

# Active transportation to school for children and adolescents from Brazil: a systematic review

## Transporte ativo para escola de crianças e adolescentes do Brasil: uma revisão sistemática

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**Abstract** – The aim of this study was to describe the use of active transportation to school (ATS) for Brazilian children and adolescents through a systematic review. This review was carried out from February to March of 2018 by using databases from the area, governmental policies and research and by contacting researchers from this area. The databases used were: *LILACS*; *BIREME*; *SCIELO*; *MEDLINE* and *SCOPUS*. The search was performed in articles published from January 2007 to December 2017. The inclusion criteria were: original articles published in journals; articles that measured ATS; articles that evaluated Brazilian children and/or adolescents with ages ranging between 0 and 19 years of age, without specific clinical conditions, without diagnoses of diseases and non-athletes. Overall, 19 articles were selected for this study. Only 8 presented ATS values for gender, with boys and girls using ATS similarly, 4 for each gender. Regarding regions, 11 studies presented data from the Southern regions, 3 studies presented data from the Southeastern region, 3 from the Northeastern region and 2 studies presented data from Brazil as a whole. The Northern and Midwestern regions were not studied in any of the articles. Based on the results, the prevalence of ATS for children and adolescents varies according to the studies and regions in Brazil. Authorities should be encouraged to build monitoring systems for ATS to support planning and evaluation of public policies.

**Key words:** Adolescents; Brazil; Children; Physical activity; Sedentary lifestyle.

**Resumo** – O objetivo desse estudo foi descrever o uso do transporte ativo para escola (TAE) em crianças e adolescentes brasileiros em uma revisão sistemática. A revisão foi realizada no período de fevereiro à março de 2018, utilizando bases de dados da área, e pesquisas políticas e governamentais através de pesquisadores da área. As bases de dados utilizadas foram: *LILACS*; *BIREME*; *SCIELO*; *MEDLINE* e *SCOPUS*. A busca foi realizada em artigos publicados no período de Janeiro de 2007 à Dezembro de 2017. Os critérios de inclusão foram: artigos originais publicados em periódicos; artigos que mediram TAE; artigos que avaliaram crianças e / ou adolescentes brasileiros com idade entre 0 e 19 anos, sem condições clínicas específicas, sem diagnósticos de doenças e não atletas. No total, 19 artigos foram selecionados para este estudo. Apenas 8 apresentaram valores de TAE conforme o sexo, sendo que meninos e meninas usaram TAE de forma semelhante, sendo 4 para cada sexo. Em relação às regiões, 11 estudos apresentaram dados das regiões do Sul, 3 estudos apresentaram dados da região Sudeste, 3 da região Nordeste e 2 estudos apresentaram dados do Brasil como um todo. As regiões Norte e Centro-Oeste não foram analisadas em nenhum dos artigos. Com base nos resultados, a prevalência de TAE para crianças e adolescentes varia de acordo com os estudos e regiões no Brasil. As autoridades devem ser incentivadas a criar sistemas de monitoramento para o TAE para apoiar o planejamento e a avaliação de políticas públicas.

**Palavras-chave:** Adolescente; Brasil; Criança; Exercício; Estilo de vida sedentário.

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## INTRODUCTION

It is estimated that only one in every three young Brazilians (13-17 years old) reach the daily recommendation for physical activity<sup>1</sup>. Research shows that children and adolescents that are involved in active transportation to school (ATS), such as walking and biking, accumulate more physical activities and have lower risks of being overweight and obese, of having a metabolic syndrome and diabetes than those who use motorized transportation, such as a car or bus<sup>2-4</sup>.

Despite the potential benefits for one's health, studies from other countries, including Brazil, reported a decline in the proportion of children and adolescents who use ATS in the past few decades<sup>5,6</sup>. ATS has been independently associated to higher levels of physical activity and lower levels of body fat and obesity in adolescents. However, longitudinal studies that analyze the behavior of these variables over the course of years are necessary to clarify this relation<sup>2</sup>. Due to the global decline in physical activity and increase in sedentary behavior in the past decade, the promotion of ATS has become an important topic, since it is part of the international initiatives aimed at increasing the level of physical activity in the population<sup>2,7,8</sup>.

Though there is growing evidence about ATS in children and adolescents, most of this evidence has come from high-income countries, such as Canada, USA, Australia and European countries<sup>5,6,9-11</sup>. This information can inform public health authorities for the implementation and promotion of ATS to combat excess weight and child obesity, in addition to chronic degenerative diseases associated to the lack of physical activities<sup>12</sup>. However, there is a lack of evidence in low- and middle-income countries, including Brazil regarding ATS.

In the past few decades, Brazil has undergone rapid urbanization with significant challenges in terms of transportation and urban planning<sup>13</sup>. In the past few years, in different ways throughout Brazil, there have been attempts to improve the characteristics of the urban environment and reduce the social impact on the population<sup>13</sup>. These initiatives have a major potential to promote active transportation. For example, factors such as neighborhoods far from the destination, disconnected streets, changes in the built environment and a lack of public safety are associated to lower ATS<sup>14</sup>. Moreover, differences by gender are prevalent in the literature on ATS<sup>15,16</sup>. The results indicate that boys are more likely to use ATS than girls<sup>16</sup>. The publication of these data may contribute to planning policies and programs that consider the regional characteristics of active transportation, as well as strategies to promote these practices. Hence, the objective of this study was to describe the use of ATS in Brazilian children and adolescents through a systematic review.

## METHODOLOGICAL PROCEDURES

This revision was carried out from February to March of 2018 by searching

the main databases in the area, governmental policies and research and by contacting researchers from this area.

The databases used were: 1) Latin American and Caribbean Health Sciences Literature (LILACS); 2) Regional Library of Medicine (BIREME); 3) Scientific Electronic Library Online (SCIELO); 4) Medical Literature Analysis and Retrieval System Online (MEDLINE), through PubMed; 5) and SciVerse Scopus (SCOPUS).

For the investigation of potential articles, we used the advanced search tool in each of the databases (searches performed using “keywords”), based on building blocks of descriptors created by the authors. The descriptors were entered in Portuguese, English and Spanish. The first block (result) was composed of terms referring to active transportation: “physical activity”; “transportation”; “commute”; “travel”; “use of time”; “active travel”; “active transportation”; “active commute”; “mobility”; “walk”; “biking”; “bike”; “bicycle”; “pedestrian”; “origin and destination”; “lifestyle”. The second block included terms related to the target population of the study (children and adolescents): “child”; “children”; “adolescent”; “adolescents”; “preschool student”; “preschool students”. The search was performed in articles published from January 2007 to December 2017.

The Boolean operator “OR” was used to add to the advanced search at least one word from each block and the operator “AND” to associate the blocks of keywords to one another. Moreover, the specific filters available in each of the databases searched were used.

The bibliography manager *EndNote® X7 software* was used to create specific libraries, which enabled the identification and exclusion of duplicate studies, the division and organization of the results from each database.

The inclusion criteria were: original articles published in journals; articles that measured ATS; articles that measured active transportation and described the method used; and articles that evaluated Brazilian children and/or adolescents with ages ranging between 0 and 19 years of age (and/or average age included in this range), without specific clinical conditions, without diagnoses of any diseases, non-athletes and those of both genders.

The article selection process was performed by a team of three researchers. First, by reading the titles and abstracts, we excluded articles that did not meet the inclusion criteria. Then, the articles selected in the first step were read in full to determine which studies still met the inclusion criteria and which were selected for the presentation of the results.

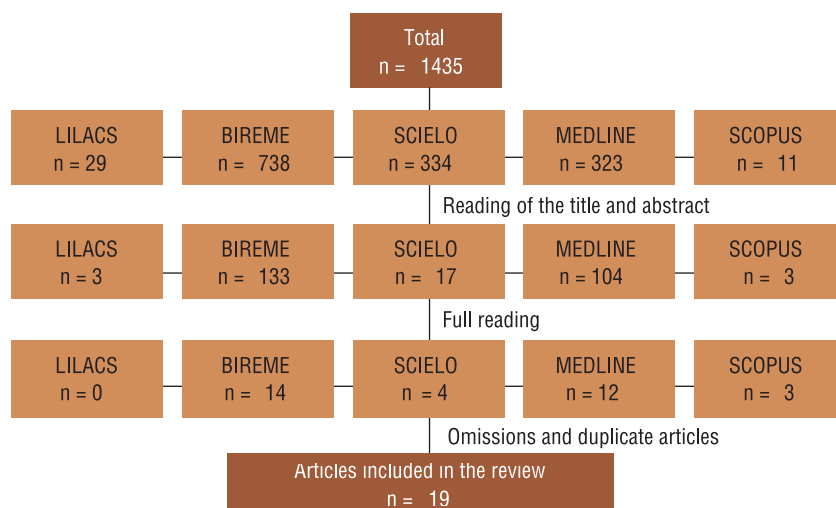
The risk of bias evaluation/methodological quality of the studies included was done by all three authors (TKF, ERV, GLMF), independently. The instrument used to evaluate the risk of bias/methodological quality was the questionnaire for cohort and transversal studies from the *National Heart, Lung and Blood Institute*<sup>17</sup>, which has 14 criteria to determine the risk of bias/methodological quality of the study. This instrument evaluates the internal validity of the studies and includes questions that help to identify the possible risk of selection bias, information bias, measurement bias and confounding factors<sup>17</sup>. For each criterion evaluated, the scores 0 “no” and 1 “yes” were

given. A total score was given to each study based on the number of positive answers to the questions in relation to the total number of questions<sup>18</sup>. The questions on the questionnaire that could not be answered by the available information and/or, that were not applicable to the study evaluated and/or aspects that had not been reported were excluded from the calculation to determine the final score of the methodological quality/risk of bias<sup>18</sup>.

According to the subjective evaluation of the reviewers, the studies were classified as having good methodological quality/low risk of bias (final score  $\geq 0.70$ ), moderate methodological quality/moderate risk of bias (final score  $\geq 0.50$ ), low methodological quality/high risk of bias (final score  $< 0.50$ )<sup>20</sup>. The reviewers applied the evaluation instrument for methodological quality/risk of bias to all the studies that met the inclusion criteria, while disagreements between the reviewers in relation to the evaluation of a determined study was resolved through discussion.

## RESULTS

The systematic search for articles that investigated ATS in Brazilian children and adolescents identified 1435 studies. After evaluating the titles and abstracts of all the studies found, 33 articles were fully analyzed. A total of 14 articles were excluded due to omissions related to the topic, the age range, the nationality and to duplication. Finally, after the omissions, 19 articles were included in this review (Figure 1).



**Figure 1.** Search results for the data and criteria used in the selection of studies aimed at investigating active transportation for children and adolescents in Brazil.

Overall, of the 19 articles selected for this systematic review, 9 (47%) showed that more than half of the students studied participated in active transportation, 6 (32%) showed that less than half participated in active transportation, and 3 (16%) presented only results separated by gender. Only 8 (42%) of the 19 articles selected had values comparing males and females, while in 4 articles, the proportion of students who participated in active

transportation was greater in males and in 4 it was greater in females (Table 1).

In relation to the year, 3 studies were from 2010 (16%), 2011 (16%) and 2014 (16%), respectively; 2 were from 2008 (10%), 2013 (10%) and 2016 (10%), respectively; and 1 was from 2009 (5,5%), 2012 (5,5%), 2015 (5,5%) e 2017 (5,5%), respectively.

Regarding the regions in Brazil, 11 (58%) presented data from the South, 3 (16%) studies presented data from the Southeast, 3 (16%) from the Northeast and 2 (10%) studies presented data from Brazil as a whole. The Northern and Midwestern regions were not studied in any of the articles selected.

In the South, of a total of 11 studies, 7 (64%) indicated active transportation in more than half of the students. Upon analyzing the studies separately, all 5 studies carried out in Rio Grande do Sul had a higher percentage of active transportation among students. In Santa Catarina, of the 6 studies carried out, only 2 indicated active transportation in more than half of the students. In the Southeast, of a total of 3 studies, only 1 indicated active transportation in more than half of the students. In the Northeast, the two studies carried out had a higher number of students using active transportation. However, in the studies that presented national data, most students used passive transportation on their way to school.

**Table 1.** Cross-sectional studies with data from active or passive transportation in Brazilian schools between 2007 and 2017.

Author	Year	Age range (years)	Location	Sample n	Active transportation			Passive transportation		
					Total n (%)	Male n (%)	Female n (%)	Total n (%)	Male n (%)	Female n (%)
Neto et al. <sup>20</sup>	2014	7-10	Vitória / Santa Maria de Jetibá – ES	1,770	63%	-	-	37%	-	-
Silva et al. <sup>21</sup>	2011	11-17	Caxias do Sul - RS	1,675	62.5%	66%	59.3%	37.5%	34%	40.7%
Oliveira et al. <sup>22</sup>	2010	9-16	São Luís – MA	592	58.4%	56.8%	60%	41.6%	43.2%	40%
Bergmann et al. <sup>23</sup>	2011	7-12	Caxias do Sul - RS	1,442	58.2%	-	-	41.8%	-	-
Ferrari et al. <sup>15</sup>	2016	9-11	São Caetano do Sul - SP	328	41.2%	-	-	58.8%	-	-
Silva et al. <sup>24</sup>	2008	7-12	João Pessoa - PB	1,570	70%	-	-	30%	-	-
Kneipp et al. <sup>25</sup>	2015	6 -12	Itajaí - SC	438	42.1%	-	-	57.9%	-	-
Benedet et al. <sup>26</sup>	2013	11-14	Florianópolis - SC	1,590	46.5%	22.7%	23.8%	53.2%	24.5%	28.7%
Silva et al. <sup>27</sup>	2011	15-19	SC	4,865	56.7%	58.3%	55.6%	43.3%	41.7%	44.4%
Silva et al. <sup>28</sup>	2009	15-19	SC	5,028	56.7%	-	-	43.3%	-	-
Corso et al. <sup>29</sup>	2012	6-11	SC	4,964	48.5%	-	-	45.6%	-	-
Pereira et al. <sup>30</sup>	2014	13-21	Santa Maria – RS	1,126	61.8%	-	-	38.2%	-	-
Victo et al. <sup>31</sup>	2017	11-18	Ilhabela – SP	181	34.3%	39.4%	28.6%	65.7%	60.6%	71.4%
PNAD <sup>32</sup>	2008	14-19	Brazil	292,553	47.5%	-	-	-	-	-
Dumith et al. <sup>33</sup>	2010	14-15	Pelotas – RS	4,325	73.4%	77.2%	69.8%	26.6%	22.8%	30.2%
Santos et al. <sup>34</sup>	2010	14- 19	PE	4,207	57%	55%	58.4%	43%	45%	41.6%
Castro et al. <sup>35</sup>	2016	14-19	São José – SC	930	49.9%	-	-	50.1%	-	-
Bergmann et al. <sup>36</sup>	2013	10-17	Uruguaiana – RS	1,343	75.7%	-	-	24.3%	-	-
Rezende et al. <sup>1</sup>	2014	7-10	Brazil	109,104	49.9%	50.9%	49.2%	38%	36.1%	39.8%

## DISCUSSION

This study conducted an extensive review of the literature to estimate the prevalence of ATS in Brazilian children and adolescents. Active transportation is understood as a commute from one destination to another, which can be by walking, bicycle, roller skates, skate board and non-motorized wheelchairs. This type of transportation provides numerous benefits, as a way to promote health by increasing physical activities on a regular day. Moreover, it favors urban sustainability in major metropolises, reducing traffic, contributing to a reduction in the emission of gases and the greenhouse effect, and helping to save money on fuel and parking<sup>37</sup>.

The results show that the estimates of ATS vary greatly according to each study. Methodological variations were found in the different studies analyzed, mainly regarding the instrument used to collect the data and the criterion for evaluating active transportation. Moreover, some studies did not perform the analysis stratified by gender, making it difficult to identify the prevalence of ATS by gender.

Despite some of the studies showing that boys tend to use ATS more than girls<sup>27</sup>, this review showed a balance in this distribution. Overall, boys use ATS similarly to girls, with four studies indicating a longer active commute for the boys and 4 indicating a longer active commute among girls.

Similarly to what has been observed in other areas of knowledge, the concentration of studies on ATS is in the Southern, Southeastern and Northeastern regions, showing that there is a lack of data in the Midwestern and Northern regions, limiting the generalizability of the research results, since ATS and its associated factors may vary according to the geographical location.

Several factors may be considered barriers to the use of ATS, such as = distance to the school, danger related to traffic and climate adversities of the city<sup>38</sup>. In Brazil, a low socioeconomic level has been associated to active commuting, with children and adolescents from higher socioeconomic levels using less active transportation due to the lack of safety<sup>39</sup>. When comparing urban and rural regions, a study showed that urban students use more transportation on foot, while rural students commute more with bicycles, buses or motor vehicles<sup>20</sup>. However, to better understand the use of ATS in different regions and socioeconomic levels, in addition to analyzing the type of active commuting, there need to be studies that analyze the commute time, the distance to the school and other environmental and urban mobility factors such as bike paths, traffic and conditions of the city.

The authors understand that this review has some limitations and strong points. Despite the research including 5 databases and being performed in three languages (English, Portuguese and Spanish), the estimates of ATS stratified by gender were not found in some studies. Despite the importance of the subject studied, only one government document provided information on ATS. All studies included failed to present an instrument to evaluate active transportation, contributing to the difficulty in evaluating

the prevalence of children and adolescents that participate in this type of transportation. However, there was an evaluation of the quality or risk of bias in all the studies that were selected, with 2 having a moderate risk of bias and 17 had a low risk of bias. Despite the studies having a low and moderate risk of bias, they still highlight the need for a better study design and more transparency in the reports.

The authors recommend the inclusion of standardized measures, which can be a challenge for researchers of public health and transportation. Moreover, the authors recommend the use of devices that use mobile GPS and speedometers to objectively measure active transportation; performing transversal and wide-ranging research, with representative samples in low- and middle-income countries, in rural and urban populations; performing longitudinal research capable of establishing the determinants of active transportation; and performing qualitative analyses that also investigate culture, commuting and infrastructure standards.

## CONCLUSION

Based on the results of this review, the prevalence of ATS for Brazilian children and adolescents varies according to the studies and regions in Brazil. Overall, boys use ATS similarly to girls, with 4 studies for each gender. Local ATS authorities should be encouraged to build monitoring systems on sources of information to generate standardized and detailed reports on ATS to support planning and evaluate public policies. This type of information may help in the fight against physical inactivity.

## COMPLIANCE WITH ETHICAL STANDARDS

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### Conflict of interest statement

The authors have no conflict of interests to declare.

### Author Contributions

Conceived and designed the experiments: GLMF. Performed the experiments: ERV and TKF. Analyzed the data: DS. Contributed reagents/materials/analysis tools: GLMF and DS. Wrote the paper: GLMF, ERV and TKF.

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