.83 (95% CI = 1.24–2.71) in the unadjusted analysis and 1.88 (95% CI = 1.27–2.79) after controlling for gender.

Conclusion: The Saude na Boa intervention was effective at reducing the prevalence of physical inactivity. The possibility of expanding the intervention to other locations should be considered.

Keywords: youth, physical activity, high school, intervention

Accumulated evidence on the benefits of physical activity has changed health priorities in recent years. During the past decade, several well-respected organizations and research groups have developed evidence-based recommendations for health-enhancing physical activity, which have been shown to be associated with disease prevention and well-being across all ages.\(^1,2\) In fact, physical inactivity is considered a major risk factor for several chronic diseases and a major determinant of the worldwide obesity epidemic.\(^2,3\)

According to the World Health Organization (WHO), “globally, there are more than 1 billion overweight adults, and at least 300 million of them are obese.”\(^3\) In addition, obesity and overweight pose a major risk for chronic diseases, and the key causes for this health problem of epidemic proportion are increased consumption of energy-dense foods high in saturated fats and sugars and reduced physical activity.\(^3\) There is evidence that the transition from adolescence to adulthood (15–24 years of age) is a critical period for the development of excess body weight that may last during the entire lifespan.\(^4\) Following the same trend of the adult population, the prevalence of overweight and obesity among Brazilian adolescents has risen from 4.1% in 1974/1975 to 13.9% in 1996/1997.\(^5\) Unfortunately, physical activity data in Brazil do not allow for a secular trend analysis.

Data from several countries indicate that physical activity significantly declines as adolescents transition into adulthood,\(^1,3\) and evidence suggests that the developmental transitions of this phase in life may be an
important aspect in understanding the age-related decline in physical activity. Particularly in developing countries, such transitions during youth (15–24 years) include concurrent demands for a job, seeking college education, getting married, along with lack of information, time, or opportunities for a healthier lifestyle. Hence, there is a strong need for effective, culturally relevant interventions to promote physical activity and healthy eating among youth, and schools are considered ideal sites for promoting such behaviors. In addition to reaching a large proportion of youth, schools offer opportunities to intervene through physical education classes as well as through environmental changes.

Young people living in large cities and attending evening classes in public schools are at higher risks for unhealthy behaviors. Although the prevalence of such risky behaviors is available, little is known about the effectiveness of school-based interventions aimed at preventing obesity through physical activity modifications, taking into account regional and cultural factors. The aim of this article was to evaluate the effectiveness of a school-based intervention on physical activity for high school students in Brazil: the Saude na Boa project.

**Methods**

High schools in Brazil and in other developing countries have distinct characteristics in comparison with schools in developed societies. First, not all young boys and girls have the chance to attend high school, and among those who do so, the dropout rate tends to be high. In fact, only half of the adolescents in Brazil attend high schools. Also, because many high school students have regular jobs, attending evening classes is their only choice. Those attending evening classes tend to be older than the average high school boy or girl, mainly because of repeated academic failure and high dropout rates.

This intervention focused on this group of high school students, 15 to 24 years of age, attending evening classes in Brazil, which represents close to 50% of all high school students in this country. Official data indicate that, in March 2006, the total number of students attending the 25 public high schools in Florianopolis was approximately 13,000, and nearly 66,000 were registered in 114 public schools in Recife. The data included all morning, afternoon, and evening classes.

The target population in the project (evening-class students from public schools, ages 15 to 24 years) is justified by the following reasons: (a) approximately 70% of high school students attend public schools; (b) almost half of high school students in Brazil attend evening classes, mainly because a large proportion of them work during the daytime (in Santa Catarina, 68% of the students attending evening classes work 6 to 8 hours a day); (c) physical inactivity and poor-quality diet (as well as other health risk behaviors) are more prevalent among students who work and, in general, attend evening classes; and (d) the choice for Florianopolis and Recife was justified by the sociocultural contrast (southern Brazil is socioeconomically more developed than northeastern Brazil and there are some marked differences in terms of cultural values and ethnicity). The selection of the 2 cities was facilitated by the existence of 2 research groups with previous experience in joint research projects.

Saude na Boa means health in a “cool” way or health can be fun. It represents a slogan and a concept derived from direct contacts with adolescents during the development of the project. A clustered, randomized controlled design was used in this study. The unit of randomization was the school because much of the intervention was delivered school wide and it provides more stringent control for the intervention comparisons, thereby reducing the error variance. Schools in each city (Recife and Florianopolis) were pair matched by size and location; 10 pairs (5 in each city) were randomly selected to take part in the study, and, within each pair, schools were randomized into intervention or control groups. The study population included all students 15 to 24 years of age attending evening classes.

The project was based on the WHO Health Promoting Schools philosophy and the CDC’s Guidelines for School and Community Programs and included 3 major areas of intervention: (a) healthy diet and physical activity education: Web site (www.saudeaboa.ufsc.br) for student and teacher use, thematic letters (4) for classroom discussion; (b) simple environmental changes: safe bike racks, fruit day (free distribution of seasonal fruits and information once a week for 10 weeks), physical education kit (US$500 to purchase simple equipment and materials selected by students and PE teacher), and special events on weekends, such as trails or bike trips; and (c) personnel training and engagement (1 initial presentation for teachers, staff, students, and parents; PE teachers curriculum modification training—eight 4-hour sessions every 2 weeks).

A questionnaire was developed and validated for this population, which included measures for physical activity and eating habits from the PACE Project. Two single items were used to assess the number of days students accumulated at least 60 minutes of moderate or vigorous physical activity (MVPA) in the past 7 days. The reliability of the questionnaire was high for the combined physical activity score (intraclass correlation coefficient [ICC] = .93, 95% CI = .90–.95). Data were collected at baseline (March 2006) and postintervention (December 2006). The Portuguese version of the questionnaire and the logic model of the intervention are available on the project Web site: www.saudeaboa.ufsc.br.

The Saude na Boa logic model was developed following the reverse logic approach (right to left) as suggested in the USDHHS/CDC’s Physical Activity Evaluation Handbook.
The intervention was planned to affect behaviors known to be associated with the increasing obesity trend among youth (physical activity and eating habits), according to the following criteria: (a) it should include culturally relevant activities and low-cost resources; (b) it should emphasize enjoyable, easy-to-implement activities; (c) physical education should include health promotion components in the curriculum; and (d) activities should be easily maintained (after the intervention period) and possible to disseminate to other schools.

The specific targeted behaviors were (a) increase the number of days per week on which students accumulated 60 minutes or more of moderate-to-vigorous physical activity (d/wk accumulating 60 minutes+ MVPA) and (b) reduce the proportion of subjects who did not accumulate 60 minutes of MVPA at least once a week (0 days of MVPA/wk). Data analyses included a comparison of the results between the 2 groups (Control × Intervention at baseline and postintervention) and within groups (Baseline × Postintervention), stratifying data by sex, age, and working status (Not Employed × Full-Time or Part-Time Employed). t tests (Table 1), chi-square, and McNemar tests (Tables 2 and 3) were carried out. The tests were used to evaluate differences in proportions between (a) control and intervention groups at baseline, (b) control and intervention groups at the postintervention phase, (c) control group at baseline and at the postintervention phase, (d) intervention group at baseline and at the postintervention phase. Because there were sex differences between the 2 groups at baseline, gender was considered a potential confounder. Logistic regression models were carried out to confirm the unadjusted analyses findings. Statistical analyses were performed using SPSS (version 15.0) and Stata (version 8.0) software.

The proposal was approved by institutional review boards, both in Recife (Ethics Research Committee of the Instituto Materno Infantil de Pernambuco, protocol 587/2005) and Florianopolis (Ethics Research Committee of the Federal University of Santa Catarina, protocol 031/2003).

### Results

The baseline evaluation included 2155 adolescents age 15 to 24 years. Mean age was 18.4 years (SD = 2.3), with 28% of males and 27% of females in the 20- to 24-year-old group. Overall, 1096 (50.9%) were in the schools randomly assigned to the control group and 1059 (49.1%) were part of the intervention group. Nine months later, at the postintervention phase, 45.9% of the subjects were reexamined to evaluate the impact of the intervention. Out of the 1166 subjects who were not evaluated at the postintervention phase, 49.8% were originally part of the control group, showing that loss to follow-up was not related to the intervention. Figure 1 presents the flowchart of the study.

Table 1 shows the impact of the intervention on the number of days per week of physical activity practice, treated as a numeric variable. At baseline, there was no difference between the control and intervention groups (P = 0.28), but after the intervention, the control group practiced significantly fewer days per week of physical activity (d/wk accumulating 60 minutes+ MVPA) in comparison with the intervention group (2.6 versus 3.3, respectively). This finding was confirmed for both sexes and cities (Table 1).

In Table 2, the impact of the intervention on the outcome “proportion of subjects meeting current physical activity recommendations (≥5 d/wk)” is presented. At baseline, the 2 groups (control and intervention) were similar in terms of this outcome (P = 0.27), but after the intervention, a marked difference was observed (P = 0.001). However, one should note that the proportion of subjects meeting physical activity recommendations decreased in both groups; the intervention was effective at minimizing this reduction in the intervention group. Only among males from the

### Table 1 Number of Days Per Week Accumulating 60 Min of Moderate or Vigorous Physical Activity

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline</th>
<th>Postintervention</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Intervention</td>
<td>Control</td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>mean</td>
<td>mean</td>
</tr>
<tr>
<td></td>
<td>(SD)</td>
<td>(SD)</td>
<td>(SD)</td>
</tr>
<tr>
<td>Whole sample</td>
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<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>males</td>
<td>3.5 (2.2)</td>
<td>3.8 (2.4)</td>
<td>3.0 (2.1)</td>
</tr>
<tr>
<td>females</td>
<td>3.1 (2.4)</td>
<td>3.3 (2.4)</td>
<td>2.3 (2.0)</td>
</tr>
<tr>
<td>City</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Florianopolis</td>
<td>3.0 (2.2)</td>
<td>3.6 (2.4)</td>
<td>2.5 (2.0)</td>
</tr>
<tr>
<td>Recife</td>
<td>3.7 (2.5)</td>
<td>3.3 (2.4)</td>
<td>2.7 (2.2)</td>
</tr>
</tbody>
</table>

*P values 1 and 2 were calculated using the independent samples t test, and P values 3 and 4 were calculated using the paired t test. 1: Intervention × Control Group (baseline); 2: Intervention × Control Group (postintervention); 3: Control Group (baseline) × Control Group (postintervention); 4: Intervention Group (baseline) × Intervention Group (postintervention).
Barros et al

In multivariable regression models, but results were mainly unaltered. The odds ratio associated with the intervention changed from 1.83 (95% CI = 1.24–2.71) in the unadjusted model to 1.88 (95% CI = 1.27–2.79) after adjustment for gender.

Discussion

This cross-cultural, randomized study aimed at observing the effects of a comprehensive school-based intervention designed to promote physical activity among high school students in 2 cities from different regions in Brazil: northeast (Recife) and south (Florianopolis).

Some limitations of this article should be considered. Study participant losses at follow-up were high. However, those lost are similar to those followed-up in terms of key variables. The main reason for the high proportion of losses to follow-up was school dropout. In such cases, we phoned subjects to understand the reasons why they left school. Those contacted mentioned that they had started working or had some type of health problem as the main reason for quitting school. About

The prevalence of physical inactivity (0 d/wk) is highlighted. A significant impact of the intervention was observed; at baseline, the groups were similar, whereas at the postintervention phase, a reduction in the prevalence of inactivity was observed in the intervention group, and a rise was found in the control group. In Table 3, results for this variable are shown according to gender and site. At the postintervention phase, there were significant (or nearly so) differences between the control and intervention groups for all subgroups analyzed. The most marked differences were observed for the outcome physical inactivity (0 d/wk).

At baseline, the 2 groups (intervention and control) were comparable in terms of age and working status, but there were more females in the intervention (62.9%) than in the control (56.7%) group ($P = .05$). Therefore, we repeated the impact analyses after adjusting for gender in multivariable regression models, but results were mainly unaltered. The odds ratio associated with the intervention changed from 1.83 (95% CI = 1.24–2.71) in the unadjusted model to 1.88 (95% CI = 1.27–2.79) after adjustment for gender.

### Table 2 Proportion of Individuals Meeting Physical Activity Recommendations (≥5 Days of 60+ Min MVPA Per Week)

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline Control %</th>
<th>Baseline Intervention %</th>
<th>Postintervention Control %</th>
<th>Postintervention Intervention %</th>
<th>P&lt;sup&gt;a&lt;/sup&gt;</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole sample</td>
<td>37.7</td>
<td>41.1</td>
<td>23.7</td>
<td>33.1</td>
<td>.27</td>
<td>.001</td>
<td>&lt;.001</td>
<td>.005</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>males</td>
<td>40.1</td>
<td>42.6</td>
<td>29.3</td>
<td>38.1</td>
<td>.61</td>
<td>.06</td>
<td>.009</td>
<td>.31</td>
<td></td>
</tr>
<tr>
<td>females</td>
<td>36.1</td>
<td>40.3</td>
<td>19.2</td>
<td>30.2</td>
<td>.30</td>
<td>.002</td>
<td>&lt;.001</td>
<td>.01</td>
<td></td>
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<tr>
<td>City</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Florianopolis</td>
<td>31.3</td>
<td>44.3</td>
<td>22.0</td>
<td>32.8</td>
<td>.002</td>
<td>.005</td>
<td>.01</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td>Recife</td>
<td>44.5</td>
<td>37.3</td>
<td>25.1</td>
<td>33.5</td>
<td>.12</td>
<td>.05</td>
<td>&lt;.001</td>
<td>.45</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: MVPA, moderate-to-vigorous physical activity.

<sup>a</sup> P values 1 and 2 were calculated using the chi-square test, and P values 3 and 4 were calculated using the McNemar test. 1: Intervention × Control Group (baseline); 2: Intervention × Control Group (postintervention); 3: Control Group (baseline) × Control Group (postintervention); 4: Intervention Group (baseline) × Intervention Group (postintervention).

### Table 3 Proportion of Physically Inactive Individuals (0 d/wk)

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline Control %</th>
<th>Baseline Intervention %</th>
<th>Postintervention Control %</th>
<th>Postintervention Intervention %</th>
<th>P&lt;sup&gt;a&lt;/sup&gt;</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>males</td>
<td>8.8</td>
<td>11.1</td>
<td>11.5</td>
<td>5.8</td>
<td>.45</td>
<td>.05</td>
<td>.36</td>
<td>.13</td>
<td></td>
</tr>
<tr>
<td>females</td>
<td>19.5</td>
<td>17.8</td>
<td>21.6</td>
<td>13.5</td>
<td>.60</td>
<td>.01</td>
<td>.63</td>
<td>.19</td>
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<td></td>
</tr>
<tr>
<td>Florianopolis</td>
<td>13.2</td>
<td>11.5</td>
<td>13.6</td>
<td>8.3</td>
<td>.57</td>
<td>.06</td>
<td>1.00</td>
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<tr>
<td>Recife</td>
<td>16.5</td>
<td>19.8</td>
<td>21.2</td>
<td>13.3</td>
<td>.36</td>
<td>.03</td>
<td>.19</td>
<td>.09</td>
<td></td>
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</table>

<sup>a</sup> P values 1 and 2 were calculated using the chi-square test, and P values 3 and 4 were calculated using the McNemar test. 1: Intervention × Control Group (baseline); 2: Intervention × Control Group (postintervention); 3: Control Group (baseline) × Control Group (postintervention); 4: Intervention Group (baseline) × Intervention Group (postintervention).
Figure 1 — Flowchart of the *Saude na Boa* intervention.
one-third of the students were not at school during the 2-week data collection period.

An inherent limitation of our physical activity measure is that self-reported information may be affected by various sources of bias. For example, subjects in the intervention group may have reported higher levels of physical activity in the postintervention phase to please interviewers. It is not possible to estimate the magnitude of such bias in this case with certainty. However, the fact that physical activity increases were observed among previously active and previously sedentary subjects from the intervention group minimizes the likelihood of such bias.

This study also has strengths. First, evaluation of physical activity interventions in Brazil is rare. School-based interventions for high school subjects attending evening classes are nonexistent. Second, the use of pretested, standardized and validated research techniques should also be highlighted. The power of the study for detecting differences in the proportions analyzed was estimated. For detecting the observed difference in terms of the prevalence of inactivity (0 d/wk accumulating 60 minutes+ of MVPA), our statistical power was 97.6%. Third, the relatively low cost of the intervention makes it sustainable and probably easy to disseminate, an issue that will be discussed in the future. The actions developed in the intervention group are easy to execute, and therefore, could potentially be implemented as routine.

The main impact of our intervention was observed in terms of changes in sedentary behavior. Subjects who were previously inactive became active to some degree after the intervention. This was not sufficient to increase significantly the proportion of subjects reaching current physical activity recommendations for adolescents, but the trend was in the desirable direction. One should consider that changing from 0 d/week of physical activity practice to 5 d/week is challenging and may take more than 1 school year of intervention. In addition, it is widely known that most of the benefits for health are obtained when completely inactive subjects become active to some extent.1

Previous school-based interventions on physical activity promotion have shown inconsistent results. In a systematic review, Kahn and colleagues11 concluded that school-based physical education interventions are likely to be effective across diverse settings. Most of the studies reviewed were carried out in developed countries,11–14 which highlights the importance of our project. In the LEAP (Leadership Education for Activity Program) project, an integrated nutrition and physical activity intervention had a beneficial effect on the onset of risk factors for coronary heart disease among American girls.12 The 2006 report of the European World Health Organization Network concluded that school-based interventions to promote physical activity are more likely to succeed if they are complex, multifactorial, and involve more than one domain of activities.13

The possibility of expanding the Saude na Boa project to other locations should be considered. Health and education authorities should use the evidence from this and similar studies to guide actions to promote healthy behaviors among Brazilian high school students, particularly those attending evening classes. Whether this data will be applicable to students attending morning and afternoon classes is unknown, although it is not likely that the effect would be different.

Acknowledgments

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![Figure 2 — Prevalence of physical inactivity in the control and intervention groups at baseline and postintervention.](image-url)
The Saude na Boa Project: Effectiveness

169

Technology, Brazil), the Federal University of Santa Catarina (UFSC), and the State University of Pernambuco (UPE). The authors thank the students and teachers from the 20 schools that participated in the Project, as well as the State Secretaries of Education in Santa Catarina and Pernambuco.

Contributors

Markus V. Nahas originated the study and supervised all aspects of its implementation. Mauro V. G. de Barros helped preparing the proposal and coordinated all the implementation of the study in Recife. Pedro C. Hallal performed the data analysis, along with José Cazuza de Farias Júnior. Simone S. Honda Barros directly contacted every school and directly managed all the administrative tasks that allowed the actions to occur. Finally, all the authors interpreted findings and reviewed drafts of the article.

References