adolescents

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Review

Analysis of Factors Associated with Active and Sedentary Behaviors of Children and Adolescents Considering Bronfenbrenner's Bioecological Theory: A Scoping Review Protocol

Vinícius Tenório Moraes da Silva [1], Rafael dos Santos Henrique [1], José Ywgne [2], Francisco Salviano Sales Nobre [3], Paulo Henrique Guerra [4,*] and Leonardo Gomes de Oliveira Luz [1,5]

[1] Department of Physical Education, Federal University of Pernambuco, Recife 50670-901, Brazil; vinicius.moraes@arapiraca.ufal.br (V.T.M.d.S.); rdshenrique@hotmail.com (R.d.S.H.); leonardoluz.ufal@gmail.com (L.G.d.O.L.)
[2] Health Science Graduate Program, Federal University of Sergipe, Aracaju 49107-230, Brazil; joseywgne@gmail.com
[3] Federal Institute of Education, Science and Technology of Ceará, Juazeiro do Norte 60040-531, Brazil; salvianonobre@ifce.edu.br
[4] Institute of Biosciences, São Paulo State University (UNESP), Rio Claro 15385-000, Brazil
[5] Campus Arapiraca, Federal University of Alagoas, Arapiraca 57317-291, Brazil
* Correspondence: paulo.guerra@unesp.br

Abstract

The present study proposes to identify information from health, educational and sports science studies that used Bronfenbrenner's theory of human development to verify the complex relationship between factors associated with physical activity (PA) and sedentary behavior (SB) in children and adolescents. The scoping review will be developed across seven databases (PubMed, Scopus, SPORTDiscus, Web of Science, PsycINFO, ERIC, and Scielo). The inclusion criteria were formulated based on the PCC (Population, Concept, Context) framework: (a) children and adolescents (5–17 years); (b) studies on PA and/or SB that used Bronfenbrenner's theory; (c) any context. Only peer-reviewed journal articles published in English, Spanish, or Portuguese will be included; grey literature will not be included. Finally, two reviewers will screen studies using Rayyan. A standardized charting form will be used to extract data on study characteristics and the factors mapped considering Bronfenbrenner's theory components. This study is expected to show how Bronfenbrenner's theory has been applied to explain PA and SB in children and adolescents, as well as to map the methodological tools used in this area, identifying gaps and providing a clear framework for future research on the complex and multilevel determinants of PA and SB in children and adolescents.

Keywords: physical activity; child; adolescents; sedentary behavior; ecology

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1. Introduction

Low levels of moderate-to-vigorous physical activity (MVPA) and high levels of sedentary behavior (SB) are two of the largest public health concerns worldwide [1]. Global trends of physical activity (PA) levels show that, between 2001 and 2016, 81% of adolescents did not meet the World Health Organization's MVPA recommendations (e.g., an average of 60 min per day of moderate-to vigorous-intensity, mostly aerobic, PA, across the week),

and it is estimated that four in five adolescents worldwide are insufficiently active [2]. Considering that the regular practice of PA contributes to human development, as well as being related to the prevention and treatment of chronic non-communicable diseases, such as heart disease, stroke, and diabetes [3], reduced PA levels represent a public health problem.

The perspective on PA and SB needs to be expanded [4]. Reducing levels of insufficient PA and time spent on SB is a complex challenge, at a global level, especially because it is necessary to consider several factors, including social, demographic, economic, and behavioral aspects, among others [5]. It is understood that biological, behavioral, environmental, and social interaction factors can influence PA habits and SB [6]. Thus, there is a need for a greater exploration of studies in this vein, with methodologies that seek to contemplate the complexity of the phenomenon. In this context, the literature contains a growing number of studies anchored in ecological theories to explain the practice of PA [7] and SB [8], highlighting the need to consider the interrelationships between correlates from different domains, such as intrapersonal and interpersonal characteristics, the built environment, and the political environment. In these cases, the ecological models used originate from the ecological theory of human development by Urie Bronfenbrenner, which the author began to construct in the late 1970s. For Bronfenbrenner, the multiple influences of the contexts in which the subjects lived were ignored, since investigations focused only on the developing person within a restricted and static environment. Although the notion that development is influenced by the environment was already familiar and common in science at the time [9], Bronfenbrenner argued that despite this common understanding, little attention had been paid to research and theories on environmental influences on human development.

Bronfenbrenner's theory of human development was accepted as being in a continuous state of development until Bronfenbrenner died in 2005 [10]. The bioecological theory developed by Urie Bronfenbrenner can be didactically divided into three phases [11]. In the first phase (1973–1979), in which the theory was called the Ecological Approach to Human Development, Bronfenbrenner focused his discussions on the methodological limitations of research at the time [12]. His main criticisms were aimed at experimental research, which focused on the behavior of people in strange situations and places, that is, in contexts to which they did not belong. In the second phase (1980–1993), Bronfenbrenner turned to the way the environment was conceptualized in research into human development [11]. The author named the model the Ecological Paradigm, which emphasized the active aspect of the person in the environment, as well as the effects of time and development processes [13]. In the third phase (1994–2006), the theory received its current nomenclature and is characterized by the formulation of the Process–Person–Context–Time Method (PPCT Model). The evolution of the term ecology to bioecology is related to the recognition of people's structural and functional levels, which include biological, cognitive, emotional, and behavioral aspects [12].

Thus, the main characteristic of this theory is the dynamic interactions between its four pillars, the process, the person, the context, and the time, with emphasis centered on proximal processes [14,15]. The model is conceptualized from a bioecological perspective, in which the individual and context relate and define each other in a reciprocal way [16]. The development of the individual in the theoretical–methodological model refers to the continuity and change in the biopsychological characteristics of human beings, both individually and in groups, throughout the person's life course and through generations and historical time [13]. Human development occurs through gradually more complex processes of reciprocal interaction between an active subject and the people, objects, and symbols of their immediate environment [17]. This process of reciprocity is called the proximal process, which, to have effects on development, must occur regularly over an extended period of time [18]. Therefore, the concept of development for Bronfenbrenner refers to the

result of a joint function between a proximal process, the characteristics of the developing person, the immediate context in which he or she lives, and the amount and frequency of time in which the developing person has been exposed to a specific proximal process and the environment. This set is called the PPCT (Process–Person–Context–Time) model of development [19].

When applying this theory, the factors associated with PA and SB can be better understood. Person characteristics, including individual attributes and biological factors, as well as proximal processes, defined by reciprocal interactions in the immediate environment, are fundamental variables. However, preliminary evidence from the literature suggests that, to date, studies applying this theory have disproportionately focused on the context component [20,21]. Variables within the microsystem, mesosystem, exosystem, and macrosystem are frequently cited as the primary determinants associated with PA and SB. Conversely, the roles of the process itself, the interactions and the time, specifically the chronosystem, in addition to the complete, interactive PPCT model, appear to be less explored. Thus, a key goal of this scoping review is to map precisely which variables have been most associated with PA and SB, and to verify how and how often the four components of the PPCT model have been fully applied in the literature.

Although some studies stand out by taking into account different determinants of PA and SB [22–24], analysis of the literature demonstrates that there is still no clarifying description of the multiple factors that determine the strong variability in children and adolescents, particularly when related to Bronfenbrenner's theory of human development, considering its three phases [11]. In this sense, the aim of the proposed study is to verify, explore, and map the existing literature concerning the utilization and application of Bronfenbrenner's theory of human development in PA and SB research from health, educational, and sports science areas. It is anticipated that the results of the scoping review will (1) identify how and how often the four components of the PPCT model have been isolated and fully applied in the literature and (2) confirm which variables have been most commonly associated with PA and SB.

2. Materials and Methods

2.1. Protocol and Registration

The scoping review will be developed based on the following references: Joanna Briggs Institute [25], Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) [26], Arksey and O'Malley [27], and Pollock et al. [28]. The protocol was previously registered on the Open Science Framework platform (https://osf.io/pzq2w/ (accessed on 14 August 2025)). The PRISMA-Protocols (PRISMA-P) checklist is presented in Supplementary Table S1.

2.2. Review Question

While the main objective of the proposed work is to map the factors associated with PA and SB, the review will be guided by specific analytical sub-questions, which mirror the PPCT model:

1. What proximal Processes (e.g., parent–child co-activity, teacher feedback) have been identified in the literature as associated with the active and sedentary behaviors of children and adolescents?
2. What Person characteristics (e.g., age, sex, gender, motor competence) have been identified as moderating these associations?
3. What Contextual (e.g., neighborhood safety, school policies) and Time (e.g., developmental stage) influences have been mapped?

4. To what extent has the literature applied the complete, interactive PPCT model, versus studies that focus primarily on the ecological levels (Context)?

2.3. Eligibility Criteria

The proposed review aims to map existing evidence on complex factors associated with active and sedentary behaviors of children and adolescents, from the perspective of Bronfenbrenner's theory of human development and his PPCT model, taking into account the multidimensional characteristics of active and sedentary behaviors. The inclusion criteria were formulated based on the PCC (Population, Concept, Context) framework [25] (Table 1).

Table 1. Inclusion criteria based on the PCC framework.

Component	Inclusion Criteria
P (Population)	Studies carried out with children and adolescents (aged between 5 and 17 years) and with any health condition.
C (Concept)	Studies in the area of PA and/or SB that used Bronfenbrenner's theory of human development and/or the PPCT model.
C (Context)	Studies conducted in any context (e.g., at home, school, community, at work, daily living environments, public and private institutions).

PA (physical activity); SB (sedentary behavior).

Eligible studies will be required to be original studies, published in peer-reviewed journals. For mixed-age samples, studies will be included only if data for the 5–17 age range can be extracted separately, or if the sample's mean/median age falls within this specified range. Eligible study designs include observational studies, such as cross-sectional, longitudinal, cohort, and intervention studies, provided they report baseline associated factors. Studies will be included regardless of geographical setting. Both objective measures of PA/SB, such as accelerometry, and subjective measures, such as questionnaires, will be eligible, and will be distinguished during data charting. Finally, only articles published in English, Spanish, or Portuguese will be included.

The exclusion criteria are as follows: reviews of all types, editorials, books, book chapters, guidelines, expert opinion articles, dissertations, theses, and conference abstracts. Additionally, studies that do not use Bronfenbrenner's theory of human development as a guide to understand PA or SB will not fall within the scope of this review.

2.4. Source of Evidence and Search Strategy

The search for studies will be carried out in the following databases: PubMed, Scopus, SPORTDiscus, Web of Science, PsycINFO, ERIC, and Scielo. Previous tests of electronic searches conducted in these databases were structured into three domains, which will be joined with the AND operator:

I. Population: child* OR adoles* OR youth or young OR student* OR teen* OR preteen OR pre-teen OR juvenile;
II. Concept: PPCT OR Bronfenbrenner;
III. Context: "physical activity" OR "physical inactivity" OR "sedentary behavior" OR fitness OR sport* OR "motor competence" OR "motor skill" OR "motor development" OR "physical education" OR lifestyle OR performance.

Supplementary Table S2 presents the search strategy for each database.

2.5. Process of Study Selection

The review will be conducted by two researchers (VS and JY), who will work independently throughout the process. These researchers, independently, will be responsible for identifying and removing duplicates, assessing titles, abstracts, and full texts, and extracting data. Another researcher, LGOL, will lead the consensus and resolution of doubts throughout the process.

The processes of identifying and removing duplicates and of assessing titles and abstracts will be carried out in Rayyan. All assessment phases will be guided by the indicated inclusion criteria. Finally, Cohen's kappa will be used to analyze inter-rater agreement in the title/abstract and full-text phases of the final review. The results of the search and the study inclusion process will be reported in full in the final scoping review and presented in a PRISMA flow diagram [26,29] (Figure 1).

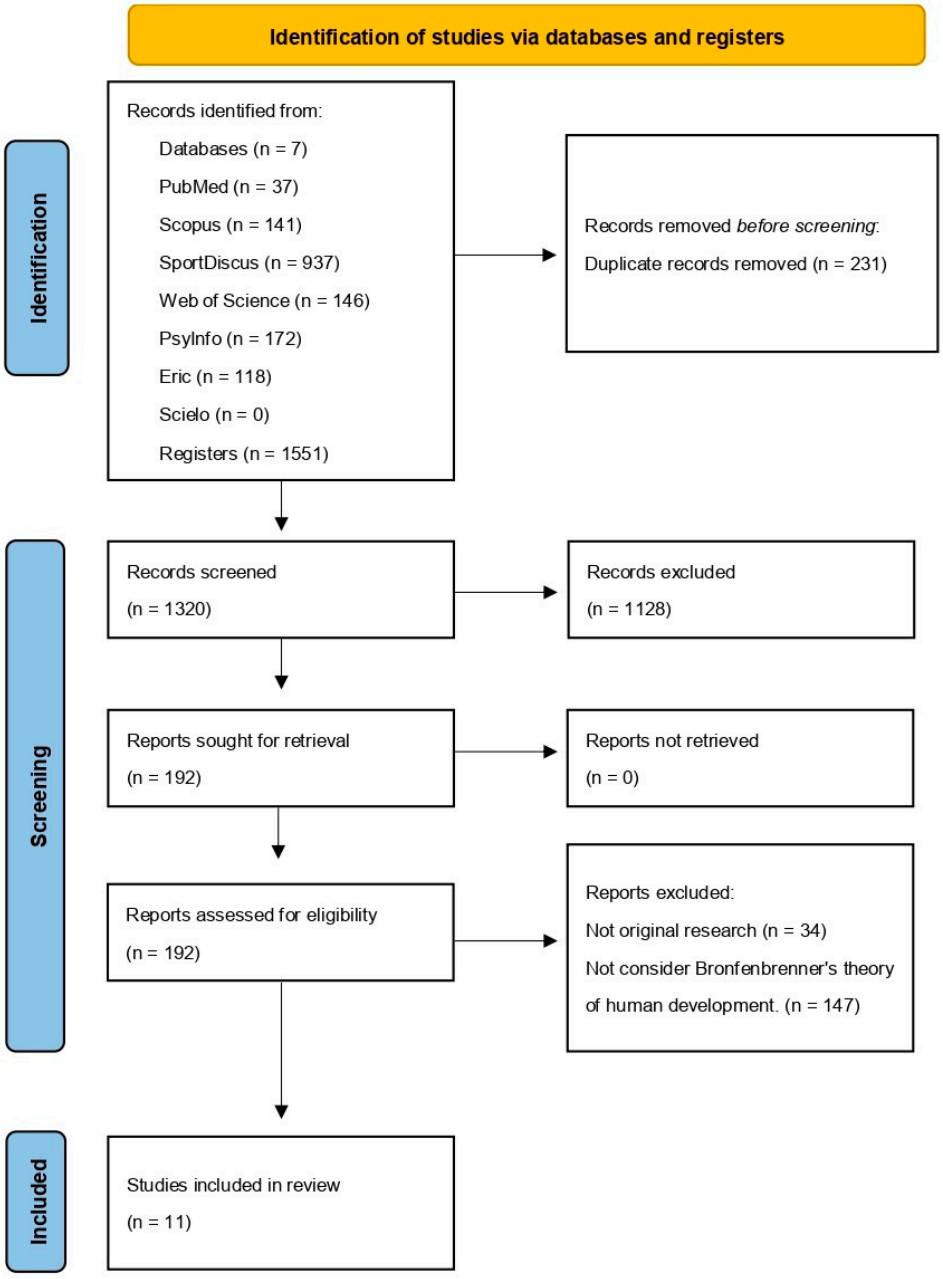


Figure 1. PRISMA flow diagram presenting an overview of the screening process with a presentation of preliminary data obtained in a pilot procedure carried out in August 2025.

2.6. Process of Data Extraction from the Selected Studies

The working group will extract the data related to the review using a dedicated spreadsheet [28], organized as follows:

I. Study characteristics: identification (citation), country in which the study was carried out, follow-up period, study design, sample size, and instruments to evaluate the variables;
II. Characteristics of individuals: sample characteristics, gender, and average age;
III. Main results: which variables were most associated with PA and SB, and how, as well as how often, the four components of the PPCT model were isolated and fully applied in the literature.

2.7. Data Synthesis

A narrative synthesis of the extracted data will be conducted, structured around Bronfenbrenner's theory of human development and the PPCT model. The synthesis will be performed in two main stages.

In the first stage, a descriptive and quantitative mapping of the included studies will be conducted. This will involve summarizing key characteristics (e.g., country in which the study was carried out, follow-up period, study design, and instruments used to evaluate the variables) and tabulating the frequency of factors associated with active and/or sedentary behaviors. These factors will be categorized according to the PPCT model (Process, Person, Context, Time) and its corresponding ecological levels (Micro, Meso, Exo, Macro, Chrono).

In the second stage, a narrative integration of the findings will be developed. This synthesis will move beyond a simple description to identify patterns, convergences, and gaps in the literature. A specific focus will be placed on synthesizing evidence regarding the interactions reported between different ecological levels (e.g., how contextual factors moderate proximal processes). To provide a more granular analysis, where data permits, the synthesis will be stratified by key study characteristics, such as (i) age group (children vs. adolescents), (ii) measurement type (objective/device-based vs. subjective/self-report), and (iii) geographic region or income setting.

Given that this study is a scoping review with general objectives, it was decided not to conduct a risk of bias assessment of the eligible studies [28,30]. It is recommended that subsequent specific systematic reviews be conducted based on the results of this scoping review.

3. Discussion

3.1. Dissemination

The proposed scoping review is expected to provide a comprehensive map of how Bronfenbrenner's theory of human development has been applied to active and sedentary behaviors in children and adolescents. It is anticipated that the findings will highlight which components of the theory (e.g., "bioecology" vs. "ecology") and which PPCT elements (e.g., Process, Person, Context, Time) have been most frequently, or infrequently, investigated. For instance, the study expects to identify whether the literature is overly focused on specific levels (e.g., the Context) while neglecting the full, interactive PPCT model. The review also aims to map the methodological tools used in this field, thereby identifying gaps and providing a clear framework for future research on the complex, multi-level determinants of youth PA and SB in different contexts that promote PA, such as at school, in the community, and in sports initiation programs.

The results of this scoping review will be submitted for publication in a peer-reviewed journal, preferably open access, and presented at scientific meetings and conferences on active and sedentary behaviors, and on the human development of children and adolescents.

Once published, the results will be disseminated through digital scientific communication platforms, including academic social networks, to expand their reach and impact.

It is expected that the findings of the study will lead to a deeper understanding of how Bronfenbrenner's theory of human development and the PPCT model can relate environmental variables to the active and sedentary behaviors of children and adolescents. The research data can guide political agents in the implementation of public policies and the development of work policies that encourage the reduction in SB and increase in PA in children and adolescents, through school projects, with the implementation of PA programs that consider the school context and interaction with the community and family, as well as awareness campaigns with presentations to raise awareness about the risks of SB and the benefits of PA. In addition, the results can help to guide the improvement in public infrastructure and to facilitate outdoor activities in the community context.

3.2. Limitations

Although some studies cite Bronfenbrenner or ecological models, they do not report deeper information about the model in question. Moreover, many interventions are published in the grey literature, which is not covered by our review. Although these possible limitations exist, it is important to remember that the results of the proposed scoping review can contribute to scientific advancement by identifying gaps and trends in research, guiding future studies, and informing companies, healthcare professionals, and the general public who are interested in PA and SB, and in human development in children and adolescents.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/adolescents6010009/s1, Table S1: Preferred Reporting Items for Systematic review and Meta-Analysis extension for Scoping Reviews (PRIS-MA-ScR) checklist.; Table S2: Draft search strategy for each electronic databases queried: PubMed, Scopus, SPORTDiscus, Web of Science, PsycINFO, ERIC, and Scielo.

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Abbreviations

The following abbreviations are used in this manuscript:

MVPA	Moderate-to-vigorous physical activity
PA	Physical activity
SB	Sedentary behavior
PPCT Model	Process–Person–Context–Time Model

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